SAVITRIBAI PHULE PUNE UNIVERSITY

First Year Engineering

Credit System Syllabus

2015 Course

$: Mandatory subjects of first, second and third semester must include at least 40 credits for Engineering Physics, Engineering Chemistry, Engineering Mathematics, social science and soft skills
In addition to above credits, there should be audit courses in semester five, six and seven to develop the various skills.
The detail structure is given in Tables

TABLE - 2 Structure for Semester-1

	Code	Subjects	Short Name	Weekly Work Load (in Hrs)			Semester Examination Scheme of Marks						Credits
				Lectures	Tutorials	PR/DRG	Theory		TW	PR	OR	Max. Marks	
							In-Semester Exam	End-Semester Exam					
	107001	Engineering Mathematics I		4	1	–	50	50	25	–	–	125	5
#	107002 / 107009.	Engineering Physics OR Engineering Chemistry		4	–	2	50	50	25	–	–	125	5
	102006	Engineering Graphics I		3	–	2	50	50	–	-	–	100	4
#	103004 / 104012	Basic Electrical Engineering OR Basic Electronics Engineering		3	–	2	50	50	25	–	–	125	4
	101005	Basic Civil and Environmental Engineering		3	–	2	50	50	25	–	–	125	4
	110003	Fundamentals of Programming Languages I		1	–	2	-	-	–	50*	–	50	2
	111007	Workshop Practice		–	–	2	–	–	50	–	–	50	1
	Total of Semester I			18	1	12	250	250	150	50	–	700	25

TABLE - 3 Structure for Semester-2

Code	Subjects	Short Name	Weekly Work Load (in Hrs)			Semester Examination Scheme of Marks						Credits
			Lectures	Tutorials	PR/ DRG	Theory		TW	PR	OR	Max. Marks	
						In-Semester Exam	End-Semester Exam					
107008	Engineering Mathematics II		4	–	–	50	50	–	–	–	100	4
# 107009 / 107002	Engineering Chemistry OR Engineering Physics		4	–	2	50	50	25	–	–	125	5
102013	Basic Mechanical Engineering		3	–	2	50	50	25	-	–	125	4
101011	Engineering Mechanics		4	–	2	50	50	25	–	–	125	5
# 104012 / 103004.	Basic Electronics Engineering OR Basic Electrical Engineering		3	–	2	50	50	25	–	–	125	4
110010	Fundamentals of Programming Languages II		1	–	2	-	-	-	50*	–	50	2
102014	Engineering Graphics II		–	–	2	–	–	50	–	–	50	1
Total of Semester II			19	–	12	250	250	150	50	–	700	25

Instructions:

1. PR/Tutorial must be conducted in minimum three batches (batch size 22 maximum) per division
2. Minimum number of required Experiments/Assignments in PR/DRG/Tutorial be carried out as mentioned in the syllabi of related subjects.
3. * for FPL-I and FPL-II: S.P. Pune University Online Practical Examination shall be conducted at the semester end.
4. # Every student should appear for Engineering Physics, Engineering Chemistry, Basic Electronics Engineering and Basic Electrical Engineering during the year.
5. # College is allowed to distribute Teaching Workload of subjects Physics, Chemistry, BEE, BXE in semester I and II by dividing number of FE divisions appropriately in two groups.

UNIVERSITY OF PUNE
First Year Engineering
107001 – Engineering Mathematics – I

Teaching Scheme:
Lectures – 4 Hrs./Week
Tutorials – 1 Hr./Week

Examination Scheme:
Paper – 50 Marks (2 Hrs.)
Online – 50 Marks
Term work: 25 Marks

Course Objectives:

After completing this course student will have adequate background to understand and solve the problem involving:

1) System of linear equations arising in all engineering fields, using matrix methods, stability of engineering systems where knowledge of Eigen values and Eigen vectors are essential.
2) Algebraic and transcendental equations.
3) Error analysis and approximations.
4) Ordinary and partial differential equations.
5) Engineering applications such as vibration theory, heat transfer, electrical circuits etc.
6) Stationary values of functions (Maxima & Minima), arising in optimization problems.

Unit I **(09 Hrs.)**
Matrices: Rank, Normal form, System of Linear Equations, Linear Dependence and Independence, Linear and Orthogonal Transformations. Eigen values, Eigen Vectors, Cayley – Hamilton Theorem. Application to problems in Engineering (Translation and Rotation of Matrix).

Unit II **(09 Hrs.)**
Complex Numbers & Applications: Argand's Diagram, De'Moivre's theorem and its application to find roots of algebraic equations. Hyperbolic Functions, Inverse Hyperbolic Functions, Logarithm of Complex Numbers, Separation into Real and Imaginary parts, Application to problems in Engineering.

Unit III **(09 Hrs.)**
Infinite Series: Infinite Sequences, Infinite Series, Alternating Series, Tests for Convergence, Absolute and Conditional Convergence, Range of Convergence.
Differential Calculus: Successive Differentiation, Leibnitz Theorem.

Unit IV **(09 Hrs.)**
Expansion of Functions: Taylor's Series and Maclaurin's Series.
Differential Calculus: Indeterminate Forms, L' Hospital's Rule, Evaluation of Limits.

Unit V **(09 Hrs.)**
Partial Differentiation and Applications: Partial Derivatives, Euler's Theorem on Homogeneous Functions, Implicit functions, Total Derivatives, Change of Independent Variables.

Unit VI **(09 Hrs.)**
Jacobian: Jacobians and their applications, Errors and Approximations.
Maxima and Minima: Maxima and Minima of Functions of two variables, Lagrange's method of undetermined multipliers.

Tutorial and Term Work:

i) Tutorial for the subject shall be engaged in minimum three batches (batch size of 22 students maximum) per division.
ii) Term work shall consist of six assignments on each unit-I to unit-VI and is based on performance and continuous internal assessment.

Text Books:

1. Higher Engineering Mathematics by B.V. Ramana (Tata McGraw-Hill).
2. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.).

Reference Books:

1. Advanced Engineering Mathematics, 7e, by Peter V. O'Neil (Thomson Learning).
2. Advanced Engineering Mathematics, 2e, by M. D. Greenberg (Pearson Education).
3. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi).
4. Applied Mathematics (Volumes I and II) by P. N. Wartikar & J. N. Wartikar (Pune Vidyarthi Griha Prakashan, Pune)

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UNIVERSITY OF PUNE
First Year Engineering
107002 – Engineering Physics

Teaching scheme:
Lectures – 4 Hrs./Week
Practical – 2Hrs. /Week

Examination scheme:
Paper – 50 Marks (2hrs.)
Online – 50 marks
T.W. – 25 Mark

Course Objectives:

1) To provide the basic concepts to resolve many engineering and technological problems.
2) After completing this course students will be able to appreciate and use the methodologies to analyze and design a wide range of engineering Systems.
3) To use various techniques for Measurement, Calculation, Control and Analysis of engineering problems based on the principles of Optics, Ultrasonic, Acoustics, Quantum Physics, Superconductivity, Laser, Physics of nano particles and Semiconductor Physics.
4) To understand the recent trends and advances in technology, this requires precise control over dynamics of macroscopic engineering systems.
5) Basic sciences like Physics also invoke manipulation of processes over micro- and even nano-scale level as there is a growing demand of solid understanding of principles of basic sciences.
6) Physics provides the basic ideas and gives the solution for developing mathematical and analytical abilities with higher precision.

Unit – I: Interference- Diffraction and its Engineering application: **(8Hrs.)**

Interference

Introduction, Concept of thin film, Interference due to thin films of uniform thickness (with derivation), Interference due to wedge shaped thin films (qualitative), fringe width (with derivation), Formation of colors in thin films, Newton's rings, its applications i) for the determination of wavelength of incident light or radius of curvature of a given plano-convex lens , ii) for the determination of refractive index of a given liquid, Applications of Interference i) Testing of optical flatness of surfaces, ii) Thickness of thin film, iii) anti-reflection coating.

Diffraction

Diffraction of waves, classes of diffraction, Fraunhofer diffraction at single slit (geometrical method) Conditions for maxima & minima, Intensity pattern due to single slit, diffraction at circular aperture, plane diffraction grating(qualitative only), Conditions for maxima & minima, Intensity pattern, Scattering of light as an application of diffraction (qualitative only).

Unit—II: Sound Engineering **(8Hrs.)**

Definitions: Velocity, frequency, wavelength, intensity, loudness (expression), timber, of sound, reflection of sound, echo, Reverberation, reverberation time, Sabine's formula(qualitative only), remedies over reverberation Absorption of sound, absorbent materials, Conditions for good acoustics of the building, Noise, its effects and remedies, Ultrasonics – Production of ultrasonics by Piezo-electric and magnetostriction oscillator, Detection of ultrasonics, Engineering applications of Ultrasonics (Non-destructive testing, cavitations, measurement of gauge).

Unit – III: Polarization & Laser (8Hrs.)

Polarization:

Introduction, Polarization of waves, Polarization of light, Representation of PPL,UPL & partially polarized light, Production of PPL by i) Reflection, ii)Refraction(pile of plates),iii)Selective absorption (dichroism) iv)Double refraction, Law of Malus, Huygen's theory of double refraction cases of double refraction of crystal cut with the optic axis lying in the plane of incidence & i)Parallel to surface ii)Perpendicular surface iii) Inclined to surface , retardation plates, QWP, HWP, optical activity, specific rotation(qualitative only), optically active materials, LCD (as an example of polarization).

LASER

Absorption, spontaneous emission, requirement for lasing action (stimulated emission, population inversion, metastable state, active medium, resonant cavity, pumping) characteristics of laser :- monochromaticity, coherence, directionality, brightness, various levels of laser systems with examples i) two levels laser system – semiconductor laser, ii) three level laser system :– ruby laser, iv) four level laser system :- He-Ne laser.

Applications in Industry (drilling, welding, micromachining etc), Medicine (as a surgical tool), Communication (Principle and advantages only), Information Technology (Holography- Recording and reconstruction).

Unit IV: Solid State Physics (8Hrs.)

Band theory in solids, free electron theory (qualitative) electrical conductivity in conductor and semiconductor, influence of external factors on conductivity (temperature, light and impurity), Fermi energy, density state (qualitative) concept of effective mass, electrons and holes, Fermi-Dirac probability distribution function (effect of temperature on Fermi level with graph), Position of Fermi level in intrinsic semiconductor (with derivation) and extrinsic semiconductors, Dependence of Fermi level on temperature and doping concentration (qualitative), diffusion and drift current (qualitative), band structure of PN junction diode under i) zero bias, ii) forward bias, iii) reverse bias, Working of transistor (NPN only) on the basis of Band diagram, Hall effect (with derivation), photovoltaic effect working of solar cell on the basis of band diagram and its applications.

Unit V: Wave Mechanics (8Hrs.)

Wave particle duality of radiation & matter, De Broglie's concept of matter waves, expressing de Broglie wavelength in terms of kinetic energy and potential, concept and derivation of group and phase velocity, group and phase velocity of matter waves , Heisenberg's uncertainty principle, Illustration of it by electron diffraction at single slit, why an electron cannot exist in the nucleus, concept of wave function ψ and probability interpretation of $|\psi|^2$, Schrodinger's time independent and dependant wave equations, applications of Schrodinger's time independent wave equation i) Particle in 1-D rigid box (infinite potential well), Comparison of quantum mechanical and classical mechanical predictions ii) Particle in 1-D non rigid box (finite potential well- qualitative, results only), tunneling effect, example of tunneling effect in tunnel diode and scanning tunneling microscope.

Unit- VI: Superconductivity and Physics of nanoparticle. (8Hrs.)

Superconductivity:

Introduction to Superconductivity, Properties of superconductors (zero resistance, Meissner effect, critical fields, persistent currents), isotope effect, BCS theory, Type I & Type-II Super conductors, Applications (super conducting magnets, transmission lines etc.) DC & AC Josephson Effect.

Physics of nano- particles:

Introduction, Nanoparticles, Properties of nanoparticles: Optical, electrical (quantum dots, quantum wires), magnetic, structural, mechanical, brief introduction to different methods of synthesis of nano-particles such as physical, chemical, biological, mechanical. Synthesis of colloids, Growth of nano-particles, Synthesis of metal nano-particles by colloidal route, Application of nanotechnology- electronics, energy, automobiles, space & defense, medical, environmental, textile, cosmetics.

List of the experiments

Conduct any ***Eight*** experiments from the following

1. Newton's rings
2. Plane diffraction grating for the determination of unknown wavelength
3. Law of Malus
4. Brewster's law
5. Double refraction (Determination of refractive indices, identification of types of crystal)
6. Half shade polarimeter
7. Laser based experiment (beam divergence)
8. Laser based experiment-(thickness of wire / determination of no of lines / cm of a grating)
9. Ultrasonic interferometer for the determination of compressibility of liquid:- $\beta = 1 / (\rho v^2)$ where, v is the velocity of ultrasonic waves through liquid and ρ is density of liquid.
10. Measurement of sound pressure level
11. Determination of band gap of a given semiconductor
12. Hall effect
13. Solar cell characteristics, measurement of V_{OC}, I_{SC}, fill factor
14. Temperature dependence characteristics of semiconductor laser
15. Determination of absorption coefficient of sound of given material

Text Books:-

1. Engineering Physics, Avadhanulu, Kshirsagar, S. Chand Publications
2. Engineering Physics, Gaur, Gupta, Dhanpat Rai and Sons Publications

References Books:-

1. Optics, Jenkins and White (Tata Mcgraw Hill)
2. Fundamentals of Physics, Resnick and Halliday (John Wiley and Sons)
3. Principles of Physics, Serway and Jewett (Saunders college publishing)
4. Introduction to Solid State Physics, Kittel C (Wiley and Sons)
5. Laser and Non-Linear Optics, B. B. Laud (Oscar publication)
6. Nanotechnology, Principles and Practices, Dr. S.K. Kulkarni (Capital Publishing Company)

UNIVERSITY OF PUNE
First Year Engineering
107009 - Engineering Chemistry

Teaching Scheme:
Lectures – 4 Hrs. / Week
Practical – 2 Hrs. /Week

Examination Scheme:
Theory – 50 marks (2 Hrs.)
Online – 50 marks
T.W. – 25 marks

Course Objectives:

After completing this course students will be able to understand:

1) Technology involved in improving quality of water for its industrial use.
2) Basic concepts of Electro analytical techniques that facilitate rapid and reliable measurements.
3) Chemical structure of polymers and its effect of on their various properties when used as engineering materials. To lay foundation for the application of polymers for specific applications and as composite materials.
4) Study of fossil fuels and derived fuels with its properties and applications.
5) An insight into nano materials and composite materials aspect of modern chemistry.
6) The principles of chemical and electrochemical reactions causing corrosion and methods used for minimizing corrosion.

Unit 1: Water technology & Green Chemistry (8Hrs.)

Water technology:

Impurities in water. Hardness of water and its determination by EDTA method, Alkalinity of water and its determination. Numericals. Ill effects of hard water in boilers. Boiler feed water treatment -1) Internal treatment –calgon, colloidal and phosphate conditioning, 2) External treatment- a) Zeolite process & its numericals b) Ion exchange method. Desalination of brackish water /Purification of water by Reverse osmosis and Electrodialysis.

Green Chemistry:

Definition, goals of green chemistry, efficiency parameters, need of Green Chemistry Major uses – traditional and green pathways of synthesis of adipic acid, polycarbonate, indigo dye.

Unit 2: Electro analytical techniques (8Hrs.)

Intoduction: Types of reference electrode(calomel electrode), indicator electrode (glass electrode), ion selective electrode, Half cell reaction and complete cell reaction.

Conductometry: Introduction, Kohlrausch's law, conductivity cell, measurement of conductance, Applications- Conductometric titrations, acid-base titrations, precipitation titrations.

pH-metry: Preparation of Buffers, standardization of pH meter, mixture of acids verses strong base titration, differential plots.

Potentiometry: Introduction, Potentiometric titrations- differential plots, Applications- redox titrations Fe/Ce titration.

UV/Visible spectroscopy: Interaction of radiation with matter, Beer lambert's law, chromophore and auxochrome, types of electronic transitions. Instrumentation and principle – block diagram of single and double beam spectrophotometer. Applications of uv-visible spectroscopy.

Unit 3 : Synthetic Organic Polymers (8Hrs.)

Introduction, functionality of monomer, polymerization- free radical mechanism and step growth polymerization. Concept and significance of –Average molecular weight, crystallinity in polymers, Tm and Tg. Thermoplastic and Thermosetting polymers. Compounding of plastics. Techniques of polymerization. Preparation, properties and engineering applications of: Polyethylene (LDPE & HDPE) and Epoxy resin. Elastomers –natural rubber- processing and vulcanization by sulphur. Synthetic rubbers- SBR.

Speciality polymers: Engineering thermoplastics– Polycarbonate, Biodegradable polymers– Poly(hydroxybutarate-hydroxyvalanate), Conducting polymers– Polyacetylene, Electroluminscent polymers– Polyphenylenevinylene, Liquid crystalline polymers– Kevlar, Polymer composites– Fibre reinforced plastic (FRP).

Unit 4: Fuels and combustion (8Hrs.)

Fossil Fuels: Definition, Calorific values, Determination– Bomb calorimeter, Boy's gas calorimeter, Numericals. Solid Fuel– Coal– Proximate and ultimate analysis. Numericals. Liquid fuels– Petroleum– Composition and refining. Octane number of petrol, Cetane number of Diesel, Power alcohol, Biodiesel.

Gaseous fuel– Composition, properties and applications of NG, CNG, LPG.

Combustion: Chemical reactions, calculations for air required. Numericals.

Fuel cells– Definition, Advantages and limitations, phosphoric acid fuel cell, polymer electrolyte membrane fuel cell.

(8Hrs.)

Unit 5: Chemistry of Hydrogen and carbon

Chemistry of Hydrogen: The element- isotopes- importance. Methods of preparation - 1) laboratory- from aqueous acid and alkali. 2) Industrial -steam reforming of methane and coke, electrolysis of water. 3) From solar energy (water splitting). Storage- chemical (sodium alanates), physical (carbon materials), difficulties in storage and transportation. Compounds of hydrogen, methods of preparation and applications- a)Molecular hydrides- hydrocarbons, silane , germane, ammonia. b) Saline hydrides- LiH, NaH. Applications of Hydrogen, Hydrogen as a future fuel.

Chemistry of Carbon: Position in periodic table, occurrence, isotopes. Allotropes (crystalline and amorphous) - occurrence, structure based on bonding and applications in detail.

(8Hrs.)

Unit 6: Corrosion Science

Introduction. Types of corrosion- Dry corrosion- mechanism, Pilling-bed worth rule. Wet corrosion- mechanism. Factors influencing corrosion- Nature of metal, Nature of environment. Methods of corrosion control: Pourbaix diagram, Cathodic and anodic protection, Use of inhibitors, Protective coatings: surface preparation, a) Metallic coatings: Types of coatings, methods of applications, (hot dipping, cladding, electroplating & cementation), Electro less coatings, b) Non-metallic coatings: chemical conversion coatings, powder coatings.

Text Books:

1. Engineering Chemistry by O. G. Palanna, Tata McGraw Hill Education Pvt. Ltd..
2. A Textbook of Engineering Chemistry by Dr. S. S. Dara, Dr. S. S. Umare, S. Chand & Company Ltd.

Reference Books:

1. Engineering Chemistry, Wiley India Pvt. Ltd., First edition 2011.
2. Inorganic chemistry, 5e, by Shriver and Atkins, Oxford University Press.
3. Hydrogen fuel – production transport and storage, Ram Gupta, CRC Press.
4. Basic Concepts of Analytical Chemistry, 2e, by S. M. Khopkar, New Age International Publishers.

Term Work: Any eight experiments:

1. Determination of hardness of water by EDTA method.
2. Determination of alkalinity of water.
3. Determination of dissociation constant of weak acid (acetic acid) using pH meter.
4. To determine maximum wavelength of absorption of CuSO4/ FeSO4, verify Beer's law and find unknown concentration in given sample.
5. Titration of mixture of weak acid and strong acid with strong base using conductometer.
6. Preparation of polystyrene and phenol-formaldehyde/urea-formaldehyde resin and its characterization.
7. Determination of molecular weight/radius of macromolecule polystyrene/polyvinylalcohol by viscosity measurements.
8. Proximate analysis of coal.
9. Preparation of nickel coating on copper metal using both methods, Electroplating & Electro less plating.
10. Determination of electrochemical equivalent (ECE) of copper.

Term Work is based on performance and regular checking of the experiments.

Laboratory manual:

1. Vogel's Text book of Quantitative Chemical Analysis, 6e, by J. Mendham, R. C. Denney, J. D. Barnes, M. J. K. Thomas, Pearson Education Ltd.
2. Applied Chemistry Theory and Practice, 2e, by O. P. Virmani and A. K. Narula, New Age International (P) Ltd.

University of Pune
First Year Engineering

110003: Fundamentals of Programming Languages -I

Teaching Scheme
Theory : 1 Hr/Week
Practical: 2 Hrs/Week

Examination Scheme
On-Line Exam: 50 Marks

Objectives

- To learn and acquire art of computer programming
- To know about some popular programming languages and how to choose a programming language for solving a problem using a computer
- To learn basics of programming in C

Unit	Syllabus	Hrs
I	Introduction to Open Source Operating Systems and Programming Languages Introduction to Bharat Operating System (BOSS) GNU/Linux users model GUI, System Folders, study Commands (Using command terminal) with switches : ls. Directory Commands, Change user, privileges, passwords, tty, who, config, make, rpm, yum, sudo, Shutdown.	01
	Eclipse Editor, Compiler, Linker, Libraries, GUI, Configuring Programming Environments: C, C++. Java, Python (Pydev), Output, Debug windows	01
	Introduction to types of Programming Languages – Machine-level, Assembly-level and High-level Languages, Scripting Languages, Natural Languages; Their relative Advantages and Limitations. Characteristics of a Good Programming Language; Selecting a Language out of many available languages for coding an application; subprograms. Short Introduction to LISP, Simulation Platforms: MATLAB and GNU Octave(Open Source), Importance of Documentation, Documentation Platform LATEX (Free ware/Open Source).	02
II	Algorithm; Advantages of Generalized Algorithms; How to Make Algorithms Generalized; Avoiding Infinite Loops in Algorithms – By Counting, By using a Sentinel Value; Different ways of Representing an Algorithm – As a Program, As a Flowchart, As a Pseudo code; Need for Planning a Program before Coding; Program Planning Tools – Flowcharts, Structure charts, Pseudo codes;	01
	Importance of use of Indentation in Programming; Structured Programming Concepts – Need for Careful Use of "Go to" statements, How all programs can be written using Sequence Logic, Selection Logic and Iteration (or looping) Logic, functions.	01

III	C Programming: Character set, Constants, Variables, Keywords and Comments; Operators and Operator Precedence; Statements; I/O Operations; Preprocessor Directives; Pointers, Arrays and Strings: User Defined Data Types – Structure and Union;	03
IV	C Programming: Control Structures – Conditional and Unconditional Branching Using "if", "switch", "break", "continue", "go to" and "return" Statements; Loop Structures – Creating Pretest Loops using "for" and "while" Statements; Creating Post test Loops using "do...while" statement; Functions – Creating Subprograms using Functions; Parameter Passing by Value; Parameter Passing by Reference; Main Function with argv, argc[]. Definition of Testing & Debugging	03

	Text Books (Use Latest Editions)
1	Pradeep K. Sinha and Priti Sinha, "Computer Fundamentals: Fourth Edition", BPB Publications, 6th Edition, 2011.
2	Behrouz A. Forouzan, Richard F. Gilberg, "COMPUTER SCIENCE – A Structured Programming approach using C", Indian Edition, Thomson, 3rd edition
3	Eclipse Step By Step by Joe Pluta ISBN 1-58347-044-1
4	Moving From Windows to Linux by Chuck Easttom ISBN-13: 978-1584504429

Reference Books (Use Latest Editions)

1. Kernighan, Ritchie, "The C Programming Language", Prentice Hall of India
2. Carlo Ghezi, Mehdi Jazayeri, "Programming Language Concepts", John Wiley and Sons
3. E. Balagurusamy, "Programming in ANSIC C", Tata McGraw Hill
4. Yashavant Kanetkar, "Let Us C" – Seventh Edition, BPB Publications
5. CDAC: BOSS GNU/Linux User's Manual

Term Work:

	Laboratory Assignments	**Hrs**
	Group A: Essential Prerequisites (Compulsory)	
1.	Use and Study of Linux GUI and Commands	1
2.	Handling and Use of Eclipse Editor for Creating Projects in C, Python (Pydev), Java.	1
3.	Using Eclipse to write/test "Hello! World" Program in C, Python	2
	Group B: Foundation Programming in C (At least 8)	

4.	Write a C program to accept five numbers from console and then to display them back on console in ascending order.	1
5.	Write a C program to calculate the sum of all numbers from 0 to 100 (both inclusive) that are divisible by 4.	1
6.	Write a C program to accept the length of three sides of a triangle from console and to test and print the type of triangle – equilateral, isosceles, right angled, none of these.	1
7.	Write a C program to accept a string from console and to display the following on console: (a) Total number of characters in the string (b) Total number of vowels in the string (c) Total number of occurrence of character 'a' in the string. (d) Total number of occurrence of string 'the' in the string.	2
8.	Write a class to convert Character String of Lowercase to Uppercase & Numeric digits in reverse order.	2
9.	Write a program in C to read an integer and display each of the digit of the integer in English.	1
10.	Write a program in C to generate first 20 Fibonacci numbers	1
11.	Write a program in C to generate prime numbers between 1 and n.	1
12.	Write a program in C to compute the GCD of the given two integers	1
13.	Write a program in C to compute the factorial of the given positive integer using recursive function.	1
14.	Write a program in C to compute the roots of a quadratic equation.	1
15.	Write a program in C to sort n integers using bubble sort.	2
16.	Write a program in C to compute addition/subtraction/multiplication of two matrices. Use functions to read, display and add/subtract/multiply the matrices.	2
17.	Write a program in C to carry out following operations on strings using library functions a. To concatenate a string S2 to string S1. b. To find the length of a given string c. To compare two strings S1 and S2. d. To copy a string S2 to another string S1.	2
18.	Find a sub-string in a string using LISP	2

	Group C: Simulations and Advanced Language Programming (At least One)	
19.	Write a program in MATLAB/OCTAVE to compute addition/ subtraction/ multiplication of two matrices. Use functions to read, display and add/ subtract/ multiply the matrices.	2
20.	Write a program in Eclipse - Python to generate prime numbers between 1 and n.	2

The Laboratory instructors are instructed to demonstrate students (at the beginning to each laboratory session) the experiment to be covered in the beginning 10 minutes of every laboratory session. Prepare Laboratory manual using LATEX. Necessary Manuals, API, Help files must be available in the laboratory as ready-Reference to the students. Each experiment must be timely submitted and teachers are required to give practical learning to the students by asking them Home Work to prepare laboratory wall charts/ Note-book exercises regarding:

Forms of Documentation – Comments, System Manual, User Manual; Documentation Standards and Notations. Difference between Testing and Debugging; Types of Program Errors; Debugging a Program for Syntax Errors; Debugging a Program for Logic Errors, Concept of APIs/Libraries, Documentation using Latex .

UNIVERSITY OF PUNE

BASIC ELECTRICAL ENGEERING (103004)

Teaching scheme
Lectures - 3Hrs/Week
Practical - 2Hrs/Week

Examination scheme
Paper - 50 Marks (2Hrs.)
Online – 50 Marks
Term work - 25 Marks

Unit 1. Elementary Concepts :
Prerequisite : Concepts of emf, potential difference, current and resistance.
Ohm's law, effect of temperature on resistance, resistance temperature coefficient, insulation resistance. S.I. units of work, power and energy. Conversion of energy from one form to another in electrical, mechanical and thermal systems.

(6 Hrs)

Unit 2. Electromagnetism :
Magnetic effect of an electric current, cross and dot conventions, right hand thumb rule and cork screw rule, nature of magnetic field of long straight conductor, solenoid and toroid. Concept of m.m.f., flux, flux density, reluctance, permeability and field strength, their units and relationships. Simple series and parallel magnetic circuits, comparison of electrical and magnetic circuit, force on current carrying conductors placed in magnetic field, Fleming's left hand rule.

(3Hrs)

Faraday's laws of electromagnetic induction, Fleming's right hand rule, statically and dynamically induced e.m.f., self and mutual inductance, coefficient of coupling, energy stored in magnetic field.

(3Hrs)

Unit 3. Single phase Transformers and Electrostatics :
A) Single phase transformers : Construction, principle of working, e.m.f. equation, voltage and current ratios, losses, definition of regulation and efficiency, determination of these by direct loading method. Descriptive treatment of autotransformers.

(3Hrs)

B) Electrostatics : Electrostatic field, electric flux density, electric field strength, absolute permittivity, relative permittivity and capacitance. Capacitor, composite dielectric capacitors, capacitors in series and parallel, energy stored in capacitors, charging and discharging of capacitors (no derivation) and time constant.

(3 Hrs)

Unit 4. AC fundamentals :

Sinusoidal voltages and currents, their mathematical and graphical representation, concept of cycle, period, frequency, instantaneous, peak (maximum), average and r.m.s. values, peak factor and form factor. Phase difference, lagging, leading and in phase quantities and phasor representation. Rectangular and polar representation of phasors.

(4 Hrs)

Study of A.C. circuits consisting of pure resistance, pure inductance, pure capacitance and corresponding voltage-current phasor diagrams, voltage-current and power waveforms.

(2 Hrs)

Unit 5. Single phase A.C. Circuits and Polyphase A. C. Circuits :

A) Single phase A.C. Circuits : Study of series and parallel R-L, R-C, R-L-C circuits, concept of impedance, admittance in case of above combinations, wave form and relevant voltage-current phasor diagrams, concept of active, reactive, apparent, complex power and power factor, resonance in series RLC circuit.

(4 Hrs)

B) Polyphase A. C. Circuits: Concept of three-phase supply and phase sequence, balanced and unbalanced load, voltages, currents and power relations in three phase balanced star-connected loads and delta-connected loads along with phasor diagrams.

(2 Hrs)

Unit 6. D. C. Circuits:

Classification of electrical networks. Kirchhoff's laws and their applications for network solutions using loop analysis. Simplifications of networks using series and parallel combinations and star-delta conversions. Energy sources - ideal and practical voltage and current sources. Superposition theorem, Thevenin's theorem.

(6 Hrs)

Term work :

The term work shall consist of a record of **minimum eight** exercises and experiments, out of which **Group A is compulsory** and **any five experiments from Group B** should be conducted.

Group A

1. Wiring Exercises:
   a) Study of various wiring components (wires, switches, fuses, sockets, plugs, lamp holders, lamps etc, their uses and ratings).
   b) Control of two lamps from two switches (looping system).
   c) Staircase wiring.
   d) Use of Megger for insulation test and continuity test of wiring installations and machines.
2. a) Study of fluorescent tube circuit.
   b) Study of Compact Fluorescent Lamp(CFL) and Light Emitting Diode (LED) lamps.
   c) Study of HID lamps such as mercury vapour lamp /sodium vapour lamp.
3. a) Study of safety precautions while working on electric installations and necessity of earthing.
   b) Introduction to energy conservation and simple techniques to achieve it.

Group B

4. Determination of temperature rise of medium resistance such as shunt field winding.
5. Verification of - a) Kirchhoff's laws and b) Superposition theorem.
6. Verification of Thevenin's theorem.
7. Study of R- L- C series resonance circuit.
8. Verification of voltage and current relations in three phase balanced star and delta connected loads.
9. Determination of performance of single phase transformer by direct loading for
   a) Voltage and current ratios and b) Efficiency and regulation.

Text Books:

1. Principles of Electrical Engineering by Del. Toro, PHI Learning Pvt. Ltd.
2. Theory and Problems of Basic Electrical Engineering- I.J.Nagrath and Kothari, PHI Learning Pvt. Ltd.
3. Basic Electrical Engineering, V.K.Mehta, S.Chand and Company Ltd., New Delhi.

Reference Books:

1. Electrical Technology- H.Cotton, C.B.S. Publications.
2. A Textbook of Electrical Technology: Volume- I – B.L.Theraja, S.Chand and Company Ltd., New Delhi.
3. Basic Electrical & Electronics Engg. By S K Bhattacharya, Pearson.
4. Basic Electrical Engineering. By D. C. Kulshreshtha, Tata McGraw Hill.
5. Electrical Technology - Edward Hughes, Pearson.

BASIC ELECTRICAL ENGINEERING

COURSE OBJECTIVES:-

At the end of this course the student will be able to-

1. Understand and demonstrate the fundamentals of electromagnetism, single phase transformers, electrostatics, and A.C. and D.C. circuits.
2. Apply concept of electromagnetism for the working of transformer.
3. Differentiate between electrical and magnetic circuits.
4. Compare between D.C and A.C circuits.
5. Draw the phasor diagrams for single phase and three phase A.C circuits.
6. Provide solution for the network by applying various laws and theorems.
7. Obtain solutions for electrical networks analytically and verify these results experimentally in laboratory.
8. Demonstrate the awareness on social issues like conservation of electrical energy, electrical safety etc.
9. Develop abilities to excel in competitive exams required for post graduation and research.

104012: BASIC ELECTRONICS ENGINEERING

Teaching Scheme:

Lectures: 3 Hrs/Week Practical: 2 Hrs/Week

Examination Scheme:

Online Exam 1:	24 Marks
Online Exam 2:	26 Marks
Paper:	50 Marks
Term work	25 Marks

Course objectives:

This course is designed to give exposure and knowledge of basic Electronic components and circuits to the First Year Engineering of all branches. The course begins with introduction of basic diodes and transistor based circuits, to the OP-AMP based simple linear applications, power supply ICs, Digital logic circuit and concludes with introduction to Industrial Electronics and Electronic communication.

1) To give knowledge of some basic electronic components and circuits.
2) To introduce basics of diode and transistor circuits.
3) To understand working of some IC based circuits.
4) To study logic gates and their usage in digital circuits.
5) To expose the students to working of some power electronic devices, transducers and application of transducers.
6) To introduce basic aspect of electronic communication systems.
7) The associated Laboratory Practical course is designed to understand working of various Electronic circuits. The students will understand how to use the basic test and measuring instruments to test the circuits.

Topics:

Unit I : Diode Circuits **[6L]**

Half wave rectifiers, Full wave rectifiers, Power supply filters and Capacitor filters, Diode limiting (Clippers) and Clamping circuits, Voltage multipliers, Zener diode & its applications, LEDs and Photodiodes.

Unit II : Bipolar Junction Transistor (BJT) Circuits **[6L]**

BJT Structure & its operation with normal biasing, Transistor characteristics and parameters, DC operating point, Transistor as an amplifier, Transistor as a switch, Enhancement-type MOSFET

Unit III: Linear Integrated Circuits **[6L]**

Introduction to operational amplifiers, Op-amp input modes and parameters, Negative feedback, Op-amp with negative feedback, Comparators, Summing amplifiers, Integrators and

Differentiators, IC 555 timer as an oscillator, Voltage regulation, IC voltage regulators (Three pin).

Unit IV: Digital Electronics **[6L]**

Introduction, Digital signals, Basic digital circuits-AND, OR, NOT, NAND, NOR, EX-OR, Boolean algebra, Examples of IC gates, Standard representation for logic functions, Half adder, Full adder, Multiplexers, De-multiplexer, Flip-flops, 1-bit memory cell, D flip-flop, Shift registers, Counters, Block diagram of Microprocessor and Microcontroller and their applications.

Unit V: Power devices and Transducers **[7L]**

Power Devices: Basics of 4-layer devices: Silicon Controlled Rectifier (SCR), Diac and Triac.
Transducers: Introduction, Electrical transducer, Selecting a transducer, Resistive transducer, Thermistor, Inductive transducer, Linear Variable Differential Transducer (LVDT), Load cell, Phototransistor, Temperature transducers, Flow measurement (Mechanical transducers) Application of transducers: Digital Thermometer, Weighing machine(Block diagrams).

Unit VI: Electronic Communication **[7L]**

Importance of Communication System, The elements of a Communication System, Bandwidth requirement, IEEE frequency spectrum, Transmission media: Wired (Twisted pair, Coaxial & Optical fiber Cables) and Wireless, Need for modulation, Analog modulation schemes- AM & FM, Mobile communication system: Cellular concept, Simple block diagram of GSM system.

Text Books:

1) Floyd, "Electronic Devices & Circuits", Pearson Education India. (For Unit I, II, III)
2) R.P. Jain, "Modern digital electronics", 3rd edition, 12th reprint TMH Publication, 2007.(For Unit IV)
3) H. S. Kalasi "Electronic Instrumentation", Tata McGraw Hill. (For Unit V)
4) Frenzel, "Communication Electronics-Principles & Applications", TATA McGraw Hill.(For Unit VI)

Reference Books:

1) Jacob Milman, C C Halkias, Chetan Parikh, "Integrated Electronics", Tata McGraw Hill
2) Paul Horowitz, Winfield Hill, "Art of Electronics", Cambridge Univ Press, Low Price Edition
3) Debashish De, Kamakhya Prasad Ghatak, "Basic Electronics", Pearson Education.
4) J R Cogdell, "Foundations of Electronics", Pearson Education.
5) Santiram Kal,"Basic Electronics, Devices, circuits and IT Fundamentals"

List of Practicals:

1) **Study of different electronic components.**
    a. Resistors (Carbon Film, Metal Film, Wire Wound, Variable),
    b. Capacitors (Electrolytic, Mica, Ceramic, Variable),
    c. Inductors, Transformers,
    d. Connectors, Switches
2) **Study of different electronic measuring instruments.**
    a. To study different controls of DMM and measurement of parameters like AC and DC voltage, current
    b. To study controls of CRO, Measurements of frequency, phase, AC & DC Voltages.
    c. To study various controls of a signal generator
3) **Study of Regulated power supply.**
   For a given Regulated Power Supply circuit with bridge Rectifier, capacitor filter and three terminal regulator:
    a. Identify pins of rectifier Diode (such as 1N4001) and study of its data sheet specifications.
    b. Identify pins of Three Pin Regulator (such as LM 78XX or LM 79XX) and study of its data sheet specifications.
    c. To measure voltages and observe waveforms at transformer secondary, output of Bridge Rectifier, output of Regulator.
4) **Study of Single stage BJT Common Emitter amplifier circuit.**
   For a given BJT CE Amplifier circuit
    a. Identify pins of a BJT (such as BC547) and study of its data sheet specifications.
    b. To measure voltages and observe waveforms at input and output terminals of single stage BJT Common Emitter amplifier circuit.
    c. Calculate voltage gain of the amplifier.
5) **Study of Op-amp based amplifiers circuits.**
    a. Identify pins of an Opamp (such as LM741)
    b. Implement given voltage equation for 2 inputs with Opamp based Summing and Difference amplifier (such as $Vo=2V_1+3V_2$ and $Vo=4V_1-V_2$)
6) **Study of IC 555 Timer circuit.**
    a. Identify pins of IC 555 Timer
    b. Observe output waveform and measure frequency of output wave for IC 555 Timer used in Astable mode.
7) **Study of Digital circuits.**
    a. Identify pins of Digital Logic Gates ICs such as AND, OR, NOT, Ex-OR, NAND
    b. Implement Half and Full Adder circuit with basic logic gate ICs
8) **Build and test Simple application circuit**
   Build & Test any circuit using IC such as Opamp LM741, IC 555 Timer, LM78XX/79XX or any digital logic gate IC.

101005 Basic Civil and Environmental Engineering

Teaching Scheme
Lectures: 03hours /week
Practicals: 02 hours /week

Examination Scheme
Online Exam. 50 marks
Theory Exam. 50 marks
Term work: 25 marks

Section I

Unit 1: Introduction to Civil Engineering (6 hours)

a) Basic Areas in Civil Engineering Surveying, Construction Engineering, Fluid Mechanics, Transportation Engineering, , Irrigation Engineering, Project Management ,Structural Engineering, Geotechnical and Foundation Engineering, Environmental Engineering, Quantity Surveying, Town Planning ,Earthquake Engineering, Infrastructure Development.

b) Role of Civil Engineer in the construction of buildings, dams, expressways and infrastructure projects for 21st century. Importance of an interdisciplinary approach in engineering.

Unit 2: Materials and Construction (6 hours)

a) basic materials for construction - cement, bricks, stone, natural and artificial sand, Reinforcing Steel-Mild, Tor and High Tensile Steel. Concrete types - PCC, RCC Prestressed and Precast. Recycling of materials.

b) *Substructure*- Definition and functions of Foundation, (Only concepts of settlement and Bearing capacity of soils.) Types of shallow foundations, Deep foundation (only concept of friction and end bearing pile).

c) *Superstructure* - Types of loads: - DL and LL, wind loads, earthquake considerations. Types of Construction-Load Bearing, Framed, Composite. Fundamental requirements of masonary.

d) Introduction to automation in construction:- Concept, need, examples related to different civil engineering projects.

Unit 3: Uses of maps and field surveys (6 hours)

a) Principles of survey ,introduction to scale, types of maps and their uses.. Modern survey methods using levels, Theodolite, EDM, lasers, total station and GPS. Measuring areas from maps using digital planimeter.

b) simple and differential levelling for setting out various benchmarks, determining the elevations of different points and preparation of contour maps. Introduction to GIS Software and its application areas.

Section II

Unit 4: Ecology and Eco System (6 hours)

a) Concept of Environment - biotic and abiotic factors. Impact of the human behaviour and the technological advancements on the environment. Need for conserving natural resources and preserving the environment. Engineer's role in achieving sustainable development. Environmental Impact Assessment (only concept).

b) Introduction to solid waste management, electronic wastes and its disposal.

Unit 5: Planning for the Built Environment (6 hours)

a) Concept of an integrated built environment-natural and manmade. Principles of planning, viz. Aspect, Prospect, Roominess, Grouping, Privacy, Circulation, Sanitation, Orientation, Economy.

b) Use of various eco-friendly materials in construction. Concept of green buildings.

c) Role of by-laws in regulating the environment, Concept of built up area, carpet area, plinth area. Plot area, FSI.

Unit 6: Energy and Environmental Pollution (6 hours)

a) Types of energy:- conventional and non-conventional. Need for harnessing alternative energies to meet the increased demand. Methods of harnessing energies.

b) Sources, causes, effects and remedial measures associated with

1. Air Pollution
2. Water pollution
3. Noise Pollution
4. Land Pollution

Term Work:

Any 8 Practical Exercises from those given below should be carried out, record to be submitted in the field book and file which will form a part of term work.

1. Study of any 4 types of maps and writing their uses.
2. Exercise on use of dumpy level and laser level.
3. Measurement of area of irregular figures by digital planimeter.
4. Drawing of plan elevation & section for a residential building, single storeyed framed/load *bearing* structure. Preparing schedule of openings [On half imperial sheet.]
5. Determination of coordinates of a traverse using Global Positioning system **(GPS)**
6. Measurement of distance by **EDM** and comparing it with the distance measured using tape.
7. Visit to a construction site for studying the various construction materials used, type of structure, type of foundation and components of superstructure – submission of visit report.
8. Demonstration of use of any 4 Civil Engineering softwares.
9. Making a poster (Full imperial sheet size) in a group of 4 students, related to Energy/Environment.
10. Presentation in a group of 4 students, any case study related to Energy/Environment.

Text Books :

1) Surveying and Levelling by Kanitkar, Kulkarni—Pune Vidyrthi Prakashan

2) Build Planning and Built Environment by Shah ,Kale, Patki—Tata Mc Graw Hill

3) Civil E ngg. Materials by Dr . S.V.Deodhar---Khanna Publications

Reference Books :

1)) Basic Civil Engineering by M.S..Palanichamy Tata Mc Graw Hill publishing Co.Ltd.N.D.

2) Basic Civil Engineering by Shatheesh Gopi---Pearson

3) Elements of Civil Engg. and Engg.Mech. by R.V.Raikar---PHI Learning Pvt Ltd.

102006 - Engineering Graphics – I

Teaching Scheme: Theory: 3 Lectures/Week Practical: 2 Hrs./Week

Examination Scheme:

Offline Test I	25 Marks	Duration: 1 Hr. ~~Units I & II~~
Offline Test II	25 Marks	Duration: 1 Hr. ~~Units III & IV~~
Theory Paper	50 Marks	Duration: 2 Hrs. ~~Units I to VI~~

Course Objective

1. *To develop imagination of Physical Objects to be represented on Paper for Engineering Communication.*
2. *To develop the manual drawing Skill, drawing interpretation Skill*
3. *To develop the physical realisation of the dimension of the objects*

UNIT: I **7 Hrs.**

Fundamentals of Engineering Drawing: Introduction to Drawing Instruments & their uses, Engineering Lettering, Drawing Sheet - Layout of drawing sheets, sizes of drawing sheets, Line - Types of lines and their applications in Mechanical Engineering Drawing, Dimensioning – Dimensioning terminology and method of execution, Placing of dimensions, General rules for dimensioning, Method of dimensioning: Linear, angular, aligned system, unidirectional system, parallel dimensioning, chain dimensioning, location dimension and size dimension.

Projections of Points and Lines: Theory of Projections (Reference Planes and Auxiliary Planes, First and Third Angle Method of projections), Projections of point only in First & Third quadrant with all possible positions.

Projections of lines: Projections of lines [by First Angle Method of projections only] inclined to horizontal plane, frontal plane and both i.e. oblique lines, on reference and auxiliary planes. True length of a line by rotation of view & rotation of plane methods, traces of lines [To locate only H.T. and V. T.]. *[Note: No application oriented questions]*.

UNIT: II **6 Hrs.**

Projections of planes: Projections of planes on reference and auxiliary planes [by First Angle Method of projections only]. Projection of planes [Triangle – All Cases, Quadrilateral, Pentagon, Hexagon and Circle] by reference and auxiliary plane methods, Planes inclined to horizontal reference plane, frontal reference plane and oblique plane, True shape of a Plane, Angles made by the plane with Principle reference planes. *[Note: No combination of planes & no HT, VT of plane]*.

UNIT: III **6 Hrs.**

Projection of Solids: Introduction to Solids, Types of Solids, Projections of Solids inclined to one & both reference plane, Projection of Solids (Tetrahedron, Cube, Prisms, Cylinder, Pyramid and Cone only with maximum six sided base). *[Note: No combination of solids & their frustums. Problems on solids resting on H.P. only]*.

UNIT: IV **6 Hrs.**

Engineering Curves: Conic section – Ellipse, Parabola, Hyperbola by Focus-diretrix & rectangle method, Helix for Cylinder, Involute of a circle, Cycloid, Archemedian Spiral. *[Note: Construction of Tangent & Normal is not expected in Examination. Only Curves to be asked in Examination from Unit-IV].*

Development of Solids: Development of prism (Maximum six sides), Development of cone [*No combination of solids].*

UNIT: V **6 Hrs.**

Orthographic views: Orthographic projections of given pictorial view by First Angle Method of Projections only, Study of Types of sections, Sectional orthographic projections. *[Note: Only full sectional Orthographic view to be asked for Examination].*

UNIT: VI **6 Hrs.**

Isometric projections: Introduction to Isometric View with the example of Cube, Isometric axes, scale, Isometric projections and Isometric views, Construction of isometric, non-isometric Lines, Angles, Circles, Sphere, Arc etc. Drawing isometric views of simple solids and objects, Dimensioning - only Length, Width & Height of Isometric Views. *[Note: Only Isometric Views to be asked for Examination].*

Term Work

The following Five sheets to be drawn based on the above topics. All these sheets should be drawn on A2 size (594X420mm) (Half imperial) drawing sheets only.

1. Projections of lines / planes [Minimum Two Problems each]
2. Projections of solids [Minimum Two Problems]
3. Engineering Curves [Minimum Four Problems]
4. Development of Solids [Minimum Two Problems]
5. Orthographic projections [Minimum Two Problems]
6. Isometric projections [Minimum Two Problems]

Text Books

1. N. D. Bhatt and V. M. Panchal, Engineering Drawing, Plane and Solid Geometry, Charotor Publication House, Anand, Gujarat, India.
2. Dhananjay A. Jolhe, Engineering Drawing with an Introduction to Auto CAD, Tata Mcgraw-hill Publishing Co. Ltd., New Delhi, India.
3. Basant Agrawal and C. M. Agrawal, Engineering Drawing, ata Mcgraw-hill Publishing Co. Ltd., New Delhi, India.
4. K. L. Narayana and P. L. Kannaiah, " Text Book on Engineering Drawing", Second Edition, Scitech Publications (India) Pvt. Ltd. Chennai, 2011.
5. K. C. John, "Engineering Graphics for Degree", PHI Learning Pvt. Ltd. New Delhi, 2009

Reference Books

1. W. J. Luzadder, Fundamentals of Engineering Drawing, Prentice Hall of India.
2. Basudeb Bhattacharyya, Machine Drawing Includes AutoCAD Supplements, Oxford University Press, India.
3. French and Vierck, Graphic Science, Mc-Graw Hill International.
4. K. Venugopal, Engineering Drawing and Graphics, New Age Publication.
5. R. K. Dhawan, A text book of Engineering Drawing, S. Chand and Company Ltd., New Delhi, India.
6. N. B. Shaha and B. C. Rana, Engineering Drawing, Pearson Education.
7. C. Jensen, J. D. Helsel and D. R. Short, "Engineering Drawing and Design", Tata McGraw-Hill Education Pvt. Ltd., New Delhi, 2012.
8. T. Jeyapoovan, "Engineering Drawing and Graphics using Auto CAD", Vikas Publication House Pvt. Ltd. New Delhi, 2011.

UNIVERSITY OF PUNE
First Year Engineering
107008 – Engineering Mathematics – II

Teaching Scheme:
Lectures – 4 Hrs./Week

Examination Scheme:
Paper – 50 Marks (2 Hrs.)
Online – 50 Marks

Course Objectives:

After completing this course student will have adequate background to understand the concepts of

1) Modeling of various physical systems such as Newton's Law of cooling, L-C-R circuits, rectilinear motion, mass-spring systems heat transfer etc.
2) Design and analysis of continuous and discrete system, where knowledge of Fourier series and Harmonic analysis is required.
3) Advanced techniques to evaluate integrals.
4) Measurement of arc lengths of various curves.
5) Sphere, cone and cylinder that arise in vector calculus, electro-magnetic field theory, cad-cam, computer graphics etc.
6) Multiple integrals which are used in calculating areas, volumes, mean and RMS values, mass, moment of inertia and centre of gravity.

Unit I **(09 Hrs.)**
Differential Equations (DE): Definition, Order and Degree of DE, Formation of DE. Solutions of Variable Separable DE, Exact DE, Linear DE and reducible to these types.

Unit II **(09 Hrs.)**
Application of DE: Applications of DE to Orthogonal Trajectories, Newton's Law of Cooling, Kirchoff's Law of Electrical Circuits, Motion under Gravity, Rectilinear Motion, Simple Harmonic Motion, One–Dimensional Conduction of Heat, Chemical problems.

Unit III **(09 Hrs.)**
Fourier Series: Definition, Dirichlet's conditions, Full Range Fourier Series, Half Range Fourier Series, Harmonic Analysis and Applications to Problems in Engineering.
Integral Calculus: Reduction formulae, Beta and Gamma functions.

Unit IV **(09 Hrs.)**
Integral Calculus: Differentiation Under the Integral Sign, Error functions.
Curve Tracing: Tracing of Curves, Cartesian, Polar and Parametric Curves. Rectification of Curves.

Unit V **(09 Hrs.)**
Solid Geometry: Cartesian, Spherical Polar and Cylindrical Coordinate Systems. Sphere, Cone and Cylinder.

Unit VI **(09 Hrs.)**
Multiple Integrals and their Applications: Double and Triple integrations, Applications to Area, Volume, Mean and Root Mean Square Values, Mass, Center of Gravity and Moment of Inertia.

Text Books:

1. Advanced Engineering Mathematics, 7e, by Peter V. O'Neil (Thomson Learning).
2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi).

Reference Books:

1. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.).
2. Advanced Engineering Mathematics, Wylie C.R. & Barrett L.C. (McGraw-Hill, Inc.)
3. Higher Engineering Mathematics by B.V. Ramana (Tata McGraw-Hill).
4. Advanced Engineering Mathematics, 2e, by M. D. Greenberg (Pearson Education).

University of Pune
First Year Engineering
110010: Fundamentals of Programming Languages-II

Teaching Scheme
Theory : 1 Hr/Week
Practical: 2 Hrs/Week

Examination Scheme
On-Line : 50 Marks

Objectives

- To learn and acquire art of computer programming
- To know about some popular programming languages and how to choose a programming language for solving a problem using a computer
- To learn to foundation programming in embedded C, Advanced Programming

Unit	Syllabus	Hrs
I	Microprocessors and Micro-Controllers Architectures and Programming Concepts	03
	Introduction to functional block diagram of 80386DX, Concepts of Machine Cycles, Memory types: Primary, Secondary, Cache, Concept of Segmentation and Paging, Processing of Interrupts and Exceptions. PIC Micro-controller systems Architecture Block diagram, SFR basics, Data and Program Memory. Programming I/O Interfaces using LED interfacing, Stepper-motor (Programmers Model/Block Diagram).	
II	Introduction to Advanced Programming Platforms	05
	Eclipse Programming Platform, C, C++, JAVA. Structured Files. File Handling operations, Linked Lists: Unidirectional, Bi-Directional and Circular. Data and Value Pointers basics, Trees, Basic Introduction to JVM, Basic Classes, Signals, Event Methods and Function, File Classes using case study of Calculator Program, Basics of Web Technology Programming using HTML for Hello! World Program, Display images, web links.	
III	Introduction to Embedded Programming Concepts	03
	Introduction to Embedded C, Introduction to C peripheral Interfaces. C Mechatronics Applications	
IV	Handheld Device Open Source Operating System Installations and Applications	01
	Overview of Android OS, Wireless Application Protocol(WAP), Open Handset Alliance, Android Platform Differences, Android Platform Basic Introduction to Android Development Environment: Configuring Development Environment, Exploring the Android SDK. Documentation, Framework, Android Tools. Sample Applications.	

	Emulator, Building, debugging and Running Android Applications	
	Text Books	
1.	Programming 8-bit PIC Micro-controllers in C, Martin P Bates, Newnes Elsevier, ISBN: 978-0-7506-8960-1	
2.	Learning Java by Patrick Niemeyer, Jonathan Knudsen, O'Reilly Media	
3.	Android Wireless Application Development: Developers Library, by Lauren Darcey and Shane Conder, Second Edition, Addison Wesly, ISBN-10: 0-321-74301-6	

	Laboratory Assignments:	Hrs.
	Groups A Assignments: (At least Two)	
1.	Use and Study of Linux GUI and Commands	1
2.	Write a program in (Eclipse) C++ to Display String "Hello! World"	1
3.	Write a program in (Eclipse) Java to Display String "Hello! World"	1
4	Web Technology Programming using HTML for Hello! World Program. Display images, web links.	1
	Groups B Assignments: (At least Six)	
5.	Write a class in C++/Java to add integer numbers	1
6.	Write a Java class for Binary Search	1
7.	Write a Java class for finding Palindrome	2
8.	Write Java/C++ program for Calculator Addition, Subtraction, Multiplication, Division.	2
9.	Write a C++ Class for sorting Numbers in Ascending/Descending Order.	2
10.	Write a class to convert string into chars & chars to string.	2
11.	Write a class for sine, cosine wave by mathematical formula.	2
12.	Write a Class for implementing Simple Calculator.	2
13.	Write a class to implement a Cross and Zero Game	2
14.	Finding the minimum spanning tree from a Tree.	2
15.	Write a Class to implement a Circular list.	1
16.	Write a class for showing the current Time. Date.	1
17.	Write a class to implement various Boolean Algebra Functions (At least 4 functions)	2
18.	Write a class to generate Gray Codes from Decimal Numbers	2
	Groups C Assignments: (At least Two)	

19.	Write a Embedded C program to switch-on/Switch-off LED (Programmers model)	3
20.	Write a Embedded C program to generate half angle bit sequence for stepper motor (Programmers model)	3
21.	Installation of Android ADT for Eclipse	3
22.	Study and implementation on Android Simulator, "Hello! World"	3

The Laboratory instructors are instructed to demonstrate students (at the beginning to each laboratory session) the experiment to be covered in the beginning 10 minutes of every laboratory session. Prepare Laboratory manual using LATEX. Necessary Manuals, API, Help files must be available in the laboratory as ready-Reference to the students. Each experiment must be timely submitted and teachers are required to give practical learning to the students by asking them Home Work to prepare laboratory wall charts/ Note-book exercises regarding:
Programmable I/O Peripherals 8255, 80386Dx Memory MAP, Paging address generation, Current characteristics Diagram of Stepper motor Driver Circuit, Booting of Linux, gcc Switchs, Developing the local *index.html* page in HTML system folder, Documentation using Latex.

Engineering Mechanics (101011)

Teaching Scheme
Lectures: 04 hours /week
Practicals: 02 hours /week

Examination Scheme
Online Exam. 50 marks
Theory Exam. 50 marks
Term work: 25 marks

Unit: I (6 hours)

a) Principle of statics, force systems, resolution and composition of forces. Resultant of concurrent forces. Moment of a force, Varignon's theorem, resultant of parallel force system. Couple, Equivalent force couple system.

b) Resultant of general force system. Distributed forces. Centroid of plane lamina and wire bends.

Unit II (7 hours)

a) Kinematics- Basic concepts, equations of motion for constant acceleration and motion under gravity. Variable acceleration and motion curves. Relative motion and dependant motion.

b) Kinetics- Newton's second law of motion and its application.

Unit III (7 hours)

a) Kinematics: basic concepts, equation of motion in Cartesian co-ordinates. Path and polar co-ordinates. Motion of projectiles.

b) Kinetics: Newton's second law of motion in Cartesian and Path co-ordinates for curvilinear motion of a particle.

Unit IV (6 hours)

a) Work, power, energy, conservative and non-conservative forces. Conservation of energy and work energy principle for motion of particle.

b) Impulse, momentum, directs central impact and coefficient of restitution. Conservation of momentum and Impulse momentum principle of particle.

Unit: V (7 hours)

a) Free body diagram, equilibrium of concurrent, parallel and general forces in a plane. Equilibrium of three forces in a plane. Types of beams: simple and compound beams, type of supports and reaction.

b) Resultant of concurrent and parallel forces in a space. Equilibrium of concurrent and parallel forces in a Space.

Unit VI (7 hours)

a) Two force members: analysis of plane trusses by method of joint and method of section, cables subjected to point loads. Multi force member: plane frames.

b) Friction: law's of friction, application of friction on inclined plane. Wedges and ladders friction, application to flat belt.

Text Books

1)Vector Mechanics for Engineers by Beer & Johnston---Mc Graw Hill

2) Engg. Mechanics :S.Timosenko,Dtp.Young and J.V.Rao.--- Tata Mc Graw Hill Education Pvt Ltd .New Delhi

3)Engg. Mechanics by Basudeb Bhattacharyya----- Oxford University Press,

Reference Books

1) Engg. Mechanics by I.H.Shames & G.K.M.Rao.--- Pearson

2)Fundamentals of Engg. Mechanics by S.Rajasekaran & G. Sankarsubramanian : Vikas Publishing House Pvt.Ltd.

3)Engg. Mechanics by K.L.Kumar & Veenu Kumar. Tata Mc Graw Hill Education pvt Ltd .New Delhi

4)Engg. Mechanics bySoutas,Little,Inman-----India Edition—Cengage Learning

UNIVERSITY OF PUNE

102013 - Basic mechanical Engineering

Teaching Scheme: Theory: 3 Lectures/Week Practical: 2 Hrs./Week Term Work: 25 Marks

Examination Scheme:

On-line Test I	25 Marks	Duration: 30 Minutes.	Units I & II
On-line Test II	25 Marks	Duration: 30 Minutes	Units III & IV
Theory Paper	50 Marks	Duration: 2 Hrs.	Units I - VI

Course Objectives:

- This course will help the student to acquire knowledge of mechanical engineering.
- Describe the scope of mechanical engineering with multidisciplinary industries.
- Understand and identify common machine elements with their functions and power transmission devices.
- Learn conventional machine tools and understand the concept of design in mechanical engineering.
- Impart knowledge of basic concepts of thermodynamics applied to industrial applications.
- Understand laying principles of energy conversion systems and power plants.

Unit 1: Introduction to Mechanical Engineering **6 Hrs.**

Mechanical Elements:- Function, Sketch, Description, Uses of- Shaft, Axle, Key (Parallel key), Coupling (Rigid Flanged Coupling), Bearing-(Ball bearing), Clutch- Single Plate Clutch, Brake - Disc Brake.

Power Transmission Devices: Construction, working, comparison & applications of: Belt Drive (Flat and V Belt), Chain Drive and Spur Gear Drive arranged with simple gear train.

Unit 2: Design Fundamentals **6 Hrs.**

Design: Steps in design process, Mechanical Properties (Strength, Toughness, Hardness, Ductility, Malleability, Brittleness, Elasticity, Plasticity, Resilience, Fatigue, Creep) and selection of Engineering materials, Applications of following materials in engineering -Aluminium, Plastic, Steel, Brass, Cast Iron, Copper, Rubber

Mechanism (Descriptive treatment only): Definition and comparison of Mechanism and Machine, Four Bar Mechanism, Slider Crank Mechanism.

Unit 3: Manufacturing Processes **6 Hrs.**

Introduction to Manufacturing Processes and their Applications (Casting, Forging, Sheet metal working and Metal joining processes), Description of the Casting process: Sand casting (Cope & Drag), Sheet metal Forming (shearing, bending, drawing), Forging (Hot working and cold working comparison), Electric Arc welding, Comparison of – Welding, Soldering, Brazing.

Unit 4: Machine Tools **6 Hrs.**

Basic Elements, Working Principle, Types of Operations with block diagram: Lathe Machine - Centre Lathe, Drilling Machines, Grinding Machines.

Unit 5: Thermal Engineering **6 Hrs.**

Thermodynamics: Thermodynamics system (open, close, isolated), Thermodynamic Properties: Definition and Units of –Temperature, Pressure (atmospheric, absolute and gauge), Volume, Internal energy, Enthalpy, Concept of Mechanical work, , Thermodynamics Laws with example- Zeroth Law, First Law, Limitations of first law, Concept of heat Sink, Source, heat engine, heat pump, refrigeration engine, 2^{nd} Law of thermodynamics statements (Kelvin Plank, Claussius), Numerical on 2^{nd} law only.

Measurement: Measurement of Temperature (Thermocouple – Type according to temperature range and application), Measurement of Pressure (Barometer, Bourdon pressure gauge, Simple U tube Manometer with numerical).

Unit 6: Applied Thermal Engineering **6 Hrs.**

Power Plant Engineering: Conventional and non-conventional energy resources, Hydro-electric, Thermal, Nuclear, Wind, Solar [with Block diagram].

Power Producing Devices: Boiler - Water tube and fire tube, Internal combustion engine – Two stroke and four stroke (Spark ignition and compression ignition), Turbines – Impulse and reaction.

Power Absorbing Devices: Pump – Reciprocating and Centrifugal, Compressor – Single acting, single stage reciprocating air compressor, Refrigeration – Vapour compression refrigeration process, House hold refrigerator, Window air conditioner (Working with block diagrams).

Term Work

Term work shall consist of the following:

1. Study of power transmitting elements: couplings, gears and bearings.
2. Study of mechanisms: four bar mechanism, slider crank mechanism
3. Study, demonstration and working of centre lathe machine
4. Study of any one power plant
5. Study, demonstration on two stroke and four stroke engine.
6. Study, domestic refrigerator and window air conditioner.
7. Study of Package Type Boiler.
8. Report on visit or guest lecture related to mechanical engineering.

Text Books:

1. G. Shanmugam, S. Ravindran, "Basic Mechanical Engineering", Tata McGraw-Hill Publisher Co. Ltd.
2. R. K. Purohit, "Foundation of Mechanical Engineering", Scientific Publishers.
3. C. S. Chetankumar, B. P. Mahesh, "Elements of Mechanical Engineering", S. Chand Publications.
4. P. K. Nag, "Engineering Thermodynamics", Tata McGraw-Hill Publishing Co. Ltd.
5. Chaudhari, Hajra, "Elements of Workshop Technology", Volume I and II, Media Promoters and Publishers, Mumbai.

Reference books:

1. P. K Nag "Thermodynamics", Tata McGraw-Hill Publishing Co. Ltd
2. V. B. Bhandari "Design of Machine Elements" Tata McGraw-Hill Publishing Co. Ltd
3. S. S. Ratan, "Theory of Machine" Tata McGraw-Hill Publishing Co. Ltd
4. Yunus A. Cengel and Boles, " Thermodynamics ",Tata McGraw-Hill Publishing Co. Ltd
5. Arora and Domkunwar, "Thermal Engineering", Dhanpat Rai and Sons.
6. Surinder Kumar, "Basics of Mechanical Engineering", Ane Books Pvt. Ltd., New Delhi, 2011
7. T. J. Parbhu, V. Jaiganesh and S. Jebaraj, "Basic Mechanical Enigeering", Scitech Publications (India) Pvt. Ltd. Chennai, 2010.

UNIVERSITY OF PUNE

102014 - Engineering Graphics – II

Practical: 2 Hrs./Week **Term Work:** 50 Marks

Drafting Technology and Introduction to Any Drafting Software/Package: Advantages of using Computer Aided Drafting (CAD) packages, applications of CAD, Introduction to GUI of CAD Software, basic operation of drafting packages, use of various commands for drawing, dimensioning, editing, modifying, saving and printing/plotting the drawings. Introduction to 3D primitives.

***Term Work** should be prepared on Five A2 size (594X420mm) (Half imperial) drawing screen using any drafting software/package as detailed below.*

1. Projections of solids [Minimum Two Problems]
2. Engineering Curves [Minimum Two Problems]
3. Development of Solids [Minimum Two Problems]
4. Orthographic projections [Minimum Two Problems]
5. Isometric projections [Minimum Two Problems]

Note: The problems for Term Work should be different for each student. The Term Work of a batch should be preserved in a form of CD/DVD.

Text Books

1. N. D. Bhatt and V. M. Panchal, Engineering Drawing, Plane and Solid Geometry, Charotor Publication House, Anand, Gujarat, India.
2. Dhananjay A. Jolhe, Engineering Drawing with an Introduction to Auto CAD, Tata Mcgraw-hill Publishing Co. Ltd., New Delhi, India.
3. Basant Agrawal and C. M. Agrawal, Engineering Drawing, Tata Mcgraw-hill Publishing Co. Ltd., New Delhi, India.
4. K. L. Narayana and P. L. Kannaiah, " Text Book on Engineering Drawing", Second Edition, Scitech Publications (India) Pvt. Ltd. Chennai, 2011.
5. K. C. John, "Engineering Graphics for Degree", PHI Learning Pvt. Ltd. New Delhi, 2009

Reference Books

1. Basudeb Bhattacharyya, Machine Drawing Includes AutoCAD Supplements, Oxford University Press, New Delhi, India.
2. K. Venugopal, Engineering Drawing and Graphics, New Age Publication.
3. Basudeb Bhattacharyya, Machine Drawing Includes AutoCAD Supplements, Oxford University Press, New Delhi, India.
4. R. K. Dhawan, A text book of Engineering Drawing, S. Chand and Company Ltd., New Delhi, India.
5. N. B. Shaha and B. C. Rana, Engineering Drawing, Pearson Education.
6. T. Jeyapoovan, "Engineering Drawing and Graphics using Auto CAD", Vikas Publication House Pvt. Ltd. New Delhi, 2011.

Board of Studies in Production/Industrial Engineering
University of Pune

FE – All Branches
Workshop Practices

Teaching Scheme	**Examination**
Scheme	**Marks**
Practical: 2 hrs/week	**Term work: 50**

Objective :
Introduction to different materials in engineering practices with respect to their workability, formability & machinability with hand tools & power tools and to develop skills through hands on experience.

I. Any Two Utility Jobs

(a) Carpentry - 1 Job
Introduction to wood working, kinds of woods, hand tools & machines, Types of joints, wood turning. Pattern making, types of patterns, contraction, draft & machining allowances
Term work to include one job involving joint and woodturning.

(b) Fitting - 1 Job
Types of Fits, concepts of interchangeability, datum selection, location layout, marking, cutting, shearing, chipping, sizing of metals, drilling and tapping.
Term work to include one job involving fitting to size, male-female fitting with drilling and tapping.

(c) Sheet Metal Practice – 1 Job
Introduction to primary technology processes involving bending, punching and drawing various sheet metal joints, development of joints.
Term work to include a utility job in sheet metal.

(d) Joining – 1 Job
Includes making temporary and permanent joints between similar and dissimilar material by processes of chemical bonding, mechanical fasteners and fusion technologies.
Term work includes one job involving various joining processes like riveting, joining of plastics, welding, brazing, etc.

II. Broad Guidelines for demonstrations [any four]
Each demonstration will be of 2 hours duration.

(a) Assembly and Inspection
Assembly and Disassembly of some products, tools used. Videos of advancement in manufacturing technology. Inspection of various components using different measuring instruments. Introduction to measuring equipments used in Quality Control

(b) Safety in Workshop

Fire hazards, electric short circuit –causes and remedies, Machine protection, Human protection, Accident prevention methods, developing ability to observe safe working habits.

(c) Forging

Hot working, cold working processes, forging materials, hand tools & appliances, Hand forging, Power Forging.

(d) Moulding

Principles of moulding, methods, core & core boxes, preparation of foundry sand, casting, Plastic moulding.

(e) Plumbing

Types of pipe joints, threading dies, Pipe fittings.

(f) PCB Making

Layout drawing, positive & negative film making, PCB etching and drilling.

(g) Machine Tools

Turning, Milling, Grinding, Shaping, Planning - machines, Tools & Accessories.

Note:

All demonstrations to be engaged by teaching faculty and corresponding teaching load be shown in the time table for respective teaching faculty.

III. Submissions:

1) Two jobs as mentioned above.
2) Brief write-up with illustration/sketches on the demonstrations (not more than 3 pages for each demonstration)

Text Book:

Chaudhas, Hazra, "Elements of Workshop Technology", Volume I&II, Media Promoters & Publishers, Mumbai

Savitribai Phule Pune University
S.E. (Civil Engineering) 2015 Course

Semester I													
Course Code	**Course**	**Teaching Scheme Hours / Week**			**Semester Examination Scheme of Marks**						**Credit**		
		Theory (TH)	**Tutorials (TUT)**	**Practical (PR)**	**In-Sem**	**End-Sem**	**TW**	**PR**	**OR**	**Total**	**TH / TUT**	**PR/OR/ TW**
201001	Building Technology and Materials	04	--	02	50	50	50	--	--	150	04	01
207001	Engineering Mathematics III	04	01	--	50	50	50	--	--	150	05	
201006	Surveying	04	--	02	50	50	--	50	--	150	04	01
201002	Strength of Materials	04	--	02	50	50	--	--	50	150	04	01
201003	Geotechnical Engineering	04	--	02	50	50	--	--	50	150	04	01
	Audit Course 1 Awareness to Civil Engineering Practices	--	--	--	--	--	--	--	--	--	Grade	
Total		**20**	**01**	**08**	**250**	**250**	**100**	**50**	**100**	**750**	**25**	

Note: For audit courses students are given certificate by the institutes based on the assignment submitted by them.

Abbreviations: TW: Term Work, **OR:** Oral, **PP:** Passed (Only for non credit courses), **NP:** Not Passed (Only for non credit courses).

Savitribai Phule Pune University
S.E. (Civil Engineering) 2015 Course

Semester II												
Course Code	Course	Teaching Scheme Hours / Week			Semester Examination Scheme of Marks						Credit	
		Theory (TH)	Tutorials (TUT)	Practical (PR)	In-Sem	End-Sem	TW	PR	OR	Total	TH / TUT	PR/OR/ TW
201004	Fluid Mechanics I	04	--	02	50	50	--	--	50	150	04	01
201005	Architectural Planning and Design of Buildings	04	--	02	50	50	--	50	--	150	04	01
201008	Structural Analysis I	03	01	--	50	50	--	--	--	100	04	--
207009	Engineering Geology	04	--	02	50	50	50	--	--	150	04	01
201007	Concrete Technology	04	--	02	50	50	--	--	50	150	04	01
201010	Soft Skill	--		02	--	--	50	--	--	50	--	01
	Audit Course 2 Road Safety Management	--	--	--	--	--	--	--	--	--	Grade	
		19	**01**	**10**	**250**	**250**	**100**	**50**	**100**	**750**	**25**	

Note: For audit courses students are given certificate by the institutes based on the assignment submitted by them.

Abbreviations: TW: Term Work, **OR:** Oral, **PP:** Passed (Only for non credit courses), **NP:** Not Passed (Only for non credit courses).

Savitribai Phule Pune University, Pune

S.E. (Civil Engineering) 2015 Course

201001: Building Technology and Materials

Credits: 04+01

Teaching Scheme:	Examination Scheme:
Theory : 04 hrs/week	**In-Semester (Online) : 50 Marks**
Practical : 02 hrs/week	**End-Semester : 50 Marks**
	Term Work : 50 Marks

Prerequisites: Fundamentals of Basic Civil Engineering and Engineering Graphics.

Course Objectives:

1) To enumerate different types of structure and their requirement as building components.
2) To describe all basic activities of construction from foundation to finishing.
3) To study different types of materials used in construction for civil engineering projects.

Course Outcomes:

On completion of the course, learner will be able to:

1) Identify types of building and basic requirements of building components.
2) Explain types of masonry, formwork, casting procedure and necessity of underpinning and scaffolding.
3) Elucidate different types of flooring and roofing materials.
4) Describe types of doors, windows, arches and lintel.
5) Illuminate means of vertical circulation and protective coatings.
6) Explain different materials especially eco-friendly materials and safety measures to be adopted at any construction site.

Course Contents

Unit I: Introduction to Building Construction and Masonry. (08 Hrs) **a) Introduction to building construction**– definition, types of building as per National Building Code. Building components and their basic requirements i.e substructure and superstructure requirements. Superstructure: Concept and advantages of a framed structure, types: light framed structures, Timber framed, RCC framed structures. Substructure - shallow and deep foundations and their suitability. General procedure in foundation design, Failure of foundation and its causes, Foundation in black cotton soil, Foundations near existing adjacent old structures. Damp Proof Course, plinth filling and soling. **b) Masonry**– Stone masonry: Principal terms, types of stone masonry. Brick masonry: characteristics of good building bricks, IS specification and tests, classification of bricks: silica, refractory, fire and fly ash bricks. Brick work, types of bonds: English, Flemish, Header, Stretcher, construction procedure, supervision.
Unit II: Block Masonry and Form work (08 Hrs) **a) Block Masonry –** Cellular lightweight concrete blocks, hollow blocks, concrete blocks, glass blocks, solid blocks, cavity wall construction. Requirement of a good partition wall: metal partitions, asbestos cement partition, wooden partition. Reinforced brick masonry: applications, advantages, materials required and construction procedure. Composite masonry: types, advantages, applications, materials required and construction procedure. b) Form work and casting procedure for reinforced concrete columns, R.C.C. beams and girders, R.C.C. slabs, curing methods, precast and pre-stressed concrete construction and joints in concrete work. Slip form work: component parts- design criteria, underpinning, Scaffolding: purpose, types and suitability.
Unit III: Flooring and Roofing Materials. (08 Hrs) **a) Flooring and Flooring Materials –** Functional requirement of flooring, types of floor finishes and their suitability, construction details for concrete, tiles and stone flooring. Types of flooring: timber flooring, cement concrete flooring, mosaic flooring, ceramic flooring, terrazzo flooring, tiled flooring, rubber flooring, cork flooring, epoxy asphalt flooring, hollow block and rib floors, Industrial flooring: tremix or Vacuum Dewatered Flooring (VDF). **b) Roofing Materials –** galvanized iron pre-coated aluminum sheets, fiber sheets, and Mangalore tiles. Roof construction: types and their suitability, method of construction, types of trusses, types of shell structure:dome, translation shells, space and frame structure: pneumatic structures, grain storage structures, prefabricated structures, fixing details of roof covering.

Unit IV: Doors, Windows, Arches and Lintels. (08 Hrs)

a) Doors and Windows – definition of technical terms, installation of doors and window frames and their size specifications, fixtures and fastenings. Types of doors: glazed or sash doors, plastic doors, flush doors, louvered doors, collapsible doors, revolving doors, rolling steel doors, sliding doors, swing doors, folding doors. Types of windows: casement window, double hung window, pivoted window, sliding windows, louvered or venetian window, metal window, sash or glazed window, bay window, corner window, dormer window, gable window, skylight window, circular window, mosquito proof window, curtain wall window. Ventilators: purpose and types.

b) Arches and Lintels – principle of arch action, types of arches, method of arch construction, centering and removal of centering. Lintels: necessity and types, chajja or weather shade necessity and types.

Unit V:Vertical Circulation and Protective Coatings (08 Hrs)

a) Vertical Circulation – Consideration in planning, design considerations, Staircase: types, and details of ramps. Ladders, lifts, and escalator. Types of staircase: straight stairs, open well stairs, quarter turn stairs, half turn stairs, turning stairs, dog-legged stairs, circular stairs, geometrical stairs, bifurcated stairs, and spiral stairs.

b) Protective Coatings – plastering types : lime plaster, cement plaster, gypsum plaster used in spray fire proofing, plaster of Paris and application, pointing: purpose & types, mortar preparation and types, painting and varnishing, types and application, white washing, distempering, oil paints. Wall cladding: materials, method, wall papering and glazing work.

Unit VI: Miscellaneous Materials and Safety in Construction (08 Hrs)

a) Miscellaneous Materials – Properties, types and uses of following materials: lime, polymers, plastic types, mastic, gypsum, clay tiles and glazed wares, Timber: types and properties, advantages and applications of aluminum, stainless steel, fibrous, laminated, particulate, combinations of composite materials: laminated fiber reinforced polymers. Glass: uses, types and properties, application and ingredients, market forms, glass claddings, aluminum composite panel cladding. Ceramic products: ceramic sanitary application, water closet, urinals, washes basins, their common sizes, pipes and fittings. Eco-friendly materials: eco-friendly decorating materials, eco-friendly flooring, thatch, bamboo, linoleum, cork.

b) Safety in Construction – safety on site, storage of materials, construction safety, prevention of accidents, fire proof construction. Repairs and maintenance: addition, and alteration, strutting and shoring.

Books:

Text:

1. Building Construction by B.C. Punmia, Laxmi Publications.
2. Building Materials by S.V.Deodhar, Khanna Publication.
3. Building Construction by Bindra and Arora, Dhanpat Rai Publications.
4. Civil Engineering Materials by Neil Jackson & Ravindra K. Dhir, Palgrave Macmillan.

Reference:

1. Building Materials by S. K. Duggal, New Age International Publishers.
2. Civil Engineering Materials by TTTI Chandigrah, Tata McGraw Hill Publications.
3. Materials of construction by D.N Ghose, Tata McGraw Hill.
4. Building Construction by S.C. Rangwala, Charotdar Publications.
5. National Building Code of India 2005.
6. The construction of buildings; seventh edition, Vol.1 & Vol.2 by R. Barry, Oxford: Blackwell Science.
7. Building Materials Technology by Ruth T. Brantley & L. Reed Brantley, Tata McGraw Hill.
8. Properties of Concrete by A. M. Neville, Pearson Education Limited.
9. Mitchell's Advanced Building Construction: The Structure by J. Stroud Foster

e-Resources:

1. http://nptel.ac.in/syllabus/105102088/
2. http://www.theconstructioncivil.org/types-of-brick-bonds
3. http://theconstructor.org/building/types-of-partition-walls/3754
4. https://www.osha.gov/Publications/OSHA3252/3252.html
5. http://www.engineerwing.com/2012/10/tremix-flooring.html
6. http://nptel.ac.in/courses/Webcourse.../Composite%20Materials/.../LNm1.pdf
7. https://en.wikipedia.org/wiki/Fibre-reinforced_plastic.
8. https://cdn.intechopen.com/pdfs-wm/41941.pdf.
9. http://home.iitk.ac.in/~mohite/Composite_introduction.pdf
10. http://www.vdfflooring.in/faqs.html.
11. http://theconstructor.org/building/buildings/eco-friendly-building-materials/720.
12. http://nptel.ac.in/courses/105103093/21.

List of Laboratory Assignments

It shall consist of the following exercises and seminar.

A) Measurement drawing exercise of an existing residential building (G+1)

Draw a detailed plan, elevation and section using suitable scale on same sheet.

Following sketches pertaining to the above plan (with Standard Dimensions).

a. Door- Panelled door

b. Window

c. Stair.

B) Students should prepare working drawing of Foundation Plan (on tracing paper) for the above Residential Building Plan. It should contain detailed foundation plan with foundation details. (Use suitable scale 1:50 or 1:100).

C) Draw sketches using computer software of the following:

1. Details of the shallow footings.
2. Details of arch showing different components

D) Two site visits and technical report on the visit.

1. Site visit based on existing residential building (G+1) as noted in part A above.
2. Any on-going Construction Site (visit report should contain: details of the project, stage of construction, sketches of components with cross section & dimensions, materials used and site plan, etc.)

E) 1. Collection of advertisements of modern construction materials and tools used in construction.

2. Visit to a construction related exhibition.

Term work: Based on above syllabus.

Savitribai Phule Pune University, Pune
S.E. (Civil Engineering) 2015 Course

207001: Engineering Mathematics III
Credits: 04+01

Teaching Scheme:	Examination Scheme:
Theory : 04 hrs/week	**In-Semester (Online) : 50 Marks**
Tutorials : 02 hrs/week	**End-Semester : 50 Marks**
	Term Work : 50 Marks

Prerequisites : Differential and Integral Calculus, Taylor series and Infinite series, Differential equations of first order and first degree, Fourier series, Measures of central tendency and dispersion, Vector algebra.

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of mathematical principles related to:

1) Ordinary and Partial differential equations applied to structural analysis and fluid dynamics in civil engineering.
2) Numerical methods for analyzing problems in hydraulics, geotechnics and structures in civil engineering.
3) Statistical methods such as correlation, regression analysis and probability theory for experimental data to quantify risk and safety in their designs.
4) Vector differentiation and integration applied to problems in fluid mechanics.

Course Outcomes:

On completion of the course, learner will be able to

1) Solve higher order linear differential equations and apply to civil engineering problems such as bending of beams and whirling of shafts.
2) Solve system of linear equations using direct and iterative numerical techniques and develop solutions to ordinary differential equations using single step and multistep methods applied to structural systems.
3) Apply statistical methods like correlation, regression analysis in analyzing and interpreting experimental data and probability theory applied to construction management.
4) Perform vector differentiation and integration, analyze the vector fields and apply to fluid flow problems.
5) Solve various partial differential equations such as wave equation, one and two dimensional heat flow equations.

Course Contents

Unit I: Linear Differential Equations (LDE) and Applications (09 Hrs)

LDE of n^{th} order with constant coefficients, Method of variation of parameters, Cauchy's & Legendre's Differential Equations, Simultaneous & Symmetric simultaneous Differential Equations. Modeling of problems on bending of beams, whirling of shafts and mass spring systems.

Unit II: Numerical Methods (09 Hrs)

Numerical solutions of (i) System of linear equations by Gauss elimination method, Cholesky and Gauss-Seidel methods (ii) Ordinary differential equations by Euler's, Modified Euler's, Runge-Kutta 4^{th} order and Predictor-Corrector methods.

Unit III: Statistics and Probability (09 Hrs)

Measures of central tendency, Standard deviation, Coefficient of variation, Moments, Skewness and Kurtosis, Correlation and Regression, Reliability of Regression estimates.

Probability, Probability density function, Probability distributions: Binomial, Poisson, Normal and Hypergometric, Test of hypothesis: Chi-square test.

Unit IV: Vector Differential Calculus (09 Hrs)

Physical interpretation of Vector differentiation, Vector differential operator, Gradient, Divergence and Curl, Directional derivative, Solenoidal, Irrotational and Conservative fields, Scalar potential, Vector identities.

Unit V: Vector Integral Calculus and Applications (09 Hrs)

Line, Surface and Volume integrals, Work-done, Green's Lemma, Gauss's Divergence theorem, Stoke's theorem. Applications to problems in Fluid Mechanics, Continuity equations, Streamlines, Equations of motion, Bernoulli's equation.

Unit VI: Applications of Partial Differential Equations (PDE) (09Hrs)

Basic concepts, modeling of Vibrating String, Wave equation, one and two dimensional Heat flow equations, method of separation of variables, use of Fourier series. Applications of PDE to problems of Civil and allied Engineering.

Books:

Text:

1. Advanced Engineering Mathematics, Ninth edition, by Erwin Kreyszig (Wiley India).
2. Advanced Engineering Mathematics, seventh edition, by Peter V. O'Neil (Cengage Learning).

Reference:

1. Advanced Engineering Mathematics, second edition, by M. D. Greenberg (Pearson Education).
2. Advanced Engineering Mathematics, Wylie C.R. & Barrett L.C. (McGraw-Hill, Inc.)
3. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi).
4. Applied Mathematics (Volumes I and II) by P. N. Wartikar & J. N. Wartikar (Pune Vidyarthi Griha Prakashan, Pune).
5. Higher Engineering Mathematics by B.V. Ramana (Tata McGraw-Hill).
6. Advanced Engineering Mathematics with MATLAB, second edition, by Thomas L. Harman, James Dabney and Norman Richert (Brooks/Cole, Thomson Learning).

Guidelines for Tutorial and Term Work

1. Tutorial shall be engaged in four batches (batch size of 20 students maximum) per division.
2. Term work shall be based on continuous assessment of six assignments (one per each unit) and performance in internal tests.

Term work: Based on above syllabus.

Savitribai Phule Pune University, Pune
S.E. (Civil Engineering) 2015 Course

201006: Surveying
Credits: 04+01

Teaching Scheme:		Examination Scheme :	
Theory :	04 hrs/week	In-Semester (Online)	: 50 Marks
Practical :	02 hrs/week	End-Semester	: 50 Marks
		Practical	: 50 Marks

Prerequisites: Fundamentals of Basic Civil Engineering and Engineering Mathematics.

Course Objectives:

1) To learn the basics of plane surveying and different types of instruments used for plane surveying.
2) To learn different methods of surveying.
3) To understand advancements in plane surveying such as electronic instruments and softwares.

Course Outcomes:

On completion of the course, learner will be able to

1) Operate and use surveying equipment.
2) Draw plan or map of the existing permanent features on the ground.
3) Classify the ground features from the map or plan.
4) Analyze temporary adjustments and check permanent adjustments of the Theodolite.

Course Contents

Unit I: Compass and Plane Table Surveying. (08 Hrs)

a) Definition, objective and fundamental classification of surveying (Plane and Geodetic), concept of Scale, Ranging, Chaining, Offsetting and Traversing. Concept of bearing, meridian and their types, construction and use of prismatic compass, local attraction and correction for local attraction, dip, declination and calculation of true bearings.

b) Equipment required for plane table surveying and their uses, advantages and disadvantages, methods of plane table survey: Radiation, intersection, traversing.

Unit II: Levelling and Contouring. (08 Hrs)

a) Introduction to leveling, Types of leveling, Types of bench marks, Study and use of dumpy level, auto level, digital level and laser level in construction industry, principle axes of dumpy level, testing and permanent adjustments, reciprocal leveling, curvature and refraction corrections, distance to the visible horizon.

b) Contouring – direct and indirect methods of contouring, uses of contour maps, study and use of topo-sheets, profile leveling and cross-sectioning and their applications.

Unit III: Theodolite Surveying. (08 Hrs)

a) Study of vernier transit 20” theodolite, uses of theodolite for measurement of horizontal angles by repetition and reiteration, vertical angles, measurement of deflection angles using transit theodolite and magnetic bearing, prolonging a line, lining in and setting out an angle with a theodolite. Fundamental axes of theodolite: testing and permanent adjustments of a transit theodolite.

b) Theodolite traversing – computation of consecutive and independent co-ordinates, adjustment of closed traverse by transit rule and Bowditch’s rule, Gales traverse table. Checks, omitted measurements, area calculation by independent co-ordinates.

Unit IV: Tacheometry& Electronic Measurement Techniques. (08 Hrs)

a) Tacheometry – application and limitations, principle of stadia tacheometry, fixed hair method with vertical staff to determine horizontal distances and elevations of points, finding tacheometric constants. Tacheometric contouring.

b) Surveying using total station – Study and use of Electronic Tacheometer (Total station) types, functions (remote elevation measurements, remote distance measurements, area measurement).

Unit V: Curves. (08 Hrs)

Introduction to horizontal and vertical curves (no numerical and derivations to be asked on vertical curves and reverse curves), different types and their applications, simple and compound circular curves, elements and setting out by linear methods such as radial and perpendicular offsets, offsets from long chord, successive bisection of chord and offsets from chords produced. Angular methods: Rankine’s method of deflection angles (one and two theodolite methods). (Numerical on simple circular curves and compound curves to be asked), Transition curves: necessity and types.

Unit VI: Construction Survey & Space Based Positioning System (SBPS) (08 Hrs)

a) Introduction to construction survey, establishing of horizontal and vertical controls, setting out of buildings, maintaining verticality of tall buildings, survey for open traverse (roadway, railways, drainage lines, water lines, canals).

b) Introduction to SBPS, SBPS systems - GPS, GLONASS, Galileo, GAGAN, BeiDou and their features, Segments of SBPS (Space, Control and User), applications of SBPS in surveying.

Books:

Text:

1. Surveying and Levelling Vol. I and Vol. II by T. P. Kanetkar and S.V.Kulkarni , Pune Vidyarthi Griha Prakashan.
2. Surveying and Levelling by Subramanian, Oxford University Press.
3. Surveying, Vol. I & II by Dr. B. C. Punmia, Ashok K. Jain, ArunK.Jain , Laxmi Publications.
4. Textbook of Surveying by C. Venkatramaiah , University Press.
5. Surveying for Engineers by John Uren & Bill Price, Palgrave Macmillan.
6. Surveying, Vol. I & II by S. K. Duggal, TataMc-Graw Hill.

Reference:

1. Plane Surveying by A. M. Chandra, New Age International Publishers.
2. Surveying and Levelling by N. N. Basak , Tata McGraw Hill.
3. Surveying Vol. I & II by Dr. K. R. Arora , Standard Book House.
4. Surveying: Theory and Practice by James M. Anderson, Edward M. Mikhail, Tata McGraw Hill.
5. Surveying theory and practices by Devis R. E., Foot F. S.
6. Plane and Geodetic surveying for Engineers. Vol. I by David Clark, Constable.
7. Principles of Surveying. Vol. I by J. G. Olliver, J. Clendinning - Van Nostrand Reinhold.

Codes:

1. IRC: SP: 19 -Manual for Survey, Investigation and Preparation of Road Projects
2. IRC: SP: 35 - Guidelines for Inspection and Maintenance of Bridges
3. IRC: SP: 54 - Project Preparation Manual for Bridges
4. IRC: SP: 42 - Guidelines on Road Drainage
5. IRC: SP: 50 - Guidelines on Urban Drainage
6. IRC: 73 - Geometric Design Standards for Rural (Non-Urban) Highways
7. IRC: 86 - Geometric Design Standards for Urban Roads in Plains
8. IRC: 38 - Design Tables for Horizontal Curves for Highways
9. IRC SP: 23 - Vertical Curves for Highways

e-Resources:

1. http://www.bis.org.in/sf/wrd/p_449.pdf
2. http://www.bis.org.in/sf/wrd/WRD10(491).pdf
3. http://www.bis.org.in/sf/wrd/WRD10(491).pdf
4. http://sbq.com.au/member/board-publications/code-of-practice/
5. http://usa.autodesk.com/adsk/servlet/pc/index?id=3091031&siteID=123112
6. http://www.cadacademynoida.com/?page=civileng3
7. http://www.sitetopo.com

List of Laboratory Assignments

Perform any five out of 1 to 7 and All projects are mandatory:

1. Measurement of magnetic bearings of sides of a triangle or polygon, correction for local attraction and calculations of true bearings using prismatic compass.
2. Plane table survey by Intersection method.
3. Finding horizontal and vertical distance using Tacheometer.
4. Simple and differential levelling with at least three change points using digital level.
5. Measurement of horizontal angles (by repetition method) using Vernier Transit Theodolite.
6. Setting out a circular curve by Rankine's method of deflection angles.
7. Setting out a building from a given foundation plan (minimum six co-ordinates).

Project I : Road project using Auto level for a minimum length of 100 m including fixing of alignment, profile levelling, cross-sectioning, plotting of L section and Cross Section. (One full imperial sheet including plan, L-section and any three typical Cross-sections).
Project II: Tachometric contouring project on hilly area with at least two instrument stations about 60 m to 100 m apart and generating contours using software such as Autodesk land desktop, Auto-civil, Foresight etc. (minimum contour interval 1 meter).
Project III: Traversing using a total station (up to 2 acres area).

Savitribai Phule Pune University, Pune
S.E. (Civil Engineering) 2015 Course

201002: Strength of Materials
Credits : 04+01

Teaching Scheme:		**Examination Scheme:**	
Theory :	**04 hrs/week**	**In-Semester (Online)**	**: 50 Marks**
Practical :	**02 hrs/week**	**End-Semester**	**: 50 Marks**
		Oral	**: 50 Marks**

Prerequisites : Fundamentals of Physics, Mathematics and Engineering Mechanics.

Course Objectives:

1) To study the different types of stresses due to load, temperature, etc.
2) To learn concept of Shear Force and Bending Moment Diagram for determinate beams.

Course Outcomes:

On completion of the course, learner will be able to

1) Compute different type of stresses in determinate, indeterminate, homogeneous and composite structures.
2) Develop bending and shear stress diagram.
3) Determine the torsional stresses and stresses due to strain energy for different loading conditions.
4) Explain the concept of principal stresses due to combined loading and able to compare the values of analytical and graphical (Mohr's circle) method.
5) Plot loading diagram, Shear Force Diagram (SFD) and Bending Moment Diagram (BMD).
6) Analyze axially and eccentrically loaded column

Course Contents

Unit I: Simple Stresses and Strains. (08 Hrs)

a) Materials used in construction and their nature, Hook's Law, Stress-Strain Diagram for elastic , plastic materials and brittle material, Idealized stress-strain diagram , Concept of axial stresses (compression, tension), strain s(linear, lateral, shear and volumetric), Elastic constants and their relations. Stresses and strains due to change in temperature.

b) Stresses, strains and deformations in determinate and indeterminate structures for homogeneous and composite structures under concentrated loads and temperature changes.

Unit II: Bending and Shear Stresses.	**(08 Hrs)**

a) Concept and determination of Moment of Inertia for various cross-sections. Stress due to bending: theory of simple or pure bending, Assumptions, derivation of flexure formula, bending stress distribution diagrams, Moment of Resistance of cross-section.
b) Shear stresses in beams: concept of shear, complimentary shear, derivation of shear stress formula, shear stress distribution for various cross sections, maximum and average shear stress for circular and rectangular sections and shear connectors.

Unit III: Torsion and Strain Energy. **(08 Hrs)**

a) Torsion of circular shafts: theory of torsion, assumptions, derivation of torsion formula. Stresses, strains and deformations in determinate and indeterminate shafts of hollow, solid, homogeneous and composite cross-sections subjected to twisting moments. Power transmitted by shafts, twisting moment diagrams
b) Strain energy and impact: concept of strain energy, expression of strain energy for axially loaded member under gradual, sudden and impact loads. Strain energy due to self-weight.

Unit IV: Principal Stresses and Strains. **(08 Hrs)**

a) Principal stresses and strains: concept of principal planes and principal stresses, normal and shear stresses on an oblique plane, magnitude and orientation of principal stresses and maximum shear stress.
b) Combined effect of axial stress, bending moment, shear and torsion. Theories of failure: maximum normal stress, maximum shear stress and maximum strain theory

Unit V: Shear Force and Bending Moment Diagram. **(08 Hrs)**

a) Concept of shear force and bending moment. Relation between shear force, bending moment and intensity of loading. Shear force and bending moment diagrams for cantilevers, simple and compound beams due to concentrated, uniformly distributed, uniformly varying loads and couples in determinate beams.
b) Bending moment and loading diagram from given shear force diagram. Shear force and loading diagram from given bending moment diagram

Unit VI: **Axially and Eccentrically Loaded Columns.** **(08 Hrs)**

a) Axially loaded columns: concept of critical load and buckling, Euler’s formula for buckling load with hinged ends, concept of equivalent length for various end conditions, Rankine’s formula, safe load on column and limitations of Euler’s formula.
b) Direct and bending stresses for eccentrically loaded short column and other structural components such as retaining walls, dams, chimneys, etc. Effect of lateral force and self-weight. Resultant stress diagrams due to axial loads, uni-axial, and bi-axial bending. Concept of core of section for solid and hollow rectangular and circular sections.

Books:

Text:

1. Mechanics of Structures Vol. II by S. B. Junnarkar and Dr. H. J. Shah, Twenty second edition, Charotar Publishing House Pvt Ltd.
2. Strength of Materials by D. Ghosh A. K. Datta, New Age International Publishers
3. Strength of Materials by R. Subramanian, Oxford University Press.
4. Strength of Materials by S. S. Ratan, Tata McGraw Hill.
5. Mechanics of solids by R Vaidynathan, P Perumal and S Lingedwari, Scitech Publication (India) Pvt Ltd.

Reference:

1. Elements of Strength of Materials by Timoshenko and Young, East-West Press Ltd.
2. Strength of Materials by F.L. Singer and Andrew Pytel , Harper and Row Publication.
3. Mechanics of Materials by Beer and Johnston, McGraw Hill Publication.
4. Introduction to Mechanics of Solids by E.P. Popov, Prantice Hall Publication.
5. Mechanics of Materials by Gere & Timoshenko, CBC publisher.

List of Laboratory Experiments

Sr. No.	Group A
1	**Metals** 1. Tension test on mild and TMT steel. 2. Shear (Single & Double)test on mild steel. 3. Torsion test on mild steel. 4. Impact (I & C) test on mild steel, aluminum, brass.
	Group B
2	**Timber & Ply wood** 1. Compression test on timber (Parallel & Perpendicular) 2. Bending test on timber and plywood.
	Group C
3	**Bricks &Tiles** 1. Field tests, Water absorption and efflorescence test on bricks. 2. Compressive strength test on bricks 3. Flexural strength of flooring tiles. 4. Abrasion test of flooring tiles.

Term Work : Based on above syllabus

Savitribai Phule Pune University, Pune
S.E. (Civil Engineering) 2015 Course
201003: Geotechnical Engineering
Credits: 04+01

Teaching Scheme:		Examination Scheme:	
Theory :	**04 hrs/week**	**In-Semester**	**: 50 Marks**
Practical :	**02 hrs/week**	**End-Semester**	**: 50 Marks**
		Oral	**: 50 Marks**

Prerequisites : Fundamentals of Engineering Mathematics and Engineering Mechanics.

Course Objectives:

1) To describe soil properties, classification and its behavior under stress.
2) To learn methods for measurements and determination of index & properties of soil.
3) To study the interaction between water and soil and the effects of static vs flowing water on soil strength.

Course Outcomes:

On completion of the course, learner will be able to

1) Differentiate the different types of soil and their engineering properties and classify them;
2) Determine the soil properties in laboratory and develop a proficiency in handling experimental data;
3) Understand of the concept of effective stress and its influence on soil behavior.
4) Develop an understanding of the influence of water flow on the engineering behaviour of soils.
5) Analyze engineering properties like compaction, permeability, soil shear strength.
6) Compute the lateral thrust due to backfill on the retaining walls.
7) Classify soil slopes and identify their modes of failure.

Course Contents

Unit I: Introduction and Index Properties. **(08 Hrs)**

a) Introduction to Geotechnical Engineering and its applications to Civil Engineering, Types of soil structure, major soil deposits of India, Field identification of soils. Introduction to soil exploration: objective and purpose.

b) Three phase soil system, weight – volume relationships, Index properties of soil: Methods of determination and their significance. IS and Unified Soil classification systems.

Unit II: Permeability and Seepage. (08 Hrs) a) Soil water, permeability definition and necessity of its study, Darcy's law, factors affecting permeability. Laboratory measurement of permeability: Constant head method and Falling head method as per IS 2720. Field test for determination of permeability- Pumping in test and Pumping out test as per IS 5529 Part-I. Permeability of stratified soil deposits.	
b) Seepage and Seepage Pressure, quick sand phenomenon, critical hydraulic gradient, General flow equation for 2-D flow (Laplace equation), Flow Net, properties and application, Flow Net construction for flow under sheet pile and earthen dam.	
Unit III: Compaction and Stress Distribution. (08 Hrs) **a) Compaction –** Introduction, Comparison between compaction and consolidation, compaction tests- Standard Proctor test, Modified Proctor test, Zero air void line. Factors affecting compaction. Effect of compaction on soil properties. Field compaction methods and compaction equipment for different types of soil, Placement water content, Field compaction control- use of compaction test result, Proctor needle in field compaction control. **b) Stress Distribution in Soils –** Geostatic stress, Boussinesq's theory with assumptions for point load and circular load (with numerical), Pressure Distribution diagram on a horizontal and vertical plane, Pressure bulb and its significance. Westergaard's theory, equivalent point load method, Approximate stress distribution method.	
Unit IV: Shear Strength of Soil. (08 Hrs) **a) Introduction –** Shear strength an Engineering Property. Mohr's stress circle, Mohr-Coulomb failure theory. The effective stress principle- Total stress, effective stress and neutral stress / pore water pressure. Peak and Residual shear strength, factors affecting shear strength. Stress-strain behavior of sands and clays. **b) Measurement of Shear Strength –** Direct Shear test, Triaxial Compression test, Unconfined Compression test, Vane Shear test. Their suitability for different types of soils, advantages and disadvantages. Different drainage conditions for shear tests. Sensitivity and thixotropy of cohesive soils.	
Unit V: Earth Pressure. (08 Hrs) **a) Earth Pressure –** Introduction, Rankine's state of Plastic Equilibrium in soils- Active and Passive states due to wall movement, Earth Pressure at rest. Rankine's Theory : Earth pressure on Retaining wall due to submerged backfill. b) Backfill with uniform surcharge, backfill with sloping surface, layered backfill. Coulomb's Wedge theory. Rebhann's and Culmann's graphical method of determination of earth pressure.	

Unit VI: Stability of Slopes and Introduction to Geo-environmental engineering.(08Hrs)

a) Stability of Slopes – Classification of slopes and their modes of failure, Taylor's stability number, Infinite Slopes in cohesive and cohesion less soil, Landslides- Causes and remedial measures.

b) Introduction to Geo-environmental engineering, subsurface contamination, contaminant transport, effects of subsurface contamination, Control and remediation, Soil- A geochemical trap, detection of polluted zones, Monitoring effectiveness of designed facilities.

Books:

Text:

1. Soil Mechanics and Foundation Engineering by Dr. B. C. Punmia, Laxmi Publications.
2. Geotechnical Engineering by Shashi K. Gulati & Manoj Datta, Tata McGraw Hill.
3. Principles of Soil Mechanics and Foundation Engineering by V.N.S. Murthy, UBS Publishers.
4. Geotechnical Engineering by Dr. B. J. Kasmalkar, Pune Vidyarthi Griha Prakashan.

Reference:

1. Geotechnical Engineering by C. Venkatramaiah, New Age International Publishers.
2. Principles of Geotechnical Engineering by Braj M.Das, Cengage Learning.
3. Geotechnical Engineering by P Purushothma Raj , Tata McGraw Hill.
4. Geotechnical Engineering by Principles & Practices by Donald. P. Coduto, Pearson Education.
5. Basic and Applied Soil Mechanics by Gopal Ranjan and A. S. R. Rao, Newage International.
6. Physical and Geotechnical Properties of Soils by Joseph E. Bowles, International Students Edition.

e- Resources:

1. http://ascelibrary.org/page/books/s-gsp.
2. http://accessengineeringlibrary.com/browse/geotechnical-engineers-portable-handbook-second-edition.
3. http://nptel.ac.in/courses/105101084/
4. http://nptel.ac.in/courses/105106142/

List of Laboratory Experiments / Assignments

The term work shall consist of a journal giving details of at least 11 out of 13 of the following experiments. Assignments - Sr. No 14 and 15 are compulsory.

1. Water content determination by any two methods a) Oven drying method, b) Infrared moisture method, c) calcium carbide method
2. Specific gravity determination by Pycnometer /density bottle.
3. Sieve analysis, particle size determination and IS classification as per I.S. Codes.
4. Determination of Consistency limits and their use in soil classification as per I.S. Codes.
5. Field density test by a) Core cutter b) Sand Replacement and c) Clod method
6. Determination of coefficient of permeability by a) Constant head and b) Variable head method.
7. Direct shear test.
8. Unconfined compression test.
9. Vane Shear test.
10. Standard Proctor test / Modified Proctor test.
11. Differential free swell test.
12. Triaxial test
13. Swelling Pressure test
14. Collection of sample soil investigation report for any construction project and write report about interpretation of index properties of soil.
15. Assignments on the following topics:
    a) Rebhann's and Cullman's graphical method for determination of earth pressure.
    b) Solution of problems on shear strength parameters using graph.
    c) Flow net construction for sheet pile or earthen dam.

Note: Performance based oral examination on the above Term Work.

Savitribai Phule Pune University, Pune
S.E. (Civil Engineering) 2015 Course

Awareness to Civil Engineering Practices
Audit Course
(Certificate to be issued by institute based on performance assessment)

Civil Engineering is the oldest engineering profession comprising of a variety of sub-disciplines such as structural engineering, geotechnical, water resources, environmental engineering, construction, transportation etc. Undergraduate programmes are designed with different theoretical approaches on the application of basic sciences to solve different societal problems by engineering knowledge. However, there is a need to make the students aware about how the Civil Engineering industry operates and how theories taught in different courses are applied in practice. The students can learn from the experience gained from different workplaces such civil engineering consultancies, contracting companies, construction sites etc. The course aims to provide insight of the different practices followed by the industry such use of different contracts in civil engineering practice, local by-laws, duties and responsibilities of the Engineers, site records and diaries, Health and Safety practices on site, etc.

Course Objectives:

1) To provide basic overview of functioning of different civil engineering related industries / firms.
2) To provide awareness on application of different drawings, contract documents in civil engineering.
3) To provide insight of code of ethics, duties and responsibilities as a Civil Engineer.

Course Outcomes:

On completion of the course, learner will be able to understand

1) Different types of civil engineering industries and their functioning.
2) Applications of different documents, drawings, regulations in Civil Engineering industries.
3) Code of ethics to be practiced by a Civil Engineer and understand duties and responsibilities as a Civil Engineer
4) Different safety practices on the site.

Course Contents

1. Awareness lectures by professionals.
2. Visit to construction site/ architectural firms/ structural engineering firms etc.
3. Discuss on issues such as sustainability, eco-friendly techniques, use of locally available materials etc. directly related to techno economic development of society.

Guidelines for assessment

1. Presentation
2. Visit report
3. Group discussion

Savitribai Phule Pune University, Pune

S.E. (Civil Engineering) 2015 Course

201004: Fluid Mechanics-I

Credits: 04+01

Teaching Scheme:		**Examination Scheme :**	
Theory	**: 04 hrs/week**	**In-Semester (Online)**	**: 50 Marks**
Practical	**: 02 hrs/week**	**End-Semester**	**: 50 Marks**
		Oral	**: 50 Marks**

Prerequisites : Fundamentals of Engineering Mechanics, Engineering Mathematics and Engineering Physics.

Course Objectives:

1) To study basics of Fluid Mechanics, Fluid properties and concept of submerged & floating structure in a static fluid.
2) To make use of principles of continuity, momentum, and energy as applied to fluid motions.
3) To apply fundamental principles of fluid mechanics for the solution of practical civil engineering problems.

Course Outcomes:

On completion of the course, learners will be able to:

1) Use fluid properties, dimensional analysis for solving problems of fluid flow.
2) Solve fluid statics problems.
3) Measure fluid pressure.
4) Calibrate discharge measuring instrument like ventrurimeter, orifice meter.
5) Distinguish between various types of fluid flows and find the fluid velocity using principles of Kinematics and Dynamics.
6) Design pipes to carry particular amount of discharge.

Course Contents

UNIT I: Properties of Fluids & Dimensional Analysis	**(08 Hrs)**

a) Definition of fluid and fluid mechanics: examples and practical applications involving fluids at rest and in motion, physical properties of fluids: density, specific weight, specific volume, relative density and viscosity. Newton's law of viscosity, classification of fluids, rheological diagram, Dynamic and kinematic viscosity, compressibility, cohesion, adhesion, surface tension, capillarity, vapour pressure, problems involving use of above fluid properties.

b) Dimensions of physical quantities, dimensional homogeneity, dimensional analysis using Buckingham's π theorem method, geometric kinematic and dynamic similarity, important dimensionless parameters (Reynolds No., Froude No., Euler No., Mach no. and Weber No) and their significance , Model Laws (Froude's Law and Reynold's law)

UNIT II: Fluid Statics, Buoyancy (08 Hrs)

a) The basic equation of hydrostatics, concept of pressure head, measurement of pressure (absolute, gauge), application of the basic equation of hydrostatics, Pressure measuring devices (simple manometers, differential manometers: U tube, inclined, Mechanical gauges and precision manometers, pressure transducers and their types), Centre of pressure, total pressure on plane and curved surfaces, practical applications.

b) Principle of floatation and buoyancy, equilibrium of floating and submerged bodies, stability of floating and submerged bodies. Metacentre and metacentric height and its determination (experimental & analytical methods).

UNIT III: Fluid Kinematics (08 Hrs)

a) Methods of describing the motion of fluid, velocity and acceleration, and their components in Cartesian co-ordinates, stream line, stream tube, path line, and streak line, control volume. Classification of flow: steady and unsteady; uniform and non-uniform; laminar and turbulent; One, two, and three-dimensional flows; compressible and incompressible; rotational and irrotational; critical, sub critical and supercritical flows.

b) Equation of continuity for three dimensional flow in Cartesian co-ordinates, equation of continuity for one-dimensional flow along a streamline, types of motion, rotational and irrotational motion, velocity potential, stream function and flow net, methods of drawing flow net (graphical and electrical analogy), uses and limitations of flow net.

UNIT IV: Fluid dynamics, Bernoulli's equation (08 Hrs)

a) Forces acting on fluid mass in motion, Euler's equation of motion along a streamline and its integration, assumptions of Bernoulli's equation, Modified Bernoulli's equation, its applications and limitations, Hydraulic grade line and total energy line. Linear momentum equation and kinetic energy correction factor, momentum correction factor (Only information).

b) Venturimeter, Orifice and orifice meter, Rotameter, Flow through sharp edged circular orifice discharging free, Hydraulic coefficients for orifice, Pitot tube.

UNIT V: Laminar flow & boundary layer theory (08 Hrs)

a) Reynolds experiment, laminar flow through a circular pipe, flow between two fixed parallel plates: Couette flow (only introduction), methods of measurement of viscosity (Newton's Law of Viscosity: Rotating cylinder viscometer:, Stokes' law: Falling sphere viscometer, Hagen Poiseuille Equation : Redwood Viscometer), Darcy's law, Transition from laminar to turbulent flow.

b) Concept of boundary layer, development of boundary layer on a flat plate, nominal, displacement, momentum, energy thicknesses, laminar, transitional and turbulent boundary layer, laminar sub layer, Local and mean drag coefficients, hydrodynamically smooth and rough boundaries. Boundary Layer separation and its control.

Unit VI : Turbulent flow & Flow through Pipes (08 Hrs)

a) Characteristics of flow, instantaneous velocity, temporal mean velocity, scale of turbulence and intensity of turbulence, Prandtl's mixing length theory.

b) Flow through pipes: energy losses in pipe flow (major losses and minor losses), Darcy Weisbach Equation, variation of friction factor for laminar flow and for turbulent flow, Nikuradse's experiments on artificially roughened pipes, resistance to flow in smooth and rough pipes, friction factor for commercial pipes, Moody's diagram, flow through pipes such as simple, compound, series parallel, Dupits equations, branched pipes, Three reservoir and pipe net work analysis: only theory, flow through siphon.

Books:

Text:

1. Hydraulics & Fluid Mechanics by Dr. P. N. Modi and Dr. S. M. Seth, Standard Book House.
2. Fluid Mechanics and Hydraulic Machines by McGraw Hill Education (India).

Reference:

1. Fluid Mechanics by Yunus Cengel, Jhon Cimbala, Tata Macgraw Hill,New Delhi.
2. Fluid Mechanics by R. J. Garde, A.J Mirajgaonkar, SCITECH Publication.
3. Fluid Mechanics by Streeter & Wylie, Tata McGraw Hill.
4. Fluid Mechanics by Dr. A. K. Jain, Khanna Publishers.
5. Fluid Mechanics by K. Subramanya, McGraw Hill.
6. Fluid Mechanics by Frank White, McGraw Hill.
7. Fluid Mechanics and Fluid Machinery by R. K. Bansal, Laxmi Publications.

Hand books:

1. http://www.engmatl.com/home/viewdownload/10-engineering-handbooks-pocket-books/123- fluid-mechanics-handbook
2. http://www.springer.com/materials/mechanics/book/978-3-540-25141-5.

e-Resourses:

1. http://nptel.iitm.ac.in/courses.php
2. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-KANPUR/FLUID MECHANICS /ui/ Course_home-3.htm

List of Laboratory Experiments / Assignments

The term work shall consist of a journal giving details of a minimum 8 out of the following experiments. **First Six experiments are compulsory.**

1. Measurement of viscosity by Redwood viscometer.
2. Measurement of pressures using different pressure measuring devices (including transducers /state of arts digital instruments also).
3. Determination of stability of floating bodies using ship models.
4. Experimental verification of Bernoulli's theorem with reference to loss of energy
5. Calibration of Venturimeter / Orifice meter.
6. Drawing flow net by electrical analogy for flow below weir (with & without sheet pile)
7. Plotting the pattern of laminar flow using Reynolds apparatus or Heleshaw's apparatus.
8. Transition of Laminar and turbulent flow through pipes.
9. Determination of, minor loss in a pipe system/friction factor for a given pipe.
10. Measurement of surface tension.
11. Demonstration of fluid flow through appropriate VCD/Audio visual / PPT's.

Assignments: any two of the following

1. Solve three reservoir problem / pipe network analysis using Excel or any programming language.
2. Determination of friction factor for a pipe using any programming language.
3. Application of any fluid mechanics software to analyze the problem.
4. Developing a demo model related to any fluid flow phenomenon (physical model/ soft model).
5. Assignment on drawing of flow net graphically.

Note: Performance based oral examination on the above Term Work.

Savitribai Phule Pune University, Pune
S.E. (Civil Engineering) 2015 Course

201005: Architectural Planning and Design of Buildings
Credits: 04+01

Teaching Scheme:	**Examination Scheme:**
Theory : 04 hrs/week	**In-Semester (Online) : 50 Marks**
Practical : 02 hrs/week	**End-Semester : 50 Marks**
	Practical : 50 Marks

Prerequisites : Basic Civil Engineering, Building Technology and Materials, National Building Code-2005, Developing Control Rules and Green building concepts.

Course Objectives:

1) To understand necessity of Town planning, principles of planning, principles of architecture and byelaws.
2) To study the planning for building services such as noise and acoustics, ventilation, lighting, plumbing work and safety practices.
3) To develop the plan, elevation and section of load bearing and framed structures.

Course Outcomes:

On completion of the course, learner will be able to:

1) Make use of principles of planning and principles of architectural Planning.
2) Analyze the available primary or secondary data and plan different types of structures considering futuristic need of an area.
3) Improve the status of existing structures by proposing appropriate green measures.
4) Plan effectively various types of buildings according to their utility with reference to different codes.
5) Understand and resolve contemporary issues at multi-dimensional functional levels.

Course Contents

Unit I: Town planning and legal aspects. (08 Hrs)

a) Town Planning : Necessity and evolution of town planning in India. Development plan and its importance, Objectives and Contents of DP, Land use zoning, Introduction to different zones of land in town planning, Requirements of various zones, Height zoning and Density zoning.

b) Legal Aspects : Role of Plan sanctioning authority, 7/12 abstract, meaning of different terms of 7/12 abstract, Form 6 and its types, Concept of TDR, List of documents to be submitted to local authority, Procedure for seeking Commencement and Occupancy Certificate, Various NOCs required.

Unit II: Architectural Planning , Building bye laws and introduction to Green Buildings (08 Hrs) a) Principles of Architectural design relation between form and function, utility, aesthetics. Necessity of bye-laws, plot sizes, road width, open spaces, floor area ratio (F.A.R.), concept of V.P.R. Marginal distances, building line : control line, height regulations, room sizes, Area calculations (built-up area, carpet area etc.), Rules for ventilation, lighting, Vertical circulation, Sanitation and Parking of vehicles. b) Green buildings: salient features, benefits, planning concepts (site selection, orientation, sun path and wind diagram etc.), Rating systems (LEED, GRIHA etc.)
Unit III: Architectural Drawing and Safety Aspects (08 Hrs) **a) Introduction to Architectural drawing :** i) Line plan, ii) Developed Plan, iii) Elevation, iv) Section, Selection of scales for various drawings, dimensioning, abbreviations and conventions as per IS 962, Elements of perspective drawings, parallel and angular perspective of small building elements. **b) Safety Aspects:** Fire load, grading of occupancies by fire loads, Evacuation Time, fire escape elements, Need for earthquake resistant structures, planning considerations, disaster management.
Unit IV: Building Services (08 Hrs) **a) Noise and Acoustics –** Sound insulation, Acoustical defects, Reverberation time, Sabine's formula, sound absorbents, planning for good acoustics. **b) Ventilation –** Necessity of Ventilation, Natural ventilation: stack effect and wind effect, Thermal Insulation, Mechanical ventilation and its types, air conditioning systems. **c) Lighting –** Principles of day lighting, design of windows, artificial illumination, SC, ERC, IRC, Daylight factor, Solar energy systems for lighting (BIPV). **d) Plumbing –** Water storage tanks at ground level and on terrace (capacity), Plumbing systems, various types of traps, Fixtures and Fittings, Rain Water Harvesting etc. **e) Other services –** Telecommunication, Electrical, Smart services and Waste management etc.
Unit V: Planning of Residential Buildings (08 Hrs) a) Functional requirements of Bungalows, Twin bungalows, Row houses, Ownership flats, and Apartments. b) Developed Plan, Elevation and Sectional Elevation of above mentioned categories.

Unit VI: Planning of Public Buildings **(08 Hrs)**

a) Functional requirements and planning of industrial buildings, commercial buildings, School, Colleges , Hostel, Auditorium, Restaurant/ Hotel building, Primary Health Center/ Hospital, Shopping complex, Sports complex, Vegetable market, Post office, Bank buildings etc .

b) Dimensioned line plans of above public buildings.

Books:

Text:

1. Building Drawings with an integrated Approach to Built-Environment by M. G. Shah, C. M. Kale and S. Y. Patki, New Delhi, Tata McGraw Hill. (5th edition.)
2. Building science and planning by Dr. S. V. Deodhar, Khanna Publishers.
3. Building Services Engineering by David V. Chadderton, sixth edition, London & New York.
4. Drawing for Civil Engineering by Jan A. Van Der Westhuizen

Reference:

1. National Building Code (latest).
2. Building Design and construction by Frederick Merrit, Tata McGraw Hill.
3. Times Saver standards of Architectural Design Data by Callender, Tata McGaw Hill.
4. I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings.
5. Development plan and DCP Rules of urban local body, New Delhi, Volume 12.
6. Model building bye laws by MoUD, GoI.

e-Resources :

1. http://www.grihaindia.org/
2. http://new.usgbc.org/
3. http://www.hcd.ca.gov/hpd/green_build.pdf
4. http://ncict.net/Examples/Examples1.aspx
5. http://www.igbc.in/site/igbc

List of Laboratory Assignments

Students shall prepare working drawings of any type of building from the list given in Unit V or Unit VI (**Individual project to be planned and manually drafted to suitable scale*):***

1. Layout/ Site plan indicating water supply and drainage line (with area statement).
2. Floor Plan/ Typical floor plan (with construction notes, schedule of openings).
3. Elevation and Sectional Elevation (preferably to be drawn on same sheet).
4. Developing measurement drawing exercise done in BTM course using CAD and Printout of the same.
5. Perspective drawing of a small building element.
6. Report file: It shall consist of data given for the project, Planning considerations and line plans, Design calculations.

Practical examination will be based on above syllabus and exercises mentioned in the list.
It will consist of :

i) Planning exercise on development of line plan or drawing the line plan using suitable Software or manual drafting.

ii) Exercise on D.C. Rules / numerical thereon or perspective drawing.

Assessment criteria: Line work, Planning/ designing abilities, Presentation and Understanding based on oral examination of relevant exercises.

Savitribai Phule Pune University, Pune
S.E. (Civil Engineering) 2015 Course

201008: Structural Analysis I
Credits : 04

Teaching Scheme:	**Examination Scheme :**
Theory : 03 hrs/week	**In-Semester (Online) : 50 Marks**
Tutorial : 01 hrs/week	**End-Semester : 50 Marks**

Prerequisites : Fundamentals of Physics, Mathematics, Engineering Mechanics and Strength of Materials.

Course Objectives:
1) To understand the basics configuration and classification of structures.
2) To analyze the determinate and indeterminate structures.

Course Outcomes:
On completion of the course, learner will be able to:
1) Understand the basic concept of static and kinematic indeterminacy, slope and deflection of determinate and indeterminate beams for analysis of structures.
2) Analyze indeterminate beams structures and frames.
3) Evaluate determinate and indeterminate trusses and its application in the field.
4) Apply influence line diagrams for the analysis of structures under moving load.
5) Analyze two and three hinged arches and its application.
6) Apply plastic analysis for indeterminate steel structures by limits state method.

Course Contents

Unit I: Fundamentals of Structure, Slope and Defection (08 Hrs)

a) Types and classification of structures based on structural forms, concept of indeterminacy, static and kinematics degree of indeterminacy.
b) Slope and deflection of determinate beams by Macaulay's method, concept of moment area method and conjugate beam method and its application.
c) Strain energy, Castigliano's first theorem, application to determine slope and deflection of determinate beams and frames.

Unit II: Analysis of Indeterminate Beams and Frames. (08 Hrs)

a) Propped cantilever and fixed beams by strain energy method, analysis of continuous beams by three moment theorem (Clapeyron theorem) up to three unknowns.
b) Castigliano's second theorem, analysis of beams and rectangular portal frames with indeterminacy up to second degrees.

Unit III: Analysis of Pin Jointed Plane Trusses. (08 Hrs)

a) Joint displacement of determinate trusses by Castigliano's first theorem.

b) Analysis of redundant trusses by Castigliano's second theorem, lack of fit, sinking of support, temperature changes (indeterminacy up to second degrees).

Unit IV: Influence Line Diagram. (08 Hrs)

a) Basic concept, Muller: Braslau's principle, influence line diagram for reaction, shear and moment to simply supported and overhanging beams, application of influence line diagram to determine reaction, shear and moment in beams.

b) Influence line diagram for axial force in trusses, application of influence line diagram to determine of axial forces in the members of plane determinate trusses under dead load and live load.

Unit V: Analysis of Arches (08 Hrs)

a) Three hinged arches – Concepts, types of arches, analysis of parabolic arch with supports at same and different levels, semicircular arches with support at same level, determination of horizontal thrust, radial shear and normal thrust for parabolic and circular arch.(04 hours)

b) Two hinged arches – analysis of parabolic and semicircular arches with supports at same level, determination of horizontal thrust, radial shear and normal thrust.

Unit VI: Plastic Analysis of Structure. (08 Hrs)

a) True and idealized stress-strain curve for mild steel in tension, stress distribution in elastic, elasto-plastic and plastic stage, concept of plastic hinge and collapse mechanism, statical and kinematical method of analysis, upper, lower bound and uniqueness theorem.

b) Plastic analysis of determinate and indeterminate beams, single bay single storied portal frame

.

Books:

Text:

1. Structural Analysis: A matrix approach by G.S. Pandit and S. P. Gupta, Tata Mc Graw Hill.
2. Analysis Structures: Strength and behavior by T. S. Thandavamoorthy, Oxford University Press.
3. Mechanics of solids and Structures Volume I by R. Vaidynathan, P. Perumal and S Lingedwari, Scitech Publication (India) Pvt Ltd.
4. Structural Analysis Vol-1, third edition, By S S Bhavikatti, Vikas publishing House, PVT, LTD.

Reference:

1. Mechanics of Structures Vol. II by S B Junnarkar and Dr. H J Shah, Twenty second edition, Charotar Publishing House Pvt. Ltd.
2. Basic Structural Analysis by C. S. Reddy, Second Edition, Tata Mc Graw Hill.
3. Structural Analysis by R. C. Hibbler, sixth edition, Pearson Education.
4. Plastic Methods of Structural Analysis by B. G. Neal, Champman and Hall.
5. Elementary Structural Analysis by Senol Utku, Charles Head Norris, John Benson Wilbur, TMH.
6. Intermediate Structural Analysis by C K Wang, Tata McGraw Hill.

Savitribai Phule Pune University, Pune
S.E. (Civil Engineering) 2015 Course

207009: Engineering Geology
Credits: 04+01

Teaching Scheme:	**Examination Scheme:**
Theory : 04 hrs/week	**In-Semester (Online) : 50 Marks**
Practical : 02 hrs/week	**End-Semester : 50 Marks**
	Term Work : 50 Marks

Prerequisites : Fundamentals of Basic Civil Engineering, Building Technology and Materials, Geotechnical Engineering.

Course Objectives:

1. To study basic of engineering geology and introductory part of the earth science.
2. To understand the utility and application of geological principles in various phases of civil engineering activities.
3. To describe the sources, and characterization of common Building materials.
4. To learn the basic aspects occur due to structural features like folds and faults.
5. To explain various natural hazards and their implications on structures and effects on society.

Course Outcomes:

After completing this course students of civil engineering will be able to:

1. Explain the basic concepts of engineering geology.
2. Differentiate between the different rock types, their inherent characteristics and their application in civil engineering.
3. Understand physical properties, mechanical properties of the minerals and their application in civil engineering. .
4. Identify favourable and unfavourable conditions for the buildings, roads, dam, tunneling etc through the rocks.
5. Explain mass wasting processes, effects of mass wasting process on the civil engineering structures and remedial measures.
6. Interpret geohydrological characters of the rocks present at the foundations of the dams, percolation tanks, tunnels.
7. Understand Seismic activities and its effect on the civil engineering construction.
8. Identify geological hazards and presence of ground water.

Course Contents

Unit I: Mineralogy, Petrology and General Geology. (08 Hrs)

a) Introduction to the subject, scope and sub divisions.

b) Introduction to mineralogy: Properties of Minerals, Classification of Minerals.

c) Introduction to petrology: Rock Cycle, broad classification of rocks.

Igneous Petrology: Plutonic, Hypabyssal and Volcanic rocks, Structure, Texture and Classification of Igneous rocks. Study of common rock types prescribed in practical work and their engineering applications.

Sedimentary Petrology: Rock weathering, Genetic classification of secondary rocks and grain size classification and Textures, Sedimentary Structures, Digenesis Process. Study of common rock types prescribed in practical work and their engineering applications.

Metamorphic Petrology: Agents, Types of metamorphism, Texture and structures. Study of common rock types prescribed in practical work and their engineering applications.

Unit II: Plate Tectonics and Structural Geology. (08 Hrs)

a) Introduction to plate tectonics and Mountain building activity.

b) Structural geology: Out crop, dip and strike, conformable series, unconformity and overlap, faults and their types, folds and their types, inliers and outlier.

c) Structures: Structural features resulted due to igneous intrusions, concordant and discordant igneous Intrusions, joints and their types, stratification and lamination.

Unit III: Geomorphology and Historical Geology. (08 Hrs)

a) Geomorphology: Geological action of river, Coastal Geology.

b) Historical geology: General principles of Stratigraphy, geological time scale, physiographic divisions of India, significance of their structural characters in major civil engineering activities.

Unit IV: Preliminary Geological Studies and Remote Sensing. (08 Hrs)

a) Preliminary geological explorations: reconnaissance survey, Desk Study, surface and subsurface Geological Investigation: methods, significance and limitations.

b) Techniques of correlation for surface and subsurface exploration, engineering significance of geological structures and relevant case studies.

c) Remote sensing (RS): Elements of remote sensing for Visual interpretation and geographical information system (GIS), application of remote sensing and geographical information system in Civil Engineering.

Unit V: Role of Engineering Geology in Reservoirs, Dams and Tunneling. (08 Hrs)

a) Geology of dams & Reservoir*:* Strength, stability and water tightness of foundation rocks, influence of geological conditions on the choice and type of dam, preliminary geological work on dam and reservoir sites, precaution to be taken to counteract unsuitable conditions and their relevant treatments with case studies.

b) Tunneling: Preliminary geological investigations, important geological considerations while choosing alignment, difficulties during tunneling as encountered due to various geological conditions, role of groundwater, and suitability of common rock types for excavation and tunneling and case studies.

Unit VI: Geological Hazards, Ground Water and Building Stones. (08 Hrs)

a) Geological hazards: Volcanism, Earthquakes & Seismic zones of India, Landslides and stability of hill slopes and preventive measures

b) Groundwater: Types of ground water, water table and depth zones, influence of hydrogeological properties of rocks, geological work of groundwater, types of aquifers, fluctuations in water table levels, effects of dams and canals, effect of pumping, cone of depression, circle of influence, conservation of groundwater, artesian wells, its geological conditions, artificial recharge of groundwater.

c) Building stones: Requirements of good building stone: strength, durability, ease of dressing, appearance, mineral composition, textures and field structures, suitability of common rocks as building stone.

Books:

Text:

1. Text Book of Engineering Geology by R.B. Gupte , 2001, P.V.G. Publications, Pune.
2. A Text Book of Engineering Geology by N. Chenna Kesavulu. 2010, Mc Millan India Ltd.
3. Principles of Engineering Geology by S.K.Garg.1999, Khanna Publ, New Delhi.
4. Principles of Engineering Geology by D. Venkat Reddy. 2010, Vikas Publishers.
5. Geology and Engineering by K. V. G. K. Gokhale and D. M. Rao, Tata McGraw-Hill.

Reference:

1. Physical Geology by P. K. Mukarjee, World Press, 2013.
2. Physical Geology by Arthur Holmes, ELBS Publication.
3. Principles of Engineering Geology and Geotechniques by D. P. Krynine & W. R. Judd. CBS Publishers, New Delhi.
4. Engineering Geology by F. G. H Blyth and De Frietus,2006, Reed Elsevier India Ltd.

IS Codes:

Sr. No	No. of the IS code	Title of the IS Code
1	IS 1123:1998	Method of identification of Natural building stone.
2	IS 4078:1967	Code of Practice for Indexing and Storage of drill cores
3	IS 4453: 1967	Code of Practice for exploration by Pits, Trenches, Shafts and Drafts
4	IS 5313: 1969	Guide lines for core drilling observations
5	IS 6926: 1973	Code of Practice for diamond core drilling for site investigations for river valley projects
6	Handbook	PWD Handbook Ch No. 6 Part II: 1980 published By Govt. of Maharashtra
7	IS 7779 (Part II 1,2,3):1979	Schedule of properties and availability of stones for construction purposes
8	IS 13030:1991	Method of test for lab determination of Water Content, Porosity, Density and related properties of rock material
9	IS 9143:1996	Method of determination of Unconfined Compressive Strength of rock material
10	IS 1124: 1998	Method of test for determination of Water absorption, Apparent Sp. Gravity and porosity of natural building stone
11	IS1122: 1998	Method of test for determination of Sp. Gravity of natural building stone
12	IS 2386 Part VIII	Methods of test for Petrographic Examination
13	Code No. 653	An Introduction to Earthquake Hazards: AICTE handbook
14	IRC Sec. 2400	Surface and Subsurface Geotechnical Explorations

List of Laboratory Assignments

Following experiments are to be compulsorily performed. Term work shall consist of journal giving details of the experiments performed.

1. Megascopic identification of following mineral specimens (around 50).
Rock Forming Minerals, Economic Minerals and Ore Minerals such as:
Rock Crystal, Rosy Quartz, Transparant Quartz, Milky Quartz, Smoky Quartz, Amethyst, Chalcedoney, different varieties of Agate, Jasper Banded Hematite Jasper, Orthoclase, Microcline, Plagioclase, Muscovite, Biotite, Olivine , Apophyllite, Stilbite, different varieties of Calcite, Gypsum Tourmaline, Chromite, Limonite, Asbestos, Laterite, Kyanite, Graphite, Haematite, Pyrite, Hornblende, Diopside, Hypersthene, Micaceous Haematite, Garnet,

2. Megascopic identification of following different rock specimens (around 50).

a) **Igneous Petrology: Plutonic, Hypabyssal, Volcanic Rock** Muscovite Granite, Granite porphyry, Hornblende Granite, Syenite, Syenite porphyry, Diorite, Epidiorite, Gabbro, Pegmatite, Picrite, Graphic Granite, Tourmaline Pegmatite, Dolerite, Rhyolite, Andesite, Pumice, Trachyte, Compact Basalt, HT. altered A.B, Giant Phenocryst Basalt (GPB),Amygdaloidal Basalt, Pipe A.B, Volcanic Breccia, Tuff breccia,

b) **Sedimentary Rock: Rudaceous, Areanceous, Argillaceous, Chemical and Organic Deposits:** Laterite, Bauxite, Conglomerate, Secondary Breccia, Sandstone (Red), Sandstone with Ripple marks, Sandstone (White), Sandstone (weathered), Sandstone (Micaceous), Sandstone (Motteled), Sandstone (Current Bedding), Shahabad Limestone, Red Limestone, Black Limestone, Stalactite Limestone, Oolitic limestone, Shelly Limestone, Chert Breccia, Secondary Quartzite, Mudstone, Grit, Arkose sandstone, Shale (White), Shale (Yellow), Shale (Black)

c) **Metamorphic Petrology: Contact Metamorphic rocks, Dynamothermal Metamorphic rocks**: Kyanite Quartzite Marble, Serpentine Marble, Phyllite, Slate, Augen Gneisse, Hornblende Biotite Gneisse, Hornblende Gneisse, Mica Schist, Biotite Schist With Garnet, Muscovite Schist, Chlorite Schist With Magnetite, Hornblende Schist, Chlorite Schist, Talc Schist, Talc Chlorite Schist, Talc Mica Schist, Talc Actinolite Schist, Quartz Sericite, Schist, Graphite Schist, Khondalite, Charnockite, Amphibolite,

3. Interpretation and construction of geological sections from contoured geological maps (Total 8).

4. Solution of engineering geological problems such as alignment of dams, tunnels, roads, canals, bridges, etc. based on geological maps (Total 3). #(From A. G. Series 8 maps and 2 maps constructed by the faculty members)

5. Logging of drill core and interpretation of drilling data with graphical representation of bore log.

6. Two site visits are desirable to study various geological features And their application, covering details from sections I and II.

7. GRAM++ software and ARC GIS software may be optional to perform.

Savitribai Phule Pune University, Pune
S.E. (Civil Engineering) 2015 Course

201007: Concrete Technology
Credits: 04+01

Teaching Scheme:		Examination Scheme :	
Theory	: 04 hrs/week	In-Semester (Online)	: 50 Marks
Practical	: 02 hrs/week	End-Semester	: 50 Marks
		Oral	: 50 Marks

Prerequisites : Fundamentals of Basic Civil Engineering, Engineering chemistry.

Course Objectives:

1) To know properties of various ingredients of concrete and concept of mix design.
2) To learn the behavior of concrete at its fresh and hardened state.
3) To understand special concrete and their application.
4) To explain deterioration of concrete and study methods of repair.

Course Outcomes:

On completion of the course, learner will be able to:

1) Understand chemistry, properties, and classification of cement, fly ash, aggregates and admixtures, and hydration of cement in concrete.
2) Prepare and test the fresh concrete
3) Test hardened concrete with destructive and nondestructive testing instruments
4) Get acquainted to concrete handling equipments and different special concrete types.
5) Design concrete mix of desired grade
6) Predict deteriorations in concrete and repair it with appropriate methods and techniques.

Course Contents

Unit I: Introduction to Concrete as a Construction Material: General Perspective Ingredients of Concrete. (08Hrs)

a) Cement – Manufacture of Portland cement, basic chemistry of cement, hydration of cement, classification of cement, types of cement, tests on cement: field tests & laboratory tests.

b) Aggregate and water – Different classifications, Fine aggregate, coarse aggregate, mechanical properties, physical properties, deleterious materials, soundness, alkali-aggregate reaction, sieve analysis: Fineness and gradation tests on aggregates, artificial and recycled aggregate, mixing water, curing water, tests on water.

Admixtures: functions, classification, types: mineral and chemical, IS: specifications (9103 and 456), compatibility of admixtures.

Unit II: Properties, Production and testing of fresh concrete (08Hrs)

a) Fresh concrete: Workability – factors affecting workability, cohesion and segregation, Bleeding, Laitance, mixing, handling, placing and compaction of concrete, Influence of temperature, maturity rule.

b) Tests of fresh concrete – Workability by Slump cone, Compaction factor, Vee Bee consistometer and flow table test, Marsh cone test.

Unit III: Properties and tests on hardened concrete and Special Concretes (08Hrs)

a) Hardened concrete – Strength of concrete, factors affecting strength, micro-cracking and stress-strain relationship, other strength properties, relation between tensile and compression strength, impact strength, abrasion resistance, elasticity and creep, shrinkage and swelling.

b) Testing of hardened concrete – Compression test on cube and cylinder, flexural test, indirect tensile strength, core test. Non destructive testing: Rebound hammer, Ultrasonic pulse velocity, Pullout test and Impact echo test, Rebar locator.

Unit IV: Concreting equipments, techniques and Special concretes (08Hrs)

a) Introduction to concrete related equipments – Batching plants, hauling, pumps, Types of concrete mixers: Tilting, Non tilting and Reversible drum mixer, Types of vibrators Special concreting techniques: pumping of concrete, under water concreting, ready mix concrete, roller compacted concrete Cold weather concreting, hot weather concreting.

b) Special concretes – Light weight concrete, Cellular light weight concrete-Form concrete and autoclave C.L.C, polymer concrete, types of fibers, fiber reinforced Concrete, high density concrete, self compacting concrete and applications. Ferrocement: Definition, Basic concepts in forming ferrocement composites, Methods of casting.

Unit V: Concrete Mix Design (08Hrs)

Concepts of Mix Design, Factors for proportioning of concrete. Factors to be considered, Statistical quality control, Laboratory trial mixes and guidelines to improve mix , methods of Mix Design for M25 and above grades by IS (10262-2009, 456) and DOE methods with and without fly ash, Demonstration and application of concrete mix design software.

Unit VI: Deterioration and repairs. (08Hrs)

a) Deterioration – Permeability and durability, chemical attack and sulphate attack by seawater, acid attack, chloride attack, carbonation of concrete and its determination, corrosion of reinforcement.

b) Repairs – Symptoms and diagnosis of distress, evaluation of cracks, selection of repair procedure, repair of defects, common types of repairs, shotcrete, Introduction of retrofitting by using FRP, Corrosion monitoring techniques & preventive measures.

Books:

Text:

1. Concrete Technology by M. S. Shetty, S Chand, New Delhi-110055.
2. Concrete Technology by M. L. Gambhir, Tata McGraw-Hill.

Reference:

1. Properties of concrete by A. M. Neville, Longman Publishers.
2. Concrete Technology by R.S. Varshney, Oxford and IBH.
3. Concrete technology by A. M. Neville, J.J. Brooks, Pearson.
4. Ferrocement Construction Manual by Dr. D. B. Divekar-1030,Shivaji Nagar, Model Colony, Pune.
5. Concrete Mix Design by A. P. Remideos, Himalaya Publishing House.
6. Learning from Failures: Deficiencies in Design, Construction and Service, R& D Center, 1987.

IS Codes :

IS 456, IS 383, IS 9103, IS 10262 Latest revised editions.

List of Laboratory Assignments

The term work shall consist of a journal giving details of all the following experiments.

1. Fineness and standard consistency of cement.
2. Initial and final setting time and soundness of cement.
3. Compressive strength of cement.
4. Fineness of fly ash
5. Moisture content, silt content, density and Specific gravity of fine aggregate
6. Fineness modulus by sieve analysis of fine aggregate.
7. Moisture content , water absorption, density and Specific gravity of coarse aggregate
8. Fineness modulus by sieve analysis and gradation of fine aggregates.
9. Workability of concrete by slump test, compaction factor, Vee Bee test, effect of admixture and retarders on setting time concrete.
10. Compressive strength test of concrete by crushing and Rebound hammer.
11. Indirect tensile strength and flexural strength of hardened concrete
12. Concrete mix design by IS code method.
13. Site visit to RMC plant

Oral: Based on above syllabus and term work.

Savitribai Phule Pune University, Pune
S.E. (Civil Engineering) 2015 Course

201010: Soft Skill
Credits: 01

Teaching Scheme:	Examination Scheme:
Practical: 02 hrs/week	**Term Work : 50 Marks**

Prerequisites: Basic communication and writing skills in English.

Course Objectives:

1) To help the students in building interpersonal skills.
2) To develop skill to communicate clearly.
3) To enhance team building and time management skills.
4) To learn active listening and responding skills.

Course Outcomes:

On completion of the course, learner will be able to:

1) Make use of techniques for self-awareness and self-development.
2) Apply the conceptual understanding of communication into everyday practice.
3) Understand the importance of teamwork and group discussions skills.
4) Develop time management and stress management.
5) Apply business etiquette skills effectively an engineer requires.

Course Contents

UNIT I: Self Awareness & self Development (04 hrs)

a) Self Awareness: Self Assessment, Self Appraisal, SWOT, Goal setting: Personal & career: Self Assessment, Self-Awareness, Perceptions and Attitudes, Positive Attitude, Values and Belief Systems, Self-Esteem, Self appraisal, Personal Goal setting.

b) Self Development: Career Planning, Personal success factors, Handling failure, Depression and Habit, relating SWOT analysis & goal setting, prioritization.

UNIT II: Communication Skill (06 hrs)

a) Communication: Importance, types, barriers of communication, effective communication.

b) Speaking Skills: Public Speaking, Presentation skills, Group discussion: Importance of speaking effectively, speech process, message, audience, speech style, feedback, conversation and oral skills, fluency and self expression, body language phonetics and spoken English, speaking techniques, word stress, correct stress patterns, voice quality, correct tone, types of tones, positive image projection techniques.

c) Listening Skills: Law of nature: you have 2 ears and 1 tongue so listen twice and speak once is the best policy, Empathic listening, and Avoid selective listening.

d) Group Discussion: characteristics, subject knowledge, oral and leadership skills, team management, strategies and individual contribution and consistency.

e) Presentation skills: planning, preparation, organization, delivery.

f) Written Skills: Formal & Informal letter writing, Report writing, Resume writing: Sentence structure, sentence coherence, emphasis. Paragraph writing. Letter writing skills: form and structure, style and tone. Inquiry letters, Instruction letters, complaint letters, Routine business letters, Sales Letters etc.

UNIT III: Corporate / Business Etiquettes (02 hrs)

a) Corporate / Business Etiquettes: Corporate grooming & dressing, Email & telephone etiquettes, etiquettes in social & office setting: Understand the importance of professional behaviour at the work place, Understand and Implement etiquettes in workplace, presenting oneself with finesse and making others comfortable in a business setting.

b) Importance of first impression, Grooming, Wardrobe, Body language, Meeting etiquettes (targeted at young professionals who are just entering business environment) , Introduction to Ethics in engineering and ethical reasoning, rights and responsibilities.

UNIT IV: Interpersonal relationship (04 hrs)

a) Team work: Team effectiveness, Group discussion, Decision making : Team Communication. Team, Conflict Resolution, Team Goal Setting, Team Motivation Understanding Team Development, Team Problem Solving, Building the team dynamics. Multicultural team activity.

b) Group Discussion (GD): Preparation for a GD, Introduction and definitions of a GD, Purpose of a GD, Types of GD, Strategies in a GD , Conflict management, Do's and Don'ts in GD.

UNIT V: Leadership skills (02 hrs)

a) Leadership: Leaders' role, responsibilities and skill required - Understanding good Leadership behaviors, Learning the difference between Leadership and Management, Gaining insight into your Patterns, Beliefs and Rules.

b) Leadership Qualities: Defining Qualities and Strengths of leadership, Determining how well you perceive what's going on around you, interpersonal Skills and Communication Skills, Learning about Commitment and How to Move Things Forward, Making Key Decisions, Handling Your and Other People's Stress, Empowering, Motivating and Inspiring Others, Leading by example, effective feedback.

UNIT VI: Other skills (02 hrs)

a) Time management: The Time management matrix, apply the Pareto Principle (80/20 Rule) to time management issues, to prioritise using decision matrices, to beat the most common time wasters, how to plan ahead, how to handle interruptions , to maximize your personal effectiveness, how to say "no" to time wasters, develop your own individualized plan of action.

b) Stress management: understanding the stress & its impact, techniques of handling stress

c) Skills: Problem solving skill, Confidence building Problem solving skill, Confidence building.

Books:

Text:

1. Communication Skills by Sanjay Kumar and Pushpa Lata, Oxford University Press.
2. Developing Communication Skill by Krishna Mohan, Meera Banerji, McMillan India Ltd.
3. English for Business Communication by Simon Sweeney, Cambridge University Press.

Reference:

1. Ethics in Engineering Practice and Research by Caroline & Whitbeck, Cambridge University Press.
2. NASSCOM-Global Business Foundation Skills: Accenture, Convergys, Dell et.al. Foundation Books: Cambridge University Press.
3. Basic Managerial Skills by E. H. McGrath, Eastern Economy Edition, Prentice hall India.
4. Personality Development and Group Discussions by Barun K. Mitra, Oxford University Press.
5. Group Discussions and Interview Skills by Priyadarshi Patnaik , Foundation Books , Cambridge University Press.
6. Thinks and Grow Rich by Napoleon Hill, Ebury Publishing, ISBN 9781407029252.
7. Awaken the Giant Within by Tony Robbins HarperCollins Publishers, ISBN-139780743409384.
8. Change Your Thoughts; Change Your Life by Wayne Dyer, Hay House India, ISBN-139788189988050.
9. The Power of Your Subconscious Mind by Dr Joseph Murphy Maanu Graphics , ISBN-13 9789381529560.
10. The new Leaders by Daniel Coleman Sphere Books Ltd , ISBN-139780751533811
11. The 80/20 Principal by Richard Koch, Nicholas Brealey Publishings , ISBN-13 9781857883992.
12. Time management from inside out by Julie Morgenstern, Owl Books (NY), ISBN-13 9780805075908.
13. Wonderland of Indian Manageress by Sharu Ranganekar, Vikas Publishing Houses, ISBN-13 9788125942603.
14. You can win by Shiv Khera, Macmillan, ISBN-139789350591932.
15. The Ace of Soft Skills by Attitude, Communication and Etiquette for Success: Gopalaswamy Ramesh, Mahadevan Ramesh.

Guidelines for Laboratory Conduction

Teaching Methodology

Each class should be divided into three batches of 20-25 students each. The sessions should be activity based and should give students adequate opportunity to participate actively in each activity. Teachers and students must communicate only in English during the session. Specific details about the teaching methodology have been explained in every activity given below.

Practical Activities (Term work)

Following 10 activities are compulsory and teachers must complete them during the practical sessions within the semester. The teacher should give students 10 assignments on the basis of the 10 activities conducted in the practical sessions. Students will submit these 10 assignments as their term work at the end of the semester but it should be noted that the teacher should assess their assignment as soon as an activity is conducted. The continual assessment process should be followed.

1. SWOT analysis: The students should be made aware of their goals, strengths and weaknesses, attitude, moral values, self confidence, etiquettes, non-verbal skills, achievements etc. through this activity. The teacher should explain to them on how to set goals, SWOT Analysis, Confidence improvement, values, positive attitude, positive thinking and self esteem. The teacher should prepare a questionnaire which evaluate students in all the above areas and make them aware about these aspects.

2. Personal & Career Goal setting – Short term & Long term.

3 Presentation Skills Students should make a presentation on any informative topic of their choice. The topic may be technical or non-technical. The teacher should guide them on effective presentation skills. Each student should make a presentation for at least 10 minutes.

4. Letter/Application writing: Each student will write one formal letter, and one application. The teacher should teach the students how to write the letter and application. The teacher should give proper format and layouts.

5. Report writing: The teacher should teach the students how to write report .. The teacher should give proper format and layouts. Each student will write one report based on visit / project / business proposal etc.

6. Listening skills The batch can be divided into pairs. Each pair will be given an article (any topic) by the teacher. Each pair would come on the stage and read aloud the article one by one. After reading by each pair, the other students will be asked questions on the article by the readers. Students will get marks for correct answers and also for their reading skills. This will evaluate their reading and listening skills. The teacher should give them guidelines on improving their reading and listening skills. The teacher should also give passages on various topics to students for evaluating their reading comprehension.

7. Group discussion Each batch is divided into two groups of 12 to 14 students each. Two rounds of a GD for each group should be conducted and teacher should give them feedback.

8. Resume writing Each student will write one formal letter, and one application. The teacher should teach the students how to write the letter and application. The teacher should give proper format and layouts.

9. Public Speaking Any one of the following activities may be conducted :

a. Prepared speech (topics are given in advance, students get 10 minutes to prepare the speech and 5 minutes to deliver.

b. Extempore speech (students deliver speeches spontaneously for 5 minutes each on a given topic)

c. Story telling (Each student narrates a fictional or real life story for 5 minutes each)

d. Oral review (Each student orally presents a review on a story or a book read by them)

10. Stress management: understanding the stress & its impact, techniques of handling stress.

11. Team Activity: Use of Language laboratory.

Perform any 8 exercises from serial number 1 to serial number 10 and serial number 11 is compulsory

List of Term Work/Assignments

Term work will consist the record of any 8 assignments of following exercises

1. SWOT analysis
2. Personal & Career Goal setting – Short term & Long term
3 Presentation Skill
4. Letter/Application writing
5. Report writing
6. Listening skills
7. Group discussion
8. Resume writing
9. Public Speaking
10. Stress management
11. Team Activity-- Use of Language laboratory.

Savitribai Phule Pune University, Pune
S.E. (Civil Engineering) 2015 Course

Road Safety Management
Audit Course
(Certificate to be issued by institute based on performance assessment)

Road transport remains the least safe mode of transport, with road accidents representing the main cause of death of people. The boom in the vehicle population without adequate road infrastructure, poor attention to driver training and unsatisfactory regulation has been responsible for increase in the number of accidents. India's vehicle population is negligible as compared to the World statistics; but the comparable proportion for accidents is substantially large.

The need for stricter enforcement of law to ensure greater safety on roads and an environment-friendly road transport operation is of paramount importance. Safety and security are growing concerns for businesses, governments and the traveling public around the world, as also in India. It is, therefore, essential to take new initiatives in raising awareness, skill and knowledge of students as one of the ibid stake holders who are expected to follow the rules and policies of the government in order to facilitate safety of individual and safe mobility of others.

Course Objectives:

1) To provide basic overview on road safety & traffic management issues in view of the alarming increase in vehicular population of the country.
2) To explain the engineering & legislative measures for road safety.
3) To discuss measures for improving road safety education levels among the public.

Course Outcomes:

On completion of the course, learners will:

1) Show changes in awareness levels, knowledge and understanding.
2) Demonstrate a change in attitudes / behavior e.g. against drink-drive.
3) Utilize remedial education for those who make mistakes and for low level offences where this is more effective than financial penalties and penalty points.
4) Improve road safety together leading to casualty reduction

Course Contents

1. Existing Road Transport Scenario
2. Accident Causes & Remedies
3. Road Accident Investigation & Investigation Methods
4. Vehicle Technology – CMVR & Road Safety
5. Regulatory / Legislative Provisions for Improving Road Safety
6. Behavioral Training for Drivers for Improving Road Safety
7. Road Engineering Measures for Improving Road Safety

Guidelines for Conduction (Any one or more of following but not limited to)
1. Guest Lectures. 2. Visits and reports. 3. Assist authorities like RTO for audits (e.g. Particular road safety audit as critical on-site assessment of the shortcomings in the various elements of the road). 4. Mini Project
Guidelines for Assessment (Any one of following but not limited to)
1. Written Test 2. Practical Test 3. Presentation 4. Report

Savitribai Phule Pune University

FACULTY OF ENGINEERING

Syllabus for the

S.E (Electronics /Electronics & Telecommunications Engineering)

2015 Course

(w.e.f . June 2016)

Savitribai Phule Pune University, Pune
SE(E&TC/Electronics Engineering) 2015 Course

(With effect from Academic Year 2016-17)

Semester I													
Course Code	**Course**	**Teaching Scheme Hours / Week**			**Semester Examination Scheme of Marks**						**Credit**		
		Theory	**Tutorials**	**Practicals**	**In-Sem (On line)**	**End-Sem (Theory)**	**TW**	**PR**	**OR**	**Total**	**TH/TUT**	**PR+OR**
204181	Signals & Systems	3	1	-	50	50	25	-	-	125	4	-
204182	Electronic Devices & Circuits	4	-	2	50	50	-	50	-	150	4	1
204183	Electrical Circuits and Machines	3	-	2	50	50	25	-	-	125	3	1
204184	Data Structures and Algorithms	4	-	2	50	50	-	-	50	150	4	1
204185	Digital Electronics	4	-	2	50	50	-	50	-	150	4	1
204186	Electronic Measuring Instruments & Tools	1	-	2	-	-	50	-	-	50	1	1
204192	**Audit Course 1**	--	--	--	--	--	--	--	--	--		
	Total	19	1	10	250	250	100	100	50	750	20	05
						Total Credits					25	

Abbreviations:

Th : Theory
TW: Term Work
OR: Oral
TUT : Tutorial
PR : Practical

Note: Interested students of S.E. (Electronics/E&TC) can opt any one of the audit course from the audit courses prescribed by BoS (Electronics/Computer/IT/Electrical/Instrumentation)

SE(E&TC/Electronics Engineering) 2015 Course

(With effect from Academic Year 2016-17)

Semester II													
Course Code	**Course**	**Teaching Scheme Hours / Week**			**Semester Examination Scheme of Marks**							**Credit**	
		Theory	Tutorials	Practicals	In-Sem (on line)	End-Sem (Theory)	TW	PR	OR	Total	TH/TUT	PR+OR
207005	Engineering Mathematics III	4	1	-	50	50	25	-	-	125	5	-
204187	Integrated Circuits	4	-	2	50	50	25	50	-	175	4	1
204188	Control Systems	3	-	-	50	50	-	-	-	100	3	-
204189	Analog Communication	3	-	2	50	50	-	50	-	150	3	1
204190	Object Oriented Programming	3	-	4	50	50	-	-	50	150	3	2
204191	Employability Skill Development	2	-	2	-	-	50	-	-	50	2	1
204193	**Audit Course 2**	--	--	--	--	--	--	--	--	--		
	Total	19	1	10	250	250	100	100	50	750	20	05
								Total Credits			**25**	

Abbreviations:

TH: Theory
TW: Term Work
OR: Oral
TUT: Tutorial
PR: Practical

Note: Interested students of S.E (Electronics/E&TC) can opt any one of the audit course from the audit courses prescribed by BoS (Electronics/Computer/IT/Electrical/Instrumentation)

204181 Signals and Systems

Credits: Th- 03,Tut-01

Teaching Scheme:	**Examination Scheme:**
Theory : 03 hr/week	**In-Sem(Online): 50 Marks**
Tutorial: 01 hr/week	**End-Sem(Theory):50 Marks**
	Term Work : 25 Marks

Course Objectives:

- To understand the mathematical description of continuous and discrete time signals and systems.
- To classify signals into different categories.
- To analyse Linear Time Invariant (LTI) systems in time and transform domains.
- To build basics for understanding of courses such as signal processing, control system and communication.
- To develop basis of probability and random variables.

Course Outcomes:

On completion of the course, student will be able to

1. Understand mathematical description and representation of continuous and discrete time signals and systems.
2. Develop input output relationship for linear shift invariant system and understand the convolution operator for continuous and discrete time system.
3. Understand and resolve the signals in frequency domain using Fourier series and Fourier transforms.
4. Understand the limitations of Fourier transform and need for Laplace transform and develop the ability to analyze the system in s- domain.
5. Understand the basic concept of probability, random variables & random signals and develop the ability to find correlation, CDF, PDF and probability of a given event.

Course Contents

Unit I : Introduction to Signals and Systems (8 Hrs)

Introduction and Classification of signals: Definition of signal and systems, communication and control systems as examples. Sampling of analog signals, sampling theorem, Continuous time and discrete time signal, Classification of signals as even, odd, periodic and non-periodic, deterministic and non-deterministic, energy and power.

Elementary signals used for testing: reasons for using standard test signals, exponential, sine, impulse, step and its properties, ramp, rectangular, triangular, signum, sinc.

Operations on signals: Amplitude scaling, addition, multiplication, differentiation, integration (Accumulator for DT), time scaling, time shifting and time folding.

Systems: Definition, Classification: linear and non-linear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible.

Unit II : Time domain representation of LTI System (6 Hrs)

System modeling: Input-output relation, definition of impulse response, convolution sum, convolution integral, computation of convolution integral using graphical method for unit step to unit step, unit step to exponential, exponential to exponential, unit step to rectangular and rectangular to rectangular only. Computation of convolution sum. Properties of convolution. System interconnection, system properties in terms of impulse response, step response in terms of impulse response.

Unit III : Fourier Series (6 Hrs)

Fourier series (FS) representation of periodic Continuous Time (CT) signals, Dirichlet condition for existence of Fourier series, orthogonality, basis functions, Amplitude and phase response, FS representation of CT signals using trigonometric and exponential Fourier series. Applications of Fourier series, properties of Fourier series and their physical significance, Gibbs phenomenon, Discrete Time Fourier Series, properties, convergence of DTFS.

Unit IV : Fourier transform (7Hrs)

Fourier Transform (FT) representation of aperiodic CT signals, Dirichlet condition for existence of Fourier transform, evaluation of magnitude and phase response, FT of standard CT signals, FT of standard periodic CT signals, Properties and their significance, Interplay between time and frequency domain using sinc and rectangular signals, Fourier Transform for periodic signals, introduction to Discrete Time Fourier Transform.

Unit V : Laplace transform and its applications (7Hrs)

Definition of Laplace Transform (LT), Limitations of Fourier transform and need of Laplace transform,ROC, Laplace transform of standard periodic and aperiodic functions, properties of Laplace transform and their significance, Laplace transform evaluation using properties, Inverse Laplace transform based on partial fraction expansion, stability considerations in S domain, Application of Laplace transforms to the LTI system analysis.

Unit VI : Probability and Random Signals (6 Hrs)

Probability: Experiment, sample space, event, probability, conditional probability and statistical independence, Bayes theorem, Uniform and Gaussian probability models.

Random variables: Continuous and Discrete random variables, cumulative distributive function, Probability density function, properties of CDF and PDF.Statistical averages, mean, moments and expectations, standard deviation and variance.

Introduction to Correlation: Autocorrelation, Cross correlation, and their properties.

Text Books:

1. Simon Haykins and Barry Van Veen, “Signals and Systems”, 2nd Edition, Wiley India.
2. Charles Phillips, “Signals, Systems and Transforms”, 3rd Edition, Pearson Education.

Reference Books:

1. M.J. Roberts “Signal and Systems”, Tata McGraw Hill 2007.
2. Shaila Apte, “Signals and Systems-principles and applications”, Cambridge University press, 2016.
3. Mrinal Mandal and Amir Asif, Continuous and Discrete Time Signals and Systems, Cambridge University Press, 2007.
4. Peyton Peebles, “Probability, Random Variable, Random Processes”, 4th Edition, Tata Mc Graw Hill.
5. A. NagoorKanni “Signals and Systems”, 2nd edition, Mc Graw Hill.
6. NPTEL video lectures on Signals and Systems.

Guidelines for Tutorial / TW Assessment

Tutorials must be conducted batch wise. Batch size should not be more than 20 students. The main objective of this tutorial is to focus on the outcomes defined in the theory syllabus by solving the following assignments based on paper work.

At least 8 tutorials to be conducted. (Any 4 from first 6)

List of Tutorials

1 A) Sketch and write mathematical expression for the following signals in CT and Discrete Time (DT)

a) Sine
b) Rectangular
c) Triangular
d) Exponential
e) Unit Impulse
f) Unit Step
g) Ramp
h) Signum
i) Sinc

B) Classify and find the respective value for the above signals

a) Periodic / Non Periodic
b) Energy / Power /Neither

2. Take any two CT and DT signals and perform the following operation Amplitude scaling, addition, multiplication, differentiation, integration (accumulator for DT), time scaling, and time shifting and folding.
3. Express any two system mathematical expressions in input output relation form and determine whether each one of them is, Memory less, Causal, Linear, Stable, Time invariant, Invertible.
4. Express any two system mathematical expressions in impulse response form and determine whether each one of them is, Memory less, Causal, Linear, Stable, Time in variant, Invertible.
5. Perform Convolution Integral of Two Continuous time Signals.
   (Various Combinations can be taken for this.)
6. To find Fourier series for the signals and plot its magnitude and phase response. (Signals like: Half/Full wave rectified signal, Saw tooth wave etc.)
7. State and prove the various properties of CT Fourier Transform. Take rectangular and sinc Signal as examples and demonstrate the applications of CTFT properties. And also demonstrate the interplay between the time and frequency domain.
8. State and prove the properties of CT Laplace Transform. Take any example of a system in time domain and demonstrate the application of LT in system analysis.
9. To perform auto and cross correlation for DT and CT signals. Also explain the relation between Convolution and Correlation.

10.

A) List and Explain the properties of CDF & PDF, Suppose a certain random variable has the CDF

$$F_X(x) = \begin{cases} 0 & x \leq 0 \\ kx^2 & 0 < x \leq 10 \\ 100k & x > 10 \end{cases}$$

Evaluate k, Write the corresponding PDF and find the values of $P(X \leq 5)$ and $P(5 < X \leq 7)$

(This is only an example. Various Probability functions may be given)

B) Find mean ,mean square , standard deviation , variance of X

when $f_X(x) = ae^{-ax}u(x)$ with a>0

(This is only an example. Various Probability functions may be given)

204182 Electronic Devices and Circuits

Credits: Th- 04, Pr -01

Teaching Scheme:

Theory: 04 hrs/week
Practical: 02 hrs/week

Examination Scheme:

In-Sem (Online): 50 Marks
End-Sem(Theory):50Marks
Practical : 50 Marks

Prerequisites: - Basic knowledge of Semiconductor Physics

Course Objectives:

- To introduce semiconductor devices FET and MOSFET, their characteristics, operations, circuits and applications.
- To introduce concepts of both positive and negative feedback in electronic circuits.
- To analyse and interpret FET and MOSFET circuits for small signal at low and high frequencies.
- To simulate electronics circuits using computer simulation software and verify desired results.
- To study the different types of voltage regulators.

Course Outcomes:

On completion of the course, student will be able to:

1. Comply and verify parameters after exciting devices by any stated method.
2. Implement circuit and test the performance.
3. Analyze small signal model of FET and MOSFET.
4. Explain behavior of FET at low frequency.
5. Design an adjustable voltage regulator circuits.

Course Contents

UNIT I: JFET (8 Hrs)

Introduction to JFET, Types, Construction, Operation, Static Characteristics, Pinch off voltage, FET Volt-Ampere characteristics, FET Configurations (CS/CD/CG) and their Comparison. Biasing of FET (Self). FET as an amplifier and its analysis (CS) and its frequency response. Small signal model, FET as High Impedance circuits.

Unit II :MOSFET& its DC Analysis (8 Hrs)

Basics of MOS Transistor operation, Construction of n-channel E-MOSFET, E-MOSFET characteristics & parameters, non-ideal voltage current characteristics viz. Finite output resistance, body effect, sub-threshold conduction, breakdown effects and temperature effects. Common source circuit, Load Line & Modes of operation, common MOSFET configurations: DC Analysis, constant current source biasing.

Unit III : MOSFET AC Circuit Analysis: **(8 Hrs)**

The MOSFET CS small signal amplifier, Small signal parameters, small signal equivalent circuit, Modeling, Body effect, Analysis of CS amplifier. Introduction to BiCMOS technology. The MOSFET internal capacitances and high frequency model.

Introduction to MOSFET as basic element in VLSI, V-I characteristic equation in terms of W/L ratio, MOSFET scaling and small geometry effects, MOSFET capacitances.

Unit IV : MOSFET Circuits **(7 Hrs)**

MOSFET as switch, diode/active resistor, Current sink and source, current mirror, Voltage references, Basic principle of band gap reference, CMOS Inverter as amplifier: Active load, Current source and Push pull configurations.

Unit V : Feedback amplifiers and Oscillators **(8 Hrs)**

Four types of amplifiers. Feedback topologies. Effect of feedback on terminal characteristics of amplifiers. Examples of voltage series and Current series FET feedback amplifiers and their analysis. Barkhausen criterion, stability with feedback. General form of LC oscillator. FET RC Phase Shift oscillator, Wein bridge oscillator, Hartley and Colpitts oscillators.

Unit VI : VoltageRegulator: **(7 Hrs)**

Block diagram of an adjustable three terminal positive and negative regulators (317,337).Typical connection diagram, current boosting. Low drop out voltage regulators. Introduction to Switch Mode Power supply (SMPS), Block diagram of SMPS, Types of SMPS. Comparison of Linear Power supply and SMPS.

Text Books:

1.MillmanHalkias, “Integrated Electronics-Analog and Digital Circuits and Systems”, Tata McGraw Hill, 2000.

2. Donald Neaman, “Electronic Circuit Analysis and Design”,3rd Edition, Tata McGraw Hill.

Reference:

1. David A.Bell,“ElectronicDevicesandCircuits”,5th Edition, Oxford press
2. R. L. Boylstad, L. Nashlesky, “Electronic Devices and circuitsTheory”, 9th Edition, PrenticeHall of India, 2006.
3. Anil K. Maini and Varsha Agarwal “Electronic Devices and Circuits”, Wiley India
4. Phillip E. Allen, Douglas R. Holberg, “CMOS Analog Circuit Design”, Second Edition, Oxford.
5. K. R. Botkar, “Integrated Circuits”, 5th Edition, Khanna Publication.

Guidelines for Laboratory Conduction

Perform minimum eight experiments out of which at least three experiments should be conducted on bread board.

List of Practical

1. Design a single stage FET Amplifier in CS configuration and verify DC operating point.
2. Build and test single stage CS amplifier using FET. Calculate Ri, Ro and Av.
3. Simulate frequency response of single stage CS amplifier (use same circuit) and find the bandwidth.
4. SimulateVoltage-Series feedback amplifier and calculate Rif, Rof, Avf and Bandwidth.
5. Implement current series feedback amplifier and find Rif, Rof, Gmf and Bandwidth.
6. Simulate LC oscillator using FET.

OR

7. Implement Weinbridge /RC phase shift oscillator using FET/MOSFET.
8. Simulate MOSFET/ CMOS Inverter.

OR

9. Build and test MOSFET as a switch.
10. Design and implement an adjustable voltage regulator using three terminals voltage regulator IC.

204183 Electrical Circuits and Machines

Credits: Th – 03, Pr -01

Teaching Scheme:

Theory: 03hrs/week
Practical: 02 hrs/week

Examination Scheme:

In-Sem(Online): 50 Marks
End-Sem: (Theory): 50 Marks

Term Work: 25 Marks

Course Objectives:

- To analyse AC and DC networks with network simplification techniques.
- To gain basic knowledge of transformers and their types.
- To conduct experimental procedures on different types of electrical machines.
- To understand the constructional details, characteristics, features and application areas ofvarious types of electric motors.

Course Outcomes:

On completion of the course, student will be able to

1. Analyze basic AC & DC circuit for voltage, current and power by using KVL, KCL, andnetwork theorems.
2. Explain the working principle of different electrical machines.
3. Select proper electrical motor for given application.
4. Design and analyze transformers.

Course Contents

Unit I :Basic Circuit Analysis and Simplification Techniques (8 Hrs)

Kirchhoff's Current and Voltage Laws, Independent and dependent sources and their interconnection, power calculations.

Network Analysis: Mesh, Super mesh, Node and Super Node analysis. Source transformation and source shifting.

Network Theorems: Superposition, Thevenin's, Norton's and Maximum Power Transfer Theorems, Millers Theorem and its dual. (AC circuit analysis for all the topics of this unit)

Unit II :Transformer (6 Hrs)

Types, Construction, Transformer on No-load (Transformation ratio, emf equation), impedance transformation, losses in transformer, regulation and efficiency, rating. Auto transformer, coupling transformer, Isolation transformer, C.T. and P.T., Design of single phase transformer for instrument power supply, High frequency transformers.

Unit III :DC Machines (7 Hrs)

Construction of DC Machine, Motoring and generation action, types, EMF equation, Torque equation (Torque-armature current characteristics, Torque-speed characteristics, speed-armature current characteristics), Power flow diagram. Problems on speed, torque & losses. Different methods of speed control, different types of starters for DC shunt motor. Permanent Magnet DC motors, Applications of DC Motors

Unit IV :AC Motors (7 Hrs)

Three phase Induction motors, construction and principle of operation, types, slip and torque equation, Torque-slip characteristics, condition for maximum torque & ratios, types of starters, speed control, V/f control, Applications.

Synchronous motors: Construction, principle of operation, characteristics (V curves) and applications.

Unit V :Special Motors 1 (6 Hrs)

BLDC Motor, Construction, principle, characteristics, control circuit, sensors, applications. Construction, principle & applications of Reluctance Motor, Universal Motor.

Unit VI :Special Motors 2 (6Hrs)

Construction, types, principle, Characteristics, control circuit & applications of Stepper Motor and Servo motor.

Construction, principle, characteristics, Types and applications of single phase Induction Motor.

Text Books:

1. Abhijit Chakrabarti & Sudipta Debnath, "Electrical Machines",Tata McGraw-hill Publication.
2. William H Hayt, Jack E Kimmerly and Steven M. Durbin, "Engineering Circuit Analysis", TataMcGraw Hill.

Reference:

1. A.E. Fitzgerald, Charles Kingsley & Jr. Stephen D. Umans,"Electrical Machinery", TataMcGraw-hill Publication 6th Edition.
2. I.J Nagarath& D.P Kothari, "Electrical Machines", Tata McGraw-hill Publication 4th Edition.
3. T. J. E. Miller, "Brushless permanent-magnet and reluctance motor drives",OxfordUniversity Press(1989)
4. Ned Mohan, "Electric Machines and Drives": A first course, Wiley.
5. B. L. Theraja, "Electrical technology" volume 2, S. Chand

Guidelines for Laboratory Conduction

Perform any 8 experiments:

List of Practical

1. Network Theorems : To verify Thevenin's and Norton's theorem (DC or AC)
2. O.C. And S.C. Test on single phase transformer
3. Polarity test on single phase transformer.
4. Equivalent Circuit of a Single Phase Induction Motor by performing the no- load and blocked rotor tests.
5. Study of BLDC Motor Drive.
6. Speed control of DC motor using armature voltage and field current control method. Measure RPM and plot graph of speed versus armature voltage and field current.
7. Load test on 3-phase induction motor
8. Determination of equivalent circuit parameters of 3-phase induction motor using no load & blocked-rotor test.
9. To plot speed- torque characteristic of three phase induction motor.
10. To study various operating modes of stepper motor.

Data Structures and Algorithms
Credits: Th – 04, Pr -01

Teaching Scheme:
Theory: 04 hrs/week
Practical: 02 hrs/week

Examination Scheme:
In-Sem(Online): 50 Marks
End-Sem: (Theory):50 Marks
Oral : 50 Marks

Prerequisites: Basic knowledge of C language is required.

Course Objectives:
- To assess how the choice of data structures and algorithm design methods impacts the performance of programs.
- To choose the appropriate data structure and algorithm design method for a specified application.
- To study the systematic way of solving problems, various methods of organizing large amounts of data.
- To solve problems using data structures such as linear lists, stacks, queues, binary trees, binary search trees, and graphs and writing programs for these solutions.

To employ the different data structures to find the solutions for specific problems

Course Outcomes:
On completion of the course, student will be able to :
1. Discuss the computational efficiency of the principal algorithms such as sorting & searching.
2. Write and understand the programs that use arrays & pointers in C
3. Describe how arrays, records, linked structures are represented in memory and use them in algorithms.
4. Implement stacks & queues for various applications.
5. Understand various terminologies and traversals of trees and use them for various applications.
6. Understand various terminologies and traversals of graphs and use them for various applications.

Course Contents

Unit I : Introduction to C and Algorithm (8 Hrs)
Constants, variables and keywords in C, operators and control structure in c(decision, loop and case), functions, macros, arrays and string manipulation, structure, union, enumeration, bitwise operations Functions: Parameter passing call by value and call by reference, scope rules, functions and pointers, function returning pointer, pointer to function, String manipulations using Arrays, pointer to pointer, Dynamic memory management.
Analysis of algorithm: frequency count and its importance in analysis of an algorithm, Time complexity & Space complexity of an algorithm, Big ‘O’ notation
Unit II :Searching and Sorting (8 Hrs)
Need of searching and sorting, why various methods of searching and sorting, Sorting methods: Linear, binary search and Fibonacci Search.
Sorting methods: Bubble, insertion, selection, merge, Time complexity of each searching and sorting algorithm, Hashing Techniques.

Unit III : Stack and Queues (7 Hrs)

Stacks: Concept, Basic Stack operations, Array representation of stacks, Stack as ADT, Stack Applications: Reversing data, Arithmetic expressions conversion and evaluation.

Queues: Concept, Queue operations, Array representation of queues, Queue as ADT, Circular queues, Application of queues: Categorizing data, Simulation of queues.

Unit IV : Linked List (7 Hrs)

Concept of linked organization, singly linked list, stack using linked list, queue using linked list, doubly linked list, circular linked list, Linked list as ADT. Representation and manipulations of polynomials using linked lists, ,comparison of sequential linked organization with linked organization

Unit V : Trees (7 Hrs)

Introduction to trees: Basic Tree Concepts, Binary Trees:Concept & Terminologies, Representation of Binary Tree in memory, Traversing a binary tree, Binary Search Trees (BST): Basic Concepts, BST operations.

Unit VI : Graphs (7 Hrs)

Basic Concepts & terminology, Sequential representation of graphs; Adjacency matrix, Path matrix, Linked representation of a graph, Operations on graph, Traversing a graph, Spanning trees; Minimum Spanning tree, Kruskal's Algorithm, Prim's Algorithm. Dijkstra's Shortest Path Algorithm

Text Books:

1. Ellis Horowitz, SartajSahni, "Fundamentals of Data Structures", Galgotia Books Source. ISBN:10: 0716782928
2. Richard F. Gilberg& Behrouz A. Forouzan, Data Structures APseudocode Approach with C, Cengage Learning, second edition. ISBN-10: 0534390803

Reference:

1. Seymour Lipschutz, Data Structure with C, Schaum's Outlines, Tata McGrawHill. ISBN-10: 1259029964
2. E Balgurusamy - Programming in ANSI C, Tata McGraw-Hill, Third Edition. ISBN-10: 1259004619
3. YedidyahLangsam, Moshe J Augenstein, Aaron M Tenenbaum – Data structures using C and C++ - PHI Publications, Second Edition). ISBN 10: 8120311779

List of Practical

Note: Practical 1-8 are compulsory. Practical 9-15 are optional.

Write C program to implement

1. Write C program to store student information (e.g. RollNo, Name, Percentage etc.).
   a. Display the data in descending order of Percentage (Bubble Sort).
   b. Display data for Roll No specified by user (Linear Search).
   c. Display the number of passes and comparisons for different test cases (Worst, Average, Best case).

2. Perform following String operations with and without pointers to arrays (without using the library functions): a. substring, b. palindrome, c. compare, d. copy, e. reverse.

3. Data base Management using array of structure with operations Create, display, Modify, Append, Search and Sort.(For any database like Employee or Bank database with andwithout pointers to structures)

4. Create a singly linked list with options:
   a. Insert (at front, at end, in the middle),
   b. Delete (at front, at end, in the middle),
   c. Display,
   d. Display Reverse,
   e. Revert the SLL.

5. Implement Stack using arrays & Linked Lists. Write a menu driven program to perform following operations on stack a) Push b) Pop c) Display

6. Implement Queue using arrays & Linked Lists. Write a menu driven program to perform following operations on Queue a) Insert b) Delete c) Display

7. Binary search tree: Create, search, recursive traversals.

8. Graph using adjacency Matrix with BFS & DFS traversals.

9. Implement set operations using arrays and perform union, intersection, difference, symmetric difference

10. Accept input as a string and construct a Doubly Linked List for the input string with eachnode contains, as a data one character from the string and perform:
    a) Insert b) delete, c) Display forward, d) Display backward

11. Represent graph using adjacency list or matrix and generate minimum spanning tree using Prism's algorithm

12 Read & write operations in a text file.

13 Polynomial addition using array of structure.

14 Evaluation of postfix expression (input will be postfix expression)

15 Implement following Matrix operations:

   a. addition with pointers to arrays
   b. multiplication without pointers to arrays
   c. transpose with pointers to arrays

204185 Digital Electronics
Credits: Th – 04, Pr -01

Teaching Scheme	Examination Scheme
Theory: 04 hrs/week	**In-Sem(Online): 50 Marks**
Practicals: 02 hrs/week	**End-Sem (Theory):50 Marks**
	Practical : 50 Marks

Course Objectives:

- To acquaint the students with the fundamental principles of two-valued logic and various devices used to implement logical operations on variables.
- To lay the foundation for further studies in areas such as communication, VLSI, computer, microprocessor.

Course Outcomes:

On completion of the course, student will be able to

1. Use the basic logic gates and various reduction techniques of digital logic circuit in detail.
2. Design combinational and sequential circuits.
3. Design and implement hardware circuit to test performance and application.
4. Understand the architecture and use of microcontrollers for basic operations and Simulate using simulation software.

Course Contents

Unit I : Combinational Logic Design (8 Hrs)

Standard representations for logic functions, k map representation of logic functions (SOP and POS forms), minimization of logical functions for min-terms and max-terms (upto 4 variables), don't care conditions, Design Examples: Arithmetic Circuits, BCD - to – 7 segment decoder, Code converters. Adders and their use as subtractor, look ahead carry, ALU, Digital Comparator, Parity generators/checkers, Multiplexers and their use in combinational logic designs, multiplexer trees, De-multiplexers and their use in combinational logic designs, Decoders, demultiplexer trees. Introduction to Quine-McCluskey method.

Unit II :Sequential Logic Design (8 Hrs)

1 Bit Memory Cell, Clocked SR, JK, MS J-K flip flop, D and T flip-flops. Use of preset and clear terminals,

Excitation Table for flip flops. Conversion of flip flops. Application of Flip flops: Registers, Shift registers, Counters (ring counters, twisted ring counters), Sequence Generators, ripple counters, up/down counters, synchronous counters, lock out, Clock Skew, Clock jitter. Effect on synchronous designs.

Unit III : State Machines (8 Hrs)

Basic design steps- State diagram, State table, State reduction, State assignment, Mealy and Moore machines representation, Implementation, finite state machine implementation, Sequencedetector. Introduction to Algorithmic state machines- construction of ASM chart and realization forsequential circuits

Unit IV : Digital Logic Families (8 Hrs)

Classification of logic families, Characteristics of digital ICs-Speed of operation, power dissipation, figure of merit, fan in, fan out, current and voltage parameters, noise immunity, operating temperatures and power supply requirements.TTL logic. Operation of TTL NAND gate, active pull up, wired AND, open collector output, unconnected inputs. Tri-State logic. CMOS logic – CMOS inverter, NAND, NOR gates, unconnected inputs, wired logic , open drain output. Interfacing CMOS and TTL. Comparison table of Characteristics of TTL, CMOS, ECL, RTL, I2L, DCTL.

Unit V : Programmable Logic Devices and Semiconductor Memories (6 Hrs)

Programmable logic devices: Detail architecture, Study of PROM, PAL, PLA, Designing combinational circuits using PLDs. General Architecture of FPGA and CPLD Semiconductor memories: memory organization and operation, expanding memory size, Classification and characteristics of memories, RAM, ROM, EPROM, EEPROM, NVRAM, SRAM,DRAM.

Unit VI : Introduction to Microcontroller 8051 (7 Hrs)

Microprocessors and Microcontrollers comparison, 8051 architecture, Pin description, addressing modes, instruction set of 8051, concepts of Counters and Timers with the help of status registers, Port Structure and Interrupts. Simple programming examples – for addition, subtraction, multiplication and delay.

TextBooks:

1. R.P. Jain , “Modern digital electronics” , 3rd edition , 12threprint Tata McGraw Hill Publication, 2007.
2. M. Morris Mano, “Digital Logic and Computer Design” 4th edition,Prentice Hall of India, 2013.

Reference:

1. Anand Kumar, “Fundamentals of digital circuits” 1st edition, Prentice Hall of India, 2001
2. MykePredko, “Programming and customizing the 8051 microcontroller”, Tata McGraw Hill 2003.
3. Muhammad Mazidi, Janice Mazidi and RolinMcKinlay, ‘The 8051 Microcontroller and Embedded Systems using Assembly and C’, Pearson Education, 2nd edition.

Instructions for Laboratory Conduction

At least six practical (on bread board) from list 1 to 8 and two practicals from list 9 to 11.

List of Practicals

1. Study of IC-74LS153 as a Multiplexer. (Refer Data-Sheet).
   Design and Implement 8:1 MUX using IC-74LS153 & Verify its Truth Table.
   Design & Implement the given 4 variable function using IC74LS153. Verify its Truth-Table.
2. Study of IC-74LS138 as a Demultiplexer / Decoder (Refer Data-Sheet). Practical) (Test Benches and FSM excluded). Design and Implement full adder and subtractor function using IC- 74LS138.
   Design & Implement 3-bit code converter using IC-74LS138.(Gray to Binary/Binary to Gray)
3. Study of IC-74LS83 as a BCD adder,(Refer Data-Sheet).
   Design and Implement 1 digit BCD adder using IC-74LS83
   Design and Implement 4-bit Binary sub tractor using IC-74LS83.
4. Study of IC-74LS85 as a magnitude comparator,(Refer Data-Sheet)
   Design and Implement 4-bit Comparator.
   Design and Implement 8-bit Comparator
5. Study of Counter ICs (74LS90/74LS93). (Refer Data-Sheet)
   Design and Implement MOD-N and MOD-NN using IC-74LS90 and draw Timing diagram.
   Design and Implement MOD-N and MOD-NN using IC-74LS93 and draw Timing diagram.
6. Study of synchronous counter
   Design & Implement 4-bit Up/down Counter and MOD-N Up/down Counter using IC74HC191/ IC74HC193. Draw Timing Diagram
7 Verify four voltage and current parameters for TTL and CMOS (IC 74LSXX, 74HCXX), (Refer Data-Sheet).

8. Study of Shift Register (74HC194/74LS95), (Refer data-Sheet)
   Design and Implement Pulse train generator using IC-74HC194/IC74LS95 (Use right shift/left shift). Design and Implement 4-bit Ring Counter/ Twisted ring Counter using shift registers IC 74HC194/IC74LS95.
9. Write a assembly/C language program to perform arithmetic operations.
10. Write a assembly/C language program to perform internal and external memory transfer operations
11. Write a assembly/C language program to use port pin for simple application

204186 Electronic Measuring Instruments and Tools
Credits: Th – 01, Pr -01

Teaching Scheme:

Theory: 01hrs/week
Practical: 02 hrs/week

Examination Scheme:

Term work : 50 Marks

Course Objective:

- To make student competent for handling measuring instruments and to able to select right instrument for the purpose of measurement under different conditions.

Course Outcomes:

On completion of the course, student will be able to:

1. Understand fundamental of various electrical measurements.
2. Understand and describe specifications, features and capabilities of electronic instruments.
3. Finalize the specifications of instrument and select an appropriate instrument for given measurement.
4. Carry out required measurement using various instruments under different setups.
5. Able to compare measuring instruments for performance parameters
6. Select appropriate instrument for the measurement of electrical parameter professionally.

Course Contents

Theory

It is expected that operating principle, block diagram and other details shall be taught in theory sessions. Teachers will explore these instruments in detail in respective laboratory sessions. Specification sheet / functions of the instrument should be listed and attached in file/journal.

Theory lectures shall cover following topics along-with discussion of practicals

1. Measurement: Necessity, units, ways of measurements.
2. Performance parameters for measuring instruments.
3. Information about OIML standards.
4. Statistical analysis (Definitions and Introductions only), sources of errors and remedies
5. Calibration and Maintenance of Instruments.
6. Techno-commercial Comparative Analysis and Ordering Information of Instruments.

TextBooks:

1. Instrument manuals published by respective Manufactures.
2. KalsiH.S " Electronic Instrumentation", Tata McGraw Hill, 2004.

Guidelines for Laboratory Conduction

At least eight practical must be performed.

1. Use of everyday practicing testing/measuring instruments.
   Electrical tester, cable (continuity) tester, Indicators with Neon and LEDs Megger for insulation test, open/short circuit test Digital Panel Meter (DPM)
2. Perform following using analog and digital multimeter: Measurement of DC voltage, DC current, AC (rms) voltage, AC (rms) current, resistance, capacitance. Understand the effect of decimal point of resolution. Comment on bandwidth (only for digital multimeter) to test continuity, PN junction and transistor. Calculate mean, standard deviation, average deviation and variance of measured quantity.

3. Set up Power Supply for Conduction of Laboratory experiments (30V / 300 V) Set up Current limit, Check Over current (CC mode) and Short circuit. Setting Individual / Dual Power Supply Series / Parallel Operation of Power Supplies
4. Perform following using CRO : Set up CRO for operation: Ground check, Probe check, Dual/ Mono/Component Tester
    1) Check signal coupling. Observe alternate, chop modes.
    2) Perform Probe check and calibration of CRO, adjust if necessary

    Measure unknown frequency and phase using XY mode. Perform locking of input signal using auto, normal, external, edge trigger modes.
5. Perform following using DSO
    1) Perform Roll, Average, Peak detection operations on signal, Capture transients.
    2) Perform FFT analysis of sine and square signals.
    3) Perform various math operations like add, subtract and multiplication of two waves.
    4) Check store and retrieval of signals. Use Print, save on disk/USB
6. Compare True RMS meter with Multi-meter

    Measure RMS, peak and average voltages for half controlled rectifier or Full controlled rectifier by varying firing angle.

    Compare readings of DMM and/or Power-scope with TRMS for analyzing why TRMS is better.
7. Signal Analysis using Logic Analyzer

    Set up logic analyzer for 8/16/32 channels. Use logic analyser in stand-alone mode or with PC / Mixed Signal Oscilloscope. Verify timing diagram for any digital circuit like counter / shift register
8. Measurements using Spectrum Analyzer. Perform harmonic analysis and Total Harmonic Distortion (THD) measurement for sine and square waves. Verify frequency response of filters& high frequency (HF) amplifier.

    Analyze Spectrum of AM & FM and to measure percent modulation and bandwidth.
9. Measurements using programmable LCR meter: Measure L, C & R in series / parallel operation, at different frequencies. Comment on readings in different connections / at different frequencies. Measure Q and Dissipation factor.
10. Set up function generator/Arbitrary waveform generator. Generate signal of required amplitude, frequency, duty cycle, offset etc. Generate special signals such as noise, ECG, sweep, burst, AM, FM, PM etc. Check generated signal on oscilloscope and verify under different attenuation.
11. Compare Frequency Counter with Oscilloscope. Carry out measurements through different modes of measurement. Measure frequency, time, ratio, events & pulse width. Measure signals using oscilloscopes and compare readings with frequency counter. Comment on bandwidth of oscilloscope and compare specifications of scope and freq. counter
12. Measure Sound / Video signal strength using db-meter. Measure signal strength before / after signal amplifier. Measure loss of signal strength in connection splitters / attenuator. Plot signal strength at different frequencies

Audit course-I

204192:Japanese Language module-I

About course:

With changing times, the competitiveness has gotten into the nerves and ‘Being the Best’ at all times is only the proof of it. Nonetheless, ‘being the best’ differs significantly from ‘Communicating the best’! The best can merely be communicated whilst using the best… suited Language!!

Japanese is the new trend of 21st century. Not only youngsters but even the professionals seek value in it. It is the engineer’s companion in current times with an assertion of a thriving future. Pune has indisputably grown to become a major center of Japanese Education in India while increasing the precedence for Japanese connoisseurs.

Japanese certainly serves a great platform to unlock a notoriously tough market & find a booming career. While the companies prefer candidates having the knowledge of the language, it can additionally help connect better with the native people thus prospering in their professional journey. Learning Japanese gives an extra edge to the ‘resume’ since the recruiters consciously make note of the fact it requires real perseverance and self-discipline to tackle one of the most complex languages.

It would be easy for all time to quit the impossible; however it takes immense courage to reiterate the desired outcomes, recognize that improvement is an ongoing process and ultimately soldier on it.

The need of an hour is to introduce Japanese language with utmost professionalism to create awareness about the bright prospects and to enhance the proficiency and commitment. It will then prove to be the ultimate path to the quest for professional excellence!

Course Objectives:

- To meet the needs of ever growing industry with respect to language support.
- To get introduced to Japanese society and culture through language.

Course Outcomes:
On completion of the course student

- will have ability of basic communication.
- will have the knowledge of Japanese script.
- will get introduced to reading , writing and listening skills
- will develop interest to pursue professional Japanese Language course.

Course Contents

Unit 1 **:** Introduction to Japanese Language.
Hiragana basic Script, colors, Days of the week

Unit 2 : Hiragana : modified Kana, double consonant, Letters combined with ya, yu, yo
Long vowels, Greetings and expressions

Unit 3 : Self Introduction, Introducing other person,
Numbers, Months, Dates, Telephone numbers, Stating one's age.

Text Book:

1. Minna No Nihongo, "Japanese for Everyone", Elementary Main Text book 1-1 (Indian Edition), Goyal Publishers & Distributors Pvt. Ltd.

Guidelines for Conduction

(Any one or more of following but not limited to)

- Guest Lectures
- Visiting lectures
- Language Lab

Guidelines for Assessment (Any one of following but not limited to)

- Written Test
- Practical Test
- Presentation
- Paper
- Report

Audit Course-I
204192: Road Safety Management

Road transport remains the least safe mode of transport, with road accidents representing the main cause of death of people. The boom in the vehicle population without adequate road infrastructure, poor attention to driver training and unsatisfactory regulation has been responsible for increase in the number of accidents. India's vehicle population is negligible as compared to the World statistics; but the comparable proportion for accidents is substantially large.

The need for stricter enforcement of law to ensure greater safety on roads and an environment-friendly road transport operation is of paramount importance. Safety and security are growing concerns for businesses, governments and the traveling public around the world, as also in India. It is, therefore, essential to take new initiatives in raising awareness, skill and knowledge of students as one of the ibid stake holders who are expected to follow the rules and policies of the government in order to facilitate safety of individual and safe mobility of others.

Course Objectives:

- Provide basic overview on road safety & traffic management issues in view of the alarming increase in vehicular population of the country.
- Insight into the transportation system management (TSM) techniques.
- Overview of the engineering & legislative measures for road safety.
- Discuss measures for improving road safety education levels among the public.

Course Outcomes:

On completion of the course, society will observe –

- Changes in awareness levels, knowledge and understanding
- A change in attitudes / behavior e.g. against drink-drive;
- Casualty Reduction;
- That remedial education for those who make mistakes and for low level offences where this is more effective than financial penalties and penalty points;
- Improving Road Safety Together

Course Contents

1. Existing Road Transport Scenario
2. Accident Causes & Remedies
3. Road Accident Investigation & Investigation Methods
4. Vehicle Technology – CMVR & Road Safety
5. Regulatory / Legislative Provisions for Improving Road Safety
6. Behavioral Training for Drivers for Improving Road Safety
7. Road Safety Education
8. Road Engineering Measures for Improving Road Safety

Guidelines for Conduction (Any one or more of following but not limited to)

- Guest Lectures
- Visits and reports
- Assist authorities like RTO for audits (e.g. Particular road safety audit as critical on-site assessment of the shortcomings in the various elements of the road)
- Mini Project

Guidelines for Assessment(Any one of following but not limited to)

- Written Test
- Practical Test
- Presentation
- Paper
- Report

207005 Engineering Mathematics -III
Credits: Th – 04 ,Tut-01

Teaching Scheme:

Theory : 04 hr/week
Tutorial: 01 hr/week

Examination Scheme:

In-Sem(Online): 50 Marks
End-Sem (Theory):50 Marks
Term Work : 25 Marks

Prerequisites: - Differential and Integral Calculus, Taylor series and Infinite series, Differential equations of first order and first degree, Fourier series, Vector algebra, Algebra of complex numbers.

Course Objectives:
After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

- Linear differential equations of higher order using analytical methods and numerical methods applicable to Control systems and Network analysis.
- Transforms such as Fourier transform, Z-transform and applications to Communication systems and Signal processing.
- Vector differentiation and integration required in Electro-Magnetics and Wave theory.
- Complex functions, conformal mappings, contour integration applicable to Electrostatics, Digital filters, Signal and Image processing.

Course Outcomes:
On completion of the course, student will be able to:

1. Solve higher order linear differential equation using appropriate techniques for modeling and analyzing electrical circuits.
2. Solve problems related to Fourier transform, Z-transform and applications to Communication systems and Signal processing.
3. Obtain Interpolating polynomials, numerically differentiate and integrate functions, numerical solutions of differential equations using single step and multi-step iterative methods used in modern scientific computing.
4. Perform vector differentiation and integration, analyze the vector fields and apply to Electro-Magnetic fields.
5. Analyze conformal mappings, transformations and perform contour integration of complex functions in the study of electrostatics and signal processing.

Course Contents

Unit I: Linear Differential Equations (LDE) and Applications (09 Hours)

LDE of n^{th} order with constant coefficients, Method of variation of parameters, Cauchy's & Legendre's DE, Simultaneous & Symmetric simultaneous DE. Modeling of Electrical circuits.

Unit II: Transforms **(09 Hours)**

Fourier Transform (**FT**): Complex exponential form of Fourier series, Fourier integral theorem, Fourier Sine & Cosine integrals, Fourier transform, Fourier Sine and Cosine transforms and their inverses.

Z - Transform **(ZT):** Introduction, Definition, Standard properties, ZT of standard sequences and their inverses. Solution of difference equations.

Unit III: Numerical Methods **(09 Hours)**

Interpolation: Finite Differences, Newton's and Lagrange's Interpolation formulae, Numerical Differentiation.

Numerical Integration: Trapezoidal and Simpson's rules, Bound of truncation error,

Solution of Ordinary differential equations: Euler's, Modified Euler's, Runge-Kutta 4^{th} order methods.

Unit IV: Vector Differential Calculus **(09 Hours)**

Physical interpretation of Vector differentiation, Vector differential operator, Gradient, Divergence and Curl, Directional derivative, Solenoidal, Irrotational and Conservative fields, Scalar potential, Vector identities.

Unit V: Vector Integral Calculus and Applications **(09 Hours)**

Line, Surface and Volume integrals, Work-done, Green's Lemma, Gauss's Divergence theorem, Stoke's theorem. Applications to problems in Electro-magnetic fields.

Unit VI : Complex Variables **(09 Hours)**
Functions of Complex variables, Analytic functions, Cauchy-Riemann equations, Conformal mapping, Bilinear transformation, Cauchy's integral theorem, Cauchy's integral formula, Laurent's series, Residue theorem.

Text Books:

1. Erwin Kreyszig, “Advanced Engineering Mathematics”, 9e, Wiley India.
2. Peter V. O'Neil, “Advanced Engineering Mathematics”, 7e, Cengage Learning.

Reference Books:

1. M. D. Greenberg, “Advanced Engineering Mathematics”, 2e, Pearson Education.
2. Wylie C.R. & Barrett L.C. , “Advanced Engineering Mathematics”, McGraw-Hill, Inc.
3. B. S. Grewal, “Higher Engineering Mathematics” Khanna Publication, Delhi.
4. P. N. Wartikar & J. N. Wartikar, “Applied Mathematics”, Volumes I and II, Pune VidyarthiGrihaPrakashan,.
5. B.V. Ramana, “Higher Engineering Mathematics”, Tata McGraw-Hill.
6. Thomas L. Harman, James
7. Dabney and Norman Richert, “Advanced Engineering Mathematics with MATLAB”, 2e, Brooks/Cole, Thomson Learning.

Guidelines for Tutorial and Term Work:

i) Tutorial shall be engaged in four batches (batch size of 20 students maximum) per division.
ii) Term work shall be based on continuous assessment of six assignments (one per each unit) and performance in internal tests.

204187 Integrated Circuits
Credits: Th – 04, Pr -01

Teaching Scheme:
Theory: 04hrs/week
Practical: 02 hrs/week

Examination Scheme:
In-Sem(Online): 50 Marks
End-Sem (Theory) :50 Marks
Practical : 50 Marks
Term Work : 25 Marks

Course Objectives:

- To understand characteristics of IC and Op-Amp and identify the internal structure.
- To introduce various manufacturing techniques.
- To study various op-amp parameters and their significance for Op-Amp.
- To learn frequency response, transient response and frequency compensation techniques for Op-Amp.
- To analyse and identify linear and nonlinear applications of Op-Amp.
- To understand functionalities of PLL and its use in various applications in communication and control systems.

Course Outcomes:
On completion of the course, student will be able to:

1. Understand the characteristics of IC and Op-Amp and identify the internal structure.
2. Understand and identify various manufacturing techniques.
3. Derive and determine various performances based parameters and their significance for Op-Amp.
4. Comply and verify parameters after exciting IC by any stated method.
5. Analyze and identify the closed loop stability considerations and I/O limitations.
6. Analyze and identify linear and nonlinear applications of Op-Amp.
7. Understand and verify results (levels of V & I) with hardware implementation.
8. Implement hardwired circuit to test performance and application for what it is being designed.
9. Understand and apply the functionalities of PLL to Frequency synthesizer, multiplier, FM, and AM demodulators

Course Contents

Unit I : OP-AMP Basics (6 Hrs)
Block diagram of OP-AMP, Differential Amplifier configurations, Differential amplifier analysis for dual-input balanced-output configurations using ‘r’ parameters, Need and types of level shifter, current mirror circuits. Voltage series and voltage shunt feedback amplifier and its effect on Ri, Ro, bandwidth and voltage gain.

Unit II : Linear Applications of OP-AMP (8 Hrs)

Inverting and Non-inverting amplifier, voltage follower. Summing, averaging scaling amplifier, difference amplifier, Ideal integrator, practical integrator with frequency response, Ideal differentiator, practical differentiator withfrequency response. Instrumentation amplifiers.

Unit III : Non-linear Applications of OP-AMP (8 Hrs)

Comparator, characteristics of comparator, applications of comparator, Schmitt trigger (symmetrical/asymmetrical), clippers and clampers, voltage limiters, Square wave generator, triangular wave generator, Need of precision rectifier, Half wave , Full wave precision rectifiers, peak detectors, sample and hold circuits.

Unit IV : Converters using OP-AMP (6 Hrs)

V-F, I-V and V-I converter, DAC: types of DAC, characteristics, specifications, advantages and disadvantages of each type of DAC, ADC: types of ADC, characteristics, specifications, advantages and disadvantages of each type of ADC.

Unit V : Phase Locked Loop &Oscillators (8 Hrs)

Block diagram of PLL and its function, PLL types, characteristics/parameters of PLL, and different applications of PLL. Oscillators principle, types and frequency stability, design of phase shift, wein bridge, Quadrature, voltage controlled oscillators.

Unit VI : Active filters (8 Hrs)

Design and frequency scaling of First order and second order Active LP, HP, BP and wide and narrow band BR Butterworthfilters and notch filter. All pass filters.

TextBooks:

1. Ramakant A. Gaikwad, “Op Amps and Linear Integrated Circuits”, Pearson Education 2000.
2. Salivahanan and KanchanaBhaskaran, “Linear Integrated Circuits”, Tata McGraw Hill,India 2008

Reference:

1. George Clayton and Steve Winder, “Operational Amplifiers”, 5th Edition Newnes.
2. Sergio Franco, “Design with Operational Amplifiers and Analog Integrated Circuits”, Tata McGraw Hill.
3. Bali,”Linear Integrated Circuits”, Mc Graw Hill 2008.
4. Gray, Hurst, Lewise, Meyer, “Analysis & Design of Analog Integrated Circuits”, Wiley Publications.

Instructions for Laboratory Conduction

1- 8 experiments are compulsory and should be conducted on bread board.

List of Practical's

1. Measure Op-Amp parameters and compare with the specifications.

Input bias current, input offset current and input offset voltage. slew rate , CMRR
Compare the result with datasheet of corresponding Op-Amp.

2. Design, build and test integrator for given frequency f_a.
3. Design, build and test three Op-Amp instrumentation amplifiers for typical application
4. Design, build and test precision half & full wave rectifier.
5. Design, build and test Schmitt trigger and plot transfer characteristics.
6. Design, build and test PLL.
7. 2 bit DAC and 2 bit ADC.

A) Design and implement 2bit R-2R ladder DAC.

B) Design and implement 2bit flash type ADC.

8. Design, build and test square & triangular wave generator.

Optional Experiments:

1. Verify and understand practically virtual ground and virtual short concept in inverting and non-inverting configuration.
2. Plot DC transfer characteristics of emitter coupled differential amplifier.
3. Study effect of emitter resistance and constant current source on figure of merit (CMRR) of emitter coupled differential amplifier.
4. Design and implement V-I converter.
5. Any experiment based on application of Op-Amp.

204188 Control Systems

Credits: Th – 03

Teaching Scheme:	**Examination Scheme:**
Theory : 03 hr/week	**In-Sem(Online): 50 Marks**
	End-Sem(Theory): 50 Marks

Course Objectives:

- To introduce the elements of control system and their modelling using various Techniques.
- To introduce methods for analyzing the time response, the frequency response and the stability of systems.
- To introduce the concept of root locus, Bode plots, Nyquist plots.
- To introduce the state variable analysis method.
- To introduce concepts of PID controllers and digital and control systems.
- To introduce concepts programmable logic controller.

Course Outcomes:

On completion of the course, student will be able to:

1. Determine and use models of physical systems in forms suitable for use in the analysis and design of control systems.
2. Determine the (absolute) stability of a closed-loop control system.
3. Perform time domain and frequency domain analysis of control systems required for stability analysis.
4. Perform time domain and frequency domain correlation analysis.
5. Apply root-locus, Frequency Plots technique to analyze control systems.
6. Express and solve system equations in state variable form.

Course Contents

Unit I :Control System Modeling (6 Hrs)

Basic Elements of Control System, Open loop and Closed loop systems, Differential equations and Transfer function, Modeling of Electric systems, Translational and rotational mechanical systems, Block diagram reduction Techniques, Signal flow graph

Unit II :Time Response Analysis (6 Hrs)

Standard input signals, Time response analysis of First Order Systems, Time response analysis of second order systems, Steady state errors and error constants, design specifications for second order systems.

Unit III : Stability Analysis (6 Hrs)

Concept of Stability, Routh-Hurwitz Criterion, Relative Stability, Root Locus Technique, Construction of Root Locus, Dominant Poles, Application of Root Locus Diagram.

Unit IV :Frequency Response Analysis (6 Hrs)

Frequency domain Versus Time domain analysis and its correlation, Bode Plots, Polar Plots and development of Nyquist Plots. Frequency Domain specifications from the plots, Stability analysis from plots.

Unit V :State Variable Analysis (6 Hrs)

State space advantages and representation, Transfer function from State space, physical variable form, phase variable forms: controllable canonical form, observable canonical form, Solution of homogeneous state equations, state transition matrix and its properties, computation of state transition matrix by Laplace transform method only, Concepts of Controllability and Observability.

Unit VI :Controllers And Digital Control Systems (6 Hrs)

Introduction to PLC: Block schematic, PLC addressing, any one application of PLC using Ladder diagram. Introduction to PID controller: P, PI, PD and PID Characteristics and concept of Zeigler-Nicholas method.

Digital control systems: Special features of digital control systems, Necessity of sample and hold operations for computer control, z-transform and pulse transfer function, Stability and response of sampled-data systems.

TextBooks:

N. J. Nagrath and M.Gopal, “Control System Engineering”, New Age International Publishers, 5th Edition, 2009.

Reference:

1. Benjamin C. Kuo, “Automatic control systems”, Prentice Hall of India, 7th Edition,1995.
2. M. Gopal, “Control System – Principles and Design”, Tata McGraw Hill, 4th Edition, 2012.
3. Schaum’s Outline Series, “Feedback and Control Systems” Tata McGraw-Hill, 2007.
4. John J. D’Azzo& Constantine H. Houpis, “Linear Control System Analysis and Design”, Tata McGraw-Hill, Inc., 1995.
5. Richard C. Dorf and Robert H. Bishop, “Modern Control Systems”, Addison – Wesley, 1999.

204189 Analog Communications
Credits: Th – 03, Pr -01

Teaching Scheme:

Theory: 03hrs/week
Practical: 02 hrs/week

Examination Scheme:

In-Sem(Online): 50Marks
End-Sem (Theory): 50 Marks
Practical : 50 Marks

Course Objectives:
The students are expected to demonstrate the ability to:
- Describe and analyze the mathematical techniques of generation, transmission and reception of amplitude modulation (AM), frequency modulation (FM) and phase modulation (PM) signals.
- Evaluate the performance levels (Signal-to-Noise Ratio) of AM, FM and PM systems in the presence of additive white noise.
- Convert analog signals to digital format and describe Pulse and digital Modulation techniques.

Course Outcomes:
On completion of the course, student will be able to:

1. Understand and identify the fundamental concepts and various components of analogcommunication systems.
2. Explain signal to noise ratio, noise figure and noise temperature for single and cascaded stages in a communication system.
3. Describe analog pulse modulation techniques and digital modulation technique.
4. Develop the ability to compare and contrast the strengths and weaknesses of variouscommunication systems.

Course Contents

Unit I :AM Transmission (8 Hrs)
Base band & Carrier communication, Generation of AM (DSBFC) and its spectrum, Power relations applied to sinusoidal signals, DSBSC – multiplier modulator, Nonlinear generation, switching modulator, Ring modulator & its spectrum, Modulation Index. SSBSC, ISB & VSB, their generation methods & Comparison, Block Diagram of AM Transmitter and Broadcast technical standards.

Unit II :AM Reception (8 Hrs)
Block diagram of TRF AM Receivers, Super Heterodyne Receiver, Dual Conversion Super heterodyne Receiver, Concept of Series & Parallel resonant circuits for Bandwidth & Selectivity. Performance Characteristics: Sensitivity, Selectivity, Fidelity, Image Frequency Rejection and IFRR. Tracking, Mixers. AM Detection: Rectifier detection, Envelope detection; Demodulation of DSBSC: Synchronous detection; Demodulation of SSBSC: Envelope detection

Unit III : FM Transmission (8 Hrs)

Instantaneous frequency, Concept of Angle modulation, frequency spectrum& Eigen Values, Narrow band & wide band FM, Modulation index, Bandwidth, Phase Modulation, Bessel's Function and its mathematical analysis, Generation of FM (Direct & Indirect Method), FM stereo Transmitter, Two way FM Radio Transmitter, Comparison of FM and PM.

Unit IV : FM Reception (6 Hrs)

Block diagram of FM Receiver, FM Stereo Receiver , Two way FM Radio Receiver, FM detection using Phase lock loop(PLL) ,Slope detector, Balanced Slope detector etc.

Unit V :Noise (6 Hrs)

Sources of Noise, Types of Noise, White Noise, Thermal noise, shot noise, partition noise, Low frequency or flicker noise, burst noise, avalanche noise, Signal to Noise Ratio, SNR of tandem connection, Noise Figure, Noise Temperature, Friss formula for Noise Figure, Noise Bandwidth, Behavior of Baseband systems and Amplitude modulated systems i.e.DSBSC and SSBSC in presence of noise.

Unit VI : Pulse Analog Modulation (6 Hrs)

Band limited & time limited signals, Narrowband signals and systems, Sampling theorem in time domain, Nyquist criteria, Types of sampling- ideal, natural, flat top, Aliasing & Aperture effect. PAM PWM & PPM. Introduction to Pulse Code Modulation.

TextBooks:

1. George Kennedy, "Electronic Communication Systems" 5th Edition, McGraw-Hill.
2 Dennis Roddy &Coolen, "Electronic Communication",4th Edition, Prentice Hall.

Reference:

1. B. P. Lathi, "Modern Digital and Analog. Communication Systems", 3rd Edition, Oxford University Press.
2. Simon Haykin, "Communication Systems", 4th Edition, John Wiley & Sons.
3. Taub& Schilling, "Principles of Communication Systems", Tata McGraw-Hill.
4. Frenzel, "Principles of Electronic Communication Systems"3rd Edition, Tata McGraw-Hill.

Instructions for Laboratory Conduction

Perform any 8 experiments from following

List of Practical

1. Design, Build & Test class C tuned amplifier for AM Generation / Simulate using desirable Software
2. AM Generation (DSB-FC): Calculation of modulation index by graphical method, Power of AM Wave for different modulating signal.
3. Envelope Detector - Practical diode detector, Observe effect of change in RC time constant which leads to diagonal and negative clipping
4. Generation of DSB-SC with the help of Balanced Modulator IC1496/1596 & its detection
5. SSB modulator using Filter method/ phase shift method & its detection
6. Frequency modulator & demodulator using IC 565 (PLL based), calculation of modulation index & BW of FM.
7. Frequency modulator & demodulator using Varicap/Varactor Diode and NE 566 VCO.
8. Study of AM & FM Spectrum: Observe Spectrum of AM & FM on Spectrum Analyzer, Compare & comment on AM & FM spectrum. Observe Effect of Eigen values on carrier power in FM.
9. Measurement of Performance Characteristics of Receiver: Sensitivity, Selectivity, Fidelity
10. Verification of Sampling Theorem, PAM Techniques, (Flat top & Natural sampling), reconstruction of original signal, Observe Aliasing Effect in frequency domain.Following can be performed using suitable software(Any One)
11. Generate AM and FM waveform for given modulation index, signal frequency and carrier Frequency using suitable software.
12. Prove sampling Theorem. Reconstruct the analog signal from its samples. Observe aliasing effect by varying sampling frequency.
13. SNR and PSD of any system (Baseband or AM)(Kit based/Simulated)

Note: Visit to Broadcasting Station is desirable.

204190 Object Oriented Programming

Credit:Th-03,Pr-02

Teaching Scheme:
Theory: 3 Hrs/ Week
Practical : 4 Hr/Week

Examination Scheme:
Online: 50 Marks
Paper: 50 Marks
Oral : 50 Marks

Course Objectives:

- Make the students familiar with basic concepts and techniques of object oriented programming in C++ & Java.
- Develop an ability to write programs in C++ and Java for problem solving.

Course Outcomes:

Upon successful completion of this course, students should be able to:

1. Describe the principles of object oriented programming.

2. Apply the concepts of data encapsulation, inheritance in C++.

3. Understand basic program constructs in Java

4. Apply the concepts of classes, methods and inheritance to write programs Java.

5. Use arrays, vectors and strings concepts and interfaces to write programs in Java.

6. Describe and use the concepts in Java to develop user friendly program,

UNIT I: Introduction to Object Oriented Programming (6L)

Principles of OOP: Software crisis, Software evolution, OOP paradigm, Basic Concepts of OOP, Benefits & applications of OOP.

Beginning with C++: What is C++, Applications of C++, A Simple C++ Program, More C++ statements.

Moving from C to C++: Declaration of variable, Reference variables, Scope resolution operator, Member dereferencing operator, memory management operators.

Functions in C++: Function prototyping, Call by reference.

Unit II: Concepts of Object Oriented Programming with C++ (6L)

Classes & Objects: Specifying a class, Defining member functions, A C++ program with class, Making an outside function inline, Nesting of member function, Private member function, Arrays within class, Member allocation for objects, Arrays of objects, Objects as function arguments.

Constructors & Destructors: Constructors, Parameterized constructors, Multiple constructors in a class, Constructors with default arguments.

Operator overloading concept: Use of operator overloading, defining operator overloading, Binary operator overloading.

Introduction to Inheritance: Concept and types of Inheritance, Defining derived classes, Single inheritance, Making a private member inheritable, multilevel inheritance.

UNIT III: Java Fundamentals (6L)

Evolution of Java, Comparison of Java with other programming languages, Java features, Java Environment, Simple Java Program, Java Tokens, Java Statements, Constants, variables, data types. Declaration of variables, Giving values to variables, Scope of variables, arrays, Symbolic constants, Typecasting, Getting values of variables, Standard default values, Operators, Expressions, Type conversion in expressions, Operator precedence and associativity, Mathematical functions, Control statements- Decision making & branching, Decision making & looping.

UNIT IV: Classes, Methods & Objects in Java (6L)

Class Fundamentals, Declaring Objects, Assigning Object reference variables, Methods, Constructors, The This keyword, Garbage collection, finalize method, Overloading methods, using objects as parameters, Argument passing, returning objects, Recursion, access control, static, final, arrays, strings class, Command line arguments.

UNIT V: Inheritance, Packages and Interfaces (6L)

Inheritance basics, Using Super, Creating Multilevel hierarchy, Constructors in derived class, Method overriding, Dynamic method dispatch, Using Abstract classes, Using final with inheritance, Object class, Packages, Access protection, Importing packages, Interfaces: Define, implement and extend. Default interface methods, Use static method in interface.

UNIT VI: Multithreading, Exception handling & Applets (6L)

Introduction to multithreading: Introduction, Creating thread and extending thread class.

Concept of Exception handling: Introduction, Types of errors, Exception handling syntax, Multiple catch statements.

I/O basics, Reading console inputs, Writing Console output.

Applets: Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating a simple applet.

Text Books:

1. E Balagurusamy, Programming with C++, Tata McGraw Hill, 3^{rd} Edition.

2. Herbert Schildt, Java: The complete reference, Tata McGraw Hill, 7th Editon.

Reference Books:

1. Robert Lafore, “Object Oriented Programming in C++”, Sams Publishing, 4^{th} Edition.

2. T. Budd, Understanding OOP with Java, Pearson Education.

3. Matt Weisfeld, “The Object-Oriented Thought Process”, Pearson

4. Cox Brad, “Object –Oriented Programming: An Evolutionary Approach”, Addison –Wesley

5. E Balagurusamy, Programming with Java A Primer, Tata McGraw Hill, 3^{rd} Edition.

List of Practical:

(Perform any 4 from group I and any 12 from group II)

Group I

1. Write a program in C++ to implement database of persons having different profession e,g. engineer, doctor, student, laborer etc. using the concept of multiple inheritance. The objective of this assignment is to learn the concepts of inheritance.
2. Write a program in C++ to sort the numbers in an array using separate functions for read, display, sort and swap. The objective of this assignment is to learn the concepts of input, output, functions, call by reference in C++.
3. Write a program in C++ to perform following operations on complex numbers Add, Subtract, Multiply, Divide, Complex conjugate. Design the class for complex number representation and the operations to be performed. The objective of this assignment is to learn the concepts classes and objects
4. Write a program in C++ to implement Stack. Design the class for stack and the operations to be

performed on stack. Use Constructors and destructors. The objective of this assignment is to learn the concepts classes and objects, constructors and destructors.

5. Write a program in C++ to perform following operations on complex numbers Add, Subtract, Multiply, Divide. Use operator overloading for these operations. The objective of this assignment is to learn the concepts operator overloading.

Group II

6. Write some simple programs in Java such as

   i) To find factorial of number.

   ii) To display first 50 prime numbers.

   iii) To find sum and average of N numbers.

7. Write a program in Java to implement a Calculator with simple arithmetic operations such as add, subtract, multiply, divide, factorial etc. using switch case and other simple java statements. The objective of this assignment is to learn Constants, Variables, and Data Types, Operators and Expressions, Decision making statements in Java.
8. Write a program in Java with class Rectangle with the data fields width, length, area and colour. The length, width and area are of double type and colour is of string type. The methods are get_length(), get_width(), get_colour() and find_area(). Create two objects of Rectangle and compare their area and colour. If the area and colour both are the same for the objects then display " Matching Rectangles", otherwise display " Non-matching Rectangle".
9. Write Programs in Java to sort i) List of integers ii) List of names. The objective of this assignment is to learn Arrays and Strings in Java
10. Write a Program in Java to add two matrices. The objective of this assignment is to learn Arrays in Java
11. Write a program in Java to create a player class. Inherit the classes Cricket_player, Football_player and Hockey_player from player class. The objective of this assignment is to learn the concepts of inheritance in Java.
12. Write a Java program which imports user defined package and uses members of the classes contained in the package.
13. Write a Java program which implements interface.
14. Create an applet with three text Fields and four buttons add, subtract, multiply and divide. User will enter two values in the Text Fields. When any button is pressed, the corresponding

operation is performed and the result is displayed in the third Text Fields.

15. Write a java program which use try and catch for exception handling.
16. Implement Java program to implement a base class consisting of the data members such as name of the student, roll number and subject. The derived class consists of the data members subject code, internal assessment and university examination marks. The program should have the facilities. i) Build a master table ii) List a table iii) Insert a new entry iv) Delete old entry v) Edit an entry vi) Search for a record. Use virtual functions.
17. Write a program to implement stack or any other data structure in Java
18. Write a program to create multiple threads and demonstrate how two threads communicate with each other.
19. Write a program to implement addition, subtraction and multiplication of two complex numbers in Java
20. A Mini project in Java: A group of 4 students can develop a small application in Java.

204191 EMPLOYABILITY SKILL DEVELOPMENT

Credits:Th – 02, Pr -01

Subject Code:

Teaching Scheme
Theory / Week : 2 Hrs
Practical /Week : 2Hrs.

Examination Scheme
Term Work: 50 Marks

Course Objectives:

1. To develop analytical abilities
2. To develop communication skills
3. To introduce the students to skills necessary for getting, keeping and being successful in a profession.
4. To expose the students to leadership and team-building skills.

Course Outcomes: On completion of the course, student will be able to:

1. Have skills and preparedness for aptitude tests.
2. Be equipped with essential communication skills (writing, verbal and non-verbal)
3. Master the presentation skill and be ready for facing interviews.
4. Build team and lead it for problem solving.

Unit I :Soft Skills & Communication basics (4Hrs)

Soft skills Vs hard skills, Skills to master, Interdisciplinary relevance, Global and national perspectives on soft skills. Resume, Curriculum vitae, How to develop an impressive resume, Different formats of resume – Chronological, Functional, Hybrid, Job application or cover letter, Professional presentation- planning, preparing and delivering presentation, Technical writing

Unit II: Arithmetic and Mathematical Reasoning (4 Hours)

Aspects of intelligence, Bloom taxonomy, multiple intelligence theory, Number sequence test, mental arithmetic (square and square root, LCM and HCF, speed calculation, reminder theorem)

Unit III: Analytical Reasoning and Quantitative Ability (4 Hours)

Matching, Selection, Arrangement, Verifications (Exercises on each of these types). Verbal aptitude (Synonym, Antonym, Analogy)

Unit IV: Grammar and Comprehension (4 Hours)

English sentences and phrases, Analysis of complex sentences, Transformation of sentences, Paragraph writing, Story writing, Reproduction of a story, Letter writing, précis writing, Paraphrasing and e-mail writing.

Unit V: Skills for interviews (4Hours)

Interviews- types of interviews, preparatory steps for job interviews, interview skill tips, Group discussion- importance of group discussion, types of group discussion, difference between group discussion, panel discussion and debate, personality traits evaluated in group discussions, tips for successful participation in group discussion, Listening skills- virtues of listening, fundamentals of good listening, Non-verbal communication-body movement, physical appearance, verbal sounds, closeness, time.

Unit VI: Problem Solving Techniques (4 Hours)

Problem solving model: 1. Define the problem, 2. Gather information, 3. Identify various solution, 4. Evaluate alternatives, 5. Take actions, 6. Evaluate the actions.

Problem solving skills: 1. Communicate. 2. Brain storming, 3. Learn from mistakes.

Text Books:

1. R. Gajendra Singh Chauhan, Sangeeta Sharma, “Soft Skills- An integrated approach to maximize personality”, ISBN: 987-81-265-5639-7, First Edition 2016, Wiley.
2. Wren and Martin, "English grammar and Composition", S. Chand publications.
3. R. S. Aggarwal, "A modern approach to verbal reasoning", S. Chand publications.

Reference Books:

1. Philip Carter, "The Complete Book Of Intelligence Test", John Willey & Sons Ltd.
2. Philip Carter, Ken Russell, "Succeed at IQ test", Kogan Page
3. Eugene Ehrlich, Daniel Murphy, "Schaum’s Outline of English Grammar", McGraw Hills.
4. David F. Beer, David A. McMurrey, “A Guide to Writing as an Engineer”, ISBN : 978-1-118-30027-5 4th Edition, 2014, Wiley.

List of Practical:

1. Every student should collect five questions of each type
   a. Number sequence
   b. Mental arithmetic
   c. Square, square roots
   d. LCM, HCF
   e. Speed calculations

   Note: Teacher should distribute the question set randomly amongst the students.

2. Write up on
    a. Blooms taxonomy
    b. Multiple intelligence theory
    c. Every student should identify his/her strength and weaknesses
    d. Action plan to improve the weaknesses
3. Every student should collect five questions of each type
    a. Matching
    b. Selection
    c. Arrangements
    d. Verifications

    Note: Teacher should distribute the question set randomly amongst the students.

4. Every student should collect five questions of each type
    a. Verbal aptitude
    b. Synonym
    c. Antonym
    d. Analogy

Note: Teacher should distribute the question set randomly amongst the students.

5. Solve exercises from book (Wren and Martin, "English grammar and Composition") based on
    a. English sentences and phrases
    b. Paragraph writing
    c. Story writing
    d. Letter writing
6. Formulate suitable assignment to solve a real problem using problem solving techniques
7. Practice tests (aptitude, analytical abilities, logical reasoning)
8. Extempore, group discussions and debate.
9. Technical report writing and Seminar Presentation.
10. Mock interviews.

Audit course-II

204193:Japanese Language module II

About course:

With changing times, the competitiveness has gotten into the nerves and 'Being the Best' at all times is only the proof of it. Nonetheless, 'being the best' differs significantly from 'Communicating the best'! The best can merely be communicated whilst using the best… suited Language!!

Japanese is the new trend of 21st century. Not only youngsters but even the professionals seek value in it. It is the engineer's companion in current times with an assertion of a thriving future. Pune has indisputably grown to become a major center of Japanese Education in India while increasing the precedence for Japanese connoisseurs.

Japanese certainly serves a great platform to unlock a notoriously tough market & find a booming career. While the companies prefer candidates having the knowledge of the language, it can additionally help connect better with the native people thus prospering in their professional journey. Learning Japanese gives an extra edge to the 'resume' since the recruiters consciously make note of the fact it requires real perseverance and self-discipline to tackle one of the most complex languages.

It would be easy for all time to quit the impossible; however it takes immense courage to reiterate the desired outcomes, recognize that improvement is an ongoing process and ultimately soldier on it.

The need of an hour is to introduce Japanese language with utmost professionalism to create awareness about the bright prospects and to enhance the proficiency and commitment. It will then prove to be the ultimate path to the quest for professional excellence!

Course Objectives:

- To meet the needs of ever growing industry with respect to language support.
- To get introduced to Japanese society and culture through language.

Course Outcomes:

On completion of the course student

- will have ability of basic communication.
- will have the knowledge of Japanese script.
- will get introduced to reading , writing and listening skills
- will develop interest to pursue professional Japanese Language course.

Course Contents

Unit 1 : Katakana basic Script, Denoting things (nominal & prenominal demonstratives)

Purchasing at the Market / in a shop / mall (asking & stating price)

Unit 2 : Katakana : Modified kana, double consonant, letters with ya, yu, yo,

Long vowels

Describing time, describing starting & finishing time (kara ~ made)

Point in time (denoting the time when any action or the movement occurs)

Unit 3 : Means of transport (Vehicles), Places, Countries,

Stating Birth date, Indicating movement to a certain place by a vehicle

Text Book:

1.Minna No Nihongo, “Japanese for Everyone”, (Indian Edition), Goyal Publishers & Distributors Pvt. Ltd.

Guidelines for Conduction

(Any one or more of following but not limited to)

- Guest Lectures
- Visiting lectures
- Langauge Lab

Guidelines for Assessment (Any one of following but not limited to)

- Written Test
- Practical Test
- Presentation
- Paper
- Report

Audit course-II
204193:Cyber Crime and law

Introduction to Cyber Crime and law:

Cyber Crimes, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behavior, Clarification of Terms, Traditional Problems Associated with Computer Crime, Introduction to Incident Response, Digital Forensics, Computer Language, Network Language, Realms of the Cyber world, A Brief History of the Internet, Recognizing and Defining Computer Crime, Contemporary Crimes,Computers as Targets, Contaminants and Destruction of Data, Indian IT ACT 2000

Introduction to Cyber Crime Investigation
Firewalls and Packet Filters, password Cracking, Keyloggers and Spyware, Virus and Warms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless Networks

Guidelines for Conduction

(Any one or more of following but not limited to)

- Guest Lectures
- Visiting lectures

Guidelines for Assessment (Any one of following but not limited to)

- Written Test
- Practical Test
- Presentation
- Paper
- Report

SAVITRIBAI PHULE PUNE UNIVERSITY

FACULTY OF ENGINEERING

SYLLABUS FOR S. E. (ELECTRICAL ENGINEERING)

(2015 course)

WITH EFFECT FROM YEAR 2016-2017

SavitribaiPhule Pune University
S.E. Electrical Engineering 2015 – Course
(w. e. f. 2016-2017)

Semester I													
Sr. No.	Subject Code	Subject Title	Teaching Scheme			Semester Examination Scheme of Marks						Credit	
			Th.	Tut.	Pr.	Paper In Sem(Online)	Paper End Sem	TW	PR	OR	Total	TH/ TUT	PR+OR
1.	203141	Power Generation Technologies	04	--	--	50	50	--	--	--	100	04	---
2.	207006	Engineering Mathematics-III	04	01	--	50	50	25	--	--	125	05	---
3.	203142	Material Science	04	--	02	50	50	--	--	50	150	04	01
4.	203143	Analog and Digital Electronics	04	--	02	50	50	25	50	--	175	04	01
5.	203144	Electrical Measurements and Instrumentation	04	--	02	50	50	25	50	--	175	04	01
6.	203151	Soft Skills	--	--	02	--	--	25	--	--	25	--	01
									Total			21	04
7.	203154	Audit Course I	--	--	--	--	--	--	--	--	--	Grade: PP/NP	
	Total		20	01	08	250	250	100	100	50	750	25	

Semester II													
Sr. No.	Subject Code	Subject Title	Teaching Scheme			Semester Examination Scheme of Marks						Credit	
			Th.	Tut.	Pr.	Paper In Sem (Online)	Paper End Sem	TW	PR	OR	Total	TH/ TUT	PR+OR
1.	203145	Power System I	04	--	--	50	50	--	--	--	100	04	--
2.	203146	Electrical Machines I	04	--	02	50	50	25	50	--	175	04	01
3.	203147	Network Analysis	04	--	02	50	50	50	--	--	150	04	01
4.	203148	Numerical Methods and Computer Programming	04	01	02	50	50	25	50	--	175	05	01
5.	203149	Fundamentals of Microcontroller and Applications	04	--	02	50	50	--	--	50	150	04	01
									Total			21	04
6.	203155	**Audit Course II**										Grade: PP/NP	
Total			20	01	08	250	250	100	100	50	750	25	

TW: Term Work **OR:Oral** **PR:** Practical
PP: Passed (Only for non-credit courses) **NP:** Not Passed (Only for non-credit courses)

Audit Course

- Audit Course: Optional for 1st and 2nd term of SE Electrical Engineering
- 'Audit Courses' means a Course in which the student shall be awarded Pass or Fail only. It is left to the discretion of the respective affiliated institute to offer such courses to the students. Evaluation of audit course will be done at institute level itself.
- Teaching-learning process for these subjects is decided by concern faculty/industry experts appointed by the affiliated Engineering College.
- Marks obtained by student for audit course will not be taken into consideration of SGPA or CGPA.

203154:Audit Course I **Solar Thermal Systems.**

203155:Audit Course II **(A) Solar PV Systems.**
(B)Installation & Maintenance of Electrical appliances.

203141: Power Generation Technologies

Teaching Scheme	Credits	Examination Scheme [Marks]
Th:04 Hrs/ Week	**Th/Tut:04**	**In Sem (Online):50 Marks**
		End Sem:50 Marks

Prerequisite:

- Fuel calorific value.
- Semiconductor materials for PV cells.
- Work, power and energy calculation.

Course Objective:

- To introduce conventional energy conversion system with steam, hydro based and nuclear based power plant.
- To initiate non-conventional energy conversion system with solar, wind, fuel cell, tidal ocean, geothermal, biomass etc.
- To commence interconnection of energy source to gird, stand alone and hybrid system.

Course Outcome: Upon successful completion of this course, the students will be able to :-

- Identify operations of thermal power plant with all accessories and cycles.
- Be aware of the principle of operation, components, layout, location, environmental and social issues of nuclear, diesel and gas power plant.
- Identify and demonstrate the components of hydro power plant and calculation of turbine required based on catchment area.
- Find the importance of wind based energy generation along with its design, analysis and comparison.
- Apply solar energy in thermal and electrical power generation considering energy crisis, environmental and social benefits.
- Understand the operation of electrical energy generation using biomass, tidal, geothermal, hydel plants, fuel cell and interconnection with grid.

Unit 01 : Thermal Power Plant (9 Hrs)

Basic thermodynamic cycles: Thermodynamic cycle of steam flow; Rankine cycle; Actual Rankine cycle; Reheat cycle; Carnot cycle, heat rate.

Thermal Power Plants: Site selection, Main parts and its working. Types of boilers, Feed water and its treatment, Various boiler controls, assessment of heat recovery systems Steam turbines types, selection and control of turbines.

Fuel Handling: delivery of load, unloading, preparation, transfer, outdoor (dead) storage, indoor (live) storage, In-plant Handling, Coal weighing.

Ash disposal and dust collection: Draught systems, electrostatic precipitator. Recent Development in thermal power plants.

Unit 02 : (9 Hrs)

A. **Nuclear Power Plant:** Introduction, atomic physics, nuclear reaction, materials, site selection, nuclear reactors and working of each part, classification of nuclear reactor, nuclear waste disposal, plant layout. Recent Development in nuclear power plants.
B. **Diesel Power Plants:** Main components and its working, Diesel plant efficiency and heat balance, choice and characteristic of diesel power plant. Selection of components and sizing.
C. **Gas Power Plant:** Introduction to gas cycles. Simple gas turbine power plant, methods to improve thermal efficiency, open loop and closed loop cycle power plants, gas fuels, gas turbine materials, plant layout. Combined cycle power plants and concept of heat to power ratio. Recent Development in Gas power plants.

Unit 03 : Hydro Power Plant (8 Hrs)

Site selection, Hydrology, storage and pondage, general arrangements and operation of hydro power plant, Hydraulic turbines, turbine size, pelton wheel turbine, Francis and Kaplan turbines, selection of turbines, Dams, Spillways, gates, intake and out take works, canals and layout of penstocks, water hammer and surge tank, simple numerical on hydrographs and number of turbine required. Control of hydro turbines. Small, mini and micro hydro power plant, Recent Development in hydro power plants.

Unit 04 : Wind Energy Systems (8 Hrs)

Historical Development of Wind Power, Types of wind turbine electrical generators, Power in the Wind, Impact of Tower Height, Maximum Rotor efficiency, Speed control for Maximum Power, Average Power in the wind, Wind turbine power converters (block diagrams), Wind Turbine Economics, Simple Estimates of Wind Turbine Energy, Environmental Impacts of Wind Turbines. Change in wind pattern and its effect on power generation. Control of wind turbine generator.

Unit 05 : Solar Energy (8 Hrs)

Principles of solar radiations, solar constant, cloudy index and concentration ratio, measurement of solar radiation. Solar energy collectors (solar thermal applications), principle of energy conversion, collection systems and their features, types of collectors with comparison. Solar thermal power plants. Over view of recent development of PV technologies. A Generic Photovoltaic Cell, The Simplest Equivalent Circuit for a Photovoltaic Cell From Cells to Modules to Arrays, The PV I–V Curve under Standard Test Conditions (STC), Impacts of Temperature and Insolation on I–V Curves, Shading Impacts on I–V curves, System: Introduction to the Major Photovoltaic System Types.

Unit 06 : Other Sources and Grid Connection (6 Hrs)

Biomass energy, conversion to electricity, municipal solid waste to energy conversion, geothermal energy and ocean energy and Fuel cell Energy storage requirements and selection criteria, stand alone, hybrid stand alone and grid connected renewable systems and their requirements.

Industrial Visit: One industrial visit to conventional /non-conventional power plant is necessary. A separate report file should be maintained in the department.

Text Books:

[T1] P. K. Nag, "Power Plant Engineering", Tata McGraw Hill Publications.
[T2] Dr. P. C. Sharma, "Power Plant Engineering", S.K. Kataria Publications.
[T3] R. K. Rajput, "A text book on Power System Engineering", Laxmi Publications (P) Ltd.
[T4] Chakrabarti, Soni, Gupta, Bhatnagar, "A text book on Power System Engineering", DhanpatRai publication.
[T5] R.K. Rajput, "Non-Conventional Energy Sources and Utilization", S. Chand Publications.
[T6] M.M. Wakil, "Power Plant Engineering", McGraw Hill, Indian Edition.
[T7] G. D. Rai, "Renewable Energy Sources", Khanna Publications.

Reference Books:

[R1] Arora and Domkundwar, "A Course in Power Plant Engineering", DhapatRai Publication.
[R2] Dr. S. P. Sukhatme, "Solar Energy", Tata McGraw Hill Publication.
[R3] Mukund Patel, "Wind and Solar Power Plants", CRC Press.
[R4] Gilbert Masters John, "Renewable Energy", Wiley and sons' publications.

Unit	Text Books	Reference Books
1	T1,T2,T3	R1
2	T1,T2,T3	R1
3	T1,T2,T3	R1
4	T6,T7	R3,R4
5	T5,T6	R2,R3,R4
6	T5,T7	R4

SE(Electrical/Instrumentation and Control)
207006: Engineering Mathematics-III

Teaching Scheme	Credits	Examination Scheme [Marks]
Th:04 Hrs/ Week	Th/Tut: 05	In Sem (Online):50 Marks
Tut:01 Hr/Week		End Sem:50 Marks
		Term Work:25 Marks

Prerequisite:
- Differential and Integral Calculus
- Taylor series and Infinite series
- Differential equations of first order and first degree
- Fourier series, Vector algebra
- Algebra of complex numbers.

Course Objective: After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:-
- Linear differential equations of higher order applicable to Control systems.
- Transforms such as Laplace transform, Fourier transform, Z-Transform and applications to Control systems and Signal processing.
- Vector differentiation and integration required in Electro- Magnetics and Wave theory.
- Complex functions, conformal mappings, contour integration applicable to Electrostatics, Digital filters, Signal and Image Processing.

Course Outcome: Upon successful completion of this course, the students will be able to :-
- Solve higher order linear differential equation using appropriate techniques for modeling and analyzing electrical circuits.
- Solve problems related to Laplace transform, Fourier transform, Z-Transform and applications to Signal processing and Control systems.
- Perform vector differentiation and integration, analyze the vector fields and apply to Electro-Magnetic fields.
- Analyze conformal mappings, transformations and perform contour integration of complex functions in the study of electrostatics and signal processing.

Unit 01 : Linear Differential Equations (LDE) and Applications (9 Hrs)
LDE of nth order with constant coefficients,Method of variation of parameters, Cauchy's & Legendre's DE, Simultaneous & Symmetric simultaneous DE. Modeling of Electrical circuits.

Unit 02 : Laplace Transform(LT) (9 Hrs)
Definition of LT, Inverse LT, Properties & theorems, LT of standard functions, LT of some special functions viz. Periodic, Unit Step, Unit Impulse. Applications of LT for solving Linear differential equations.

Unit 03 : Fourier and Z - transforms (9 Hrs)
Fourier Transform (FT): Complex exponential form of Fourier series, Fourier integral theorem, Fourier Sine & Cosine integrals, Fourier transform, Fourier Sine and Cosine transforms and their inverses.
Z - Transform (ZT): Introduction, Definition, Standard properties, ZT of standard sequences and their inverses. Solution of difference equations.

Unit 04 : Vector Differential Calculus (9Hrs)

Physical interpretation of Vector differentiation, Vector differential operator, Gradient, Divergence and Curl, Directional derivative, Solenoidal, Irrotational and Conservative fields, Scalar potential, Vector identities.

Unit 05 : Vector Integral Calculus and Applications (9Hrs)

Line, Surface and Volume integrals, Work-done, Green's Lemma, Gauss's Divergence theorem, Stoke's theorem. Applications to problems in Electro-magnetic fields.

Unit 06 : Complex Variables (9Hrs)

Functions of Complex variables, Analytic functions, Cauchy-Riemann equations, Conformal mapping, Bilinear transformation, Cauchy's integral theorem, Cauchy's integral formula, Laurent's series and Residue theorem.

Text Books:

[T1] Erwin Kreyszig, "Advanced Engineering Mathematics", 9e,(Wiley India).
[T2] Peter V. O'Neil, "2. Advanced Engineering Mathematics", 7e,(Cengage Learning).

Reference Books:

[R1] M. D. Greenberg, "Advanced Engineering Mathematics", 2e, Pearson Education.
[R2] Wylie C.R. & Barrett L.C. "Advanced Engineering Mathematics", McGraw-Hill, Inc.
[R3] B. S. Grewal, "Higher Engineering Mathematics", Khanna Publication, Delhi.
[R4] P. N. Wartikar& J. N. Wartikar, "Applied Mathematics (Volumes I and II)", Pune VidyarthiGrihaPrakashan, Pune.
[R5] B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw-Hill.
[R6] Thomas L. Harman, JamesDabney and Norman Richert, "Advanced Engineering Mathematics with MATLAB", 2e, Brooks/Cole, Thomson Learning.

Guidelines for Tutorial and Term Work:

1. Tutorial shall be engaged in four batches (batch size of 20 students maximum) per division.
2. Term work shall be based on continuous assessment of six assignments (one per each unit) and performance in internal tests.

203142: Material Science

Teaching Scheme	Credits	Examination Scheme [Marks]
Th:04 Hrs/ Week	Th/Tut: 04	In Sem (Online):50 Marks
PR:02 Hrs/ Week	PR:01	End Sem : 50 Marks
		Oral :50 Marks

Prerequisite:

- Students should have knowledge of various classes of materials like solid, liquid, gaseous, conducting, insulating and resistive along with their basic characteristics.

Course Objective:

- To classify different materials from Electrical Engineering application point of view.
- To understand various properties and characteristics of different classes of materials.
- To select materials for applications in various electrical equipment.
- Toimpart knowledge of Nano-technology, battery and solar cell materials.
- Todevelop ability to test different classes of materials as per IS.

Course Outcome: Upon successful completion of this course, the students will be able to :-

- Categorize and classify different materials from Electrical Engineering applications point of view.
- Explain and summarize various properties and characteristics of different classes of materials.
- Choose materials for application in various electrical equipment.
- Explain and describe knowledge of nanotechnology, batteries and solar cell materials.
- Test different classes of materials as per IS.

Unit 01 A] : Dielectric Properties of Insulating Materials: (6Hrs)

Static Field, Parameters of Dielectric material [Dielectric constant, Dipole moment, Polarization, Polarizability], Introduction to Polar and Non- Polar dielectric materials. Mechanisms of Polarizations-Electronic, Ionic and Orientation Polarization (descriptive treatment only), ClausiusMossotti Equation, Piezo-Electric, Pyro-Electric & Ferro-Electric Materials, Dielectric loss and loss tangent, Concept of negative tan delta (δ).

Unit 01 B] : Optical Properties of Materials: (2 Hrs)

Comparison between materials used for Photo-Conductive, Photo-Electric Emissive and Photo-Voltaic cell. Different materials used for plastic, organic and thin-film solar cells (Mono-Crystalline, Poly-Crystalline). Introduction to fiber optics, materials used and its applications.

Unit 02 A] : Insulating Materials, Properties & Applications: (6Hrs)

Introduction, Characteristics of Good Insulating Material, Classification, Solid Insulating Materials-Paper, Press Board, Fibrous Materials, Ceramics, Mica, Asbestos, Resins, Amorphous materials Polymers, Ceramics, Enamels. Liquid Insulating Materials such as Transformer Oil, Varnish, Askarel. Insulating Gases like Air, SF_6. Insulating Materials for Power & Distribution Transformers, Rotating Machines, Capacitors, Cables, Line Insulators and Switchgears.

Unit 02 B] : Dielectric Breakdown: (2 Hrs)

Introduction, Concept of Primary and Secondary Ionization of Gases (descriptive treatment only), Breakdown Voltage, Breakdown Strength, Factors affecting Breakdown Strengths of Solid, Liquid and Gaseous dielectric materials.

Unit 03 : Magnetic Materials: (8Hrs)

Introduction, Parameters of Magnetic material [Permeability, Magnetic Susceptibility, Magnetization], Classification of Magnetic Materials, Diamagnetism, Paramagnetism, Ferromagnetism, Ferri-magnetism, Ferro-magnetic behavior below Critical Temperature, Spontaneous Magnetization, Curie-Weiss law, Anti-ferromagnetism, Ferrites, Applications of Ferro-magnetic Materials, Magnetic materials for Electric Devices such as Transformer Core , Core of Rotating Machines, Soft Magnetic Materials, Hard Magnetic Materials, Magnetic Recording Materials, Compact Discs. Introduction to laser and magnetic strip technology.

Unit 04 : Conducting Materials: (8Hrs)

General Properties of Conductor, Electrical Conducting Materials - Copper, Aluminum and its applications, Materials of High & Low Resistivity-Constantan, Nickel-Chromium Alloy, Tungsten, Canthal, Silver & Silver alloys, Characteristics of Copper Alloys (Brass & Bronze), Materials used for Lamp Filaments, Transmission Lines, Electrical Carbon Materials, Materials for Super-capacitors. Material used for Solders, Metals & Alloys for different types of Fuses, Thermal Bimetal & Thermocouple. Introduction to Superconductivity and Super Conductors.

Unit 05 A] : Nanotechnology: (6Hrs)

Introduction, Concepts of Energy bands & various Conducting Mechanism in Nano-structures, Carbon Nano-structures, Carbon Molecules, Carbon Clusters, Carbon Nano-tubes and applications. Special Topics in Nano Technology such as Single Electron Transistor, Molecular Machines, BN Nanotubes, Nano wires.

Unit 05 B] : Batteries: (2 Hrs)

Materials used for Batteries: Lead Acid, Lithium-ion, Sodium-Sulphur, Nickel-Cadmium, Zero Emission Battery Research Activity (ZEBRA) Batteries. Batteries used in Electric Vehicle (EV) and Electric Hybrid Vehicle (EHV).

Unit 06 : Testing of Materials: (8Hrs)

Explanation of following with objectives, equipment required, circuit diagrams and observations to be taken.

1. Measurement of Dielectric Loss Tangent (tan δ) by Schering Bridge-IS 13585-1994.
2. Measurement of Dielectric Strength of Solid Insulating Material-IS 2584.
3. Measurement of Dielectric Strength of Liquid Insulating Material – IS 6798.
4. Measurement of Dielectric Strength of Gaseous Insulating Material as per IS.
5. Measurement of Flux Density by Gauss-meter.

Guidelines for Instructor's Manual

Practical Sessions:-

Instructor's Manual should contain following things related to every experiment-

1. The circuit diagram of the experiment should be drawn at the start.
2. Aim, apparatus, theory related to that experiment should be written.
3. One sample calculation should be shown, result table should be made and graph should be plotted if required.
4. Conclusion based on calculations, result and graph (if any) should be written.
5. Five - six questions based on that experiment should be written at the end.

Guidelines for Student's Lab Journal

Student's Lab Journalshould be **Hand Written/ Drawn** containing, following things related to every experiment-

1. The circuit diagram of the experiment should be drawn on the graph paper at the start of the experiment.
2. Aim, apparatus, theory related to that experiment should be written.
3. One sample calculation should be shown, result table should be made and graph should be plotted if required.
4. Conclusion based on calculations, result and graph (if any) should be written.
5. Students should write answers to five - six questions based on that experiment at the end.

Guidelines for Lab /TW Assessment

There is **no Term Work** for the subject. But continuous assessment should be carried out such as checking of previous experiment along with its mock oral session (minimum 4-5 questions to each student), while conducting new experiment.

Guidelines for Laboratory Conduction

1. The circuit diagram should be explained to students in such a way that they should be able to develop it at their own.
2. Detail explanation of the experiment along with its circuit diagram, observation table, calculations, result table and plotting of graphs (if any).
3. While conducting new experiment, assessment of previous experiment should be carried out by its checking along with its mock oral session (minimum 4 -5 questions to each student).

List of Experiments: (Any **eight experiments** from the list below).

1. To measure dielectric strength of solid insulating materials.
2. To measure dielectric strength of liquid insulating materials.
3. To measure dielectric strength of gaseous insulating materials using Sphere Gap-Unit.
4. To obtain Hysteresis Loop of the Ferro-Magnetic Material.
5. To understand the principle of thermocouple & to obtain characteristics of different thermocouples.
6. To measure Insulation Resistance &kVAr capacity of power capacitor.
7. To measure Resistivity of High Resistive Alloys.
8. To observe development of tracks due to ageing on different insulating materials e.g. Bakelite, Perspex, polyesters, Mica, Fiberglass etc.
9. Testing of resins and polymers.
10. Measurement of Tangent of Dielectric Loss Angle (tan δ) of solid/liquid dielectric materials.
11. Measurement of Flux Density by Gauss-meter.

Industrial Visit: Minimum one visit should be arranged to an industry related to manufacturing of batteries, capacitors, cables, transformers (Any one industry). A hand written report should be submitted by every student as a part of term work.

Text Books:

[T1] S. P. Seth, “A Course in Electrical Engineering Materials”, DhanpatRai and Sons publication.

[T2] “Electrical Engineering Materials”, T.T.T.I, Madras.

[T3] K. B. Raina& S. K. Bhattacharya, “Electrical Engineering Materials”, S. K. Kataria& Sons.

[T4] P.K. Palanisamy, “Material Science for Electrical Engineering”, SciTech Pub. (India) Pvt. Ltd., Chennai.

[T5] Charles P. Poole, Jr. Frank & J. Ownes, “Introduction to Nanotechnology”, Wiley Student Edition.

[T6] Ronald M. Dell and David A.J. Rand, “Understanding Batteries”, Royal Society of Chemistry, 2001 Publication.

Reference Books:

[R1] D. M. Tagare, “Electrical Power Capacitors-Design & Manufacture”, Tata McGraw Hill Publication.

[R2] S. P. Chalotra& B. K. Bhatt, “Electrical Engineering Materials”, Khanna Publishers, Nath Market.

[R3] C. S. Indulkar& S. Thiruvengadam, “Electrical Engineering Materials”, S. Chand & Com. Ltd.

[R4] Kamraju& Naidu, “High Voltage Engineering”, Tata McGraw Hill Publication.

[R5] James F. Shackelford & M. K. Muralidhara, “Introduction to Material Science for Engineering”, Sixth Edition by Pearson Education.

[R6] “Insulation Technology Course Material of IEEMA Ratner”, Pearson Education.

[R7] Traugott Fischer, “Materials Science for Engineering Students”, Elsevier publications.

[R8] Rakosh Das Begamudre, “Energy Conversion Systems”, New Age International Publishers.

[R9] David Linden, “Handbook of Battery and Fuel Cells”, McGraw Hill, 1984, Publication.

[R10] Chetan Singh Solanki, “Solar Photovoltaic: Fundamentals, Technologies and Applications”, Prentice Hall of India Publication.

[R11] R. P. Deshpande, “Ultra capacitors – future of energy storage”, McGraw Hill, Publication.

[R12] Linden and Reddy, “Handbook of Batteries”, New York McGraw Hill, 2002, Publication.

[R13] R. P. Khare, “Fiber optics and Optoelectronics”, Oxford University publication.

Unit	Text Books	Reference Books
1	T1, T3	R1, R3, R8, R10, R13
2	T1, T4	R1, R3
3	T1, T2	R2, R3, R5
4	T1, T2	R1, R3, R6
5	T5, T6	R7, R9, R11, R12
6	T1	R4

203143: Analog And Digital Electronics

Teaching Scheme	Credits	Examination Scheme [Marks]
Lecture : 04 Hrs/ Week	Th/Tut: 04	In Sem (Online) : 50 Marks
Practical : 02 Hrs/ Week	PR:01	End Sem : 50 Marks
		Practical : 50 Marks
		Term Work : 25 Marks

Prerequisite:

- Basics of numbering system.
- Basics of diodes and BJT.

Course Objective:

- To demonstrate the concept of numbering system & Boolean's algebra reduction using K map.
- To design and analyze sequential and combinational circuits.
- To develop the concept of basics of operational Amplifier and its applications.
- To introduction to BJT and diode rectifier.

Course Outcome: Upon successful completion of this course, the students will be able to :-

- Understand conversion of number system, perform binary arithmetic and reduce Boolean expressions by K- Map.
- Demonstrate basics of various types of Flip flops, design registers and counter.
- Analyze parameter of Op-amp and its applications.
- Apply the knowledge of Op-amp as wave form generators & filters.
- Use BJT as amplifier with various configurations.
- Analysis of uncontrolled rectifier.

Unit 01 : Number system & Boolean's Algebra: (8 Hrs)

Numbering systems-binary, octal, decimal and hexadecimal and their conversion, codes-BCD, Grey and excess3, Binary arithmetic: - addition and subtraction by 1's and 2's compliment. Booleans algebra, De-Morgan's theory etc. K-map: - structure for two, three and four Variables, SOP and POS form reduction of Boolean expressions by K-map.

Unit 02 : Combinational & Sequential circuits: (9 Hrs)

Concept of Combinational & Sequential circuits, Flip flops – R-S, Clocked S-R, D latches, Edge Triggered D flip-flops, Edge triggered JK flip flops, JK Master - slave flip flop, Register- Buffer registers, shift registers, controlled shift registers, ring counter, Counters – asynchronous Counters, synchronous counter, up - down counter , twisted ring counters, N –moduleCounters.

Unit 03 : Operational Amplifier & Applications: (8 Hrs)

Op-Amp: Block diagrams of 741, ideal and practical parameters, open loop and close loop configuration of Op-Amp. Applications of Op- Amp- Comparator, Schmitt trigger, zero crossing detectors, V-I and I-V converters, Instrumentation amplifier, peak detector.

Unit 04 : Waveform generators, Filters & Regulators: (8 Hrs)

Waveform generation using Op-amp - sine, square, saw tooth and triangular generator, Active filters-Its configuration with frequency response, Analysis of first order low pass and high pass filters, IC 555 –construction, working and modes of operation- astable and monostable multi vibrators, Sequence generator, voltage regulators using ICs 78xx, 79xx, LM 317

Unit 05 : BJT & Applications: (8 Hrs)

BJT amplifier: Introduction, Class A amplifier, AC-DC load line analysis, Single stage and Multistage BJT amplifier, direct coupled, RC coupled and transformer coupled, Darlington pair, Push-Pull amplifier and differential amplifier FET-construction, Parameters, Characteristics.

Unit 06 : Diode & Precision Rectifiers: (7 Hrs)

Diode rectifier: Introduction, Single phase half wave rectifier with R, RL loads. Single phase full wave rectifier-Center tap and bridge rectifier supplying R and RL load and performance parameters. Three phase full wave bridge rectifier with R load. Comparison of single phase half wave and full wave rectifiers,

Precision rectifiers: Half wave and Full wave. Comparison of diode and precision rectifier.

Guidelines for Instructor's Manual

Practical Sessions -

The Instructor's Manual should contain following related to every experiment –

- Brief theory related to the experiment.
- Connection diagram /circuit diagram
- Observation table
- Sample calculations for one reading
- Result table
- Graph and Conclusions.
- Data sheets of the ICs used.
- Few questions related to the experiment (3 to 5)
- List of components required with their specifications , data sheets of ICs used

Guidelines for Student's Lab Journal

TheStudent's Lab Journal should contain following related to every experiment –

- Theory related to the experiment.
- Connection diagram /circuit diagram
- Observation table
- Sample calculations for one reading
- Result table
- Graph and Conclusions.
- Data sheets of the ICs used.
- List of components required with their specifications, data sheets of ICs used.

Guidelines for Lab /TW Assessment

- There should be continuous assessment of the TW.
- Assessment must be based on understanding of theory, attentiveness during practical session, how efficiently the student is able to do connections on bread board and get the results.
- Timely submission of journal.

Guidelines for Laboratory Conduction

- First half an hour should be utilized for explaining the circuit diagram and theory related to the experiment.
- Next one hour for connection and conduction of the experiment.
- Remaining half an hour for continuous assessment and timely checking of the experiment (This time slot can be adjusted as per convenience)
- Separate breadboard should be provided for every student for those experiments which are compulsory to be performed on breadboard.

List of Experiments:

Total **ten** experiments are to be conducted out of following experiments:

First seven experiments are compulsory.

1. Study of ring counter and twisted ring counter.
2. Study of up - down counters (IC 74192/74193) and N- modulo counter. (IC 7490/7493).

3*. Study of Op-amp as Schmitt trigger.

4. Study of Instrumentation amplifier using three Op-amp, CMR measurement

5*. Study of Op-amp as sine, and triangular wave generator.

6*. Study of IC-555 applications- astable, monostablemultivibrator.

7*. Study of Single Phase Full-wave bridge rectifier with RL load.

Any three experiments are to be conducted of following experiments:

1. Study of Three Phase Full-wave Rectifier with R load.

2*. Study of active filters- Low pass and high pass filters.

3. Transistor amplifiers: frequency response of BJT, multistage BJT amplifier.

4*. Study of Single Phase Half-Wave Rectifier.

5. Study of op-amp as a ZCD & Comparator
6. Study of various flip-flops and verification of truth table.
7. Study and verify shift register operation (IC 7495).

**** These experiments should be performed on general purpose PCB/ Breadboard.***

Text Books:

[T1] Floyd and Jain, "Digital Fundamentals", Pearson Education.
[T2] R. P. Jain, "Digital Electronics", Tata McGraw Hill, New Delhi.
[T3] Malvino, "Digital Computer Electronics- An Introduction to Microcomputers," Tata McGraw Hill.
[T4] Gaikwad R., "Operational Amplifier", PHI New Delhi.
[T5] Floyd, "Electronics Devices", Pearson Education.
[T6] Mottershed, "Electronics Devices & Circuits", PHI New Delhi
[T7] Muhammad H. Rashid, "Power Electronics: Circuits, Devices and Applications", 3rd edition, Pearsons Education.

Reference Books:

[R1] Tokheim, "Digital Electronics-Principles and Application", 6th edition, Tata McGraw Hill, New Delhi.
[R2] A Jaico and Charles H. Roth, "Fundamentals of Logic Design" Jr. Forth Edition.
[R3] K. R. Botkar, "Integrated Circuits", Khanna Publication, New Delhi.
[R4] James, "Operational Amplifier and Linear Integrated Circuits Theory and Application."
[R5] P John Paul, "Electronics Devices and circuits", New Age international Publications.
[R6] P. S. Bimbhra, "Power Electronics", Khanna Publications.

Unit	Text Books	Reference Books
1	T1, T2	R1
2	T1, T2, T3	R2
3	T4, T5	R3, R4
4	T4, T5	R3, R4
5	T5, T6	R5
6	T7	R6

203144: Electrical Measurements and Instrumentation

Teaching Scheme	Credits	Examination Scheme [Marks]
Th : 04 Hrs/ Week	Th/Tut: 04	In Sem (Online) : 50 Marks
PR : 02 Hrs/ Week	PR:01	End Sem : 50 Marks
		Practical : 50 Marks
		Term Work : 25 Marks

Course Objective:

- To provide the knowledge of system of units, classification and essentials of measuring instruments.
- To get the knowledge about the construction & operation of various electrical & non electrical measuring instruments.
- To apply the knowledge to identify the measuring instruments & make use of it for quantifying measurements of electrical parameters.

Course Outcome: Upon successful completion of this course, the students will be able to :-

- Understand various characteristics of measuring instruments, their classification and range extension technique.
- Classify resistance, apply measurement techniques for measurement of resistance, inductance.
- Explain construction, working principle and use of dynamometer type wattmeter for measurement of power under balance and unbalance condition.
- Explain Construction, working principle of 1-phase and 3-phase induction, static energy meter and calibration procedures.
- Use of CRO for measurement of various electrical parameters, importance of transducers, their classification, selection criterion and various applications.
- Measurement of various physical parameters using transducers.

Unit 01 : (9 Hrs)

A. **Classification of Measuring Instruments -** Characteristics of measuring instruments: static and dynamic, accuracy, linearity, speed of response, dead zone, repeatability, resolution, span, reproducibility, drifts. Necessity of calibration, standards and their classification, absolute and secondary instruments, types of secondary instruments: indicating, integrating, and recording, analog / digital.
   Ammeter and Voltmeter Theory: Essentials of indicating instruments deflecting, controlling and damping systems. Construction, working principle, torque equation, advantages and disadvantages of Moving Iron (MI) (attraction and repulsion), and Permanent Magnet Moving Coil (PMMC), block diagram and operation of digital ammeter & voltmeter.
B. **Range Extension:** PMMC ammeters and voltmeters using shunts, multipliers. Universal shunt, universal multiplier. Instrument Transformers : Construction, connection of CT & PT in the circuit, advantages of CT / PT over shunt and multipliers for range extension of MI Instruments, transformation ratio, turns ratio, nominal ratio, burden, ratio and phase angle error.(descriptive treatment only)

Unit 02 : (8 Hrs)

A. **Measurement of Resistance:** Measurement of low, medium and high resistance. Wheatstone bridge, Kelvin's double bridge, ammeter-voltmeter method, megger, loss of charge method. Earth tester for earth resistance measurement.
B. **Measurement of Inductance**: Introduction, sources and detectors for A.C. bridge, general equation for bridge at balance. Measurement of inductance: Maxwell's inductance & Maxwell's inductance – Capacitance Bridge, Anderson's bridge.

Unit 03 : (8 Hrs)

Measurement of Power: Construction, working principle, torque equation, errors and their compensation, advantages and disadvantages of dynamometer type wattmeter, low power factor wattmeter, poly-phase wattmeter. Active & reactive power measurement in three phase system for balanced and unbalanced load using three wattmeter method, two wattmeter method & one wattmeter method. Power analyzer, Multi meter.

Unit 04 : (7 Hrs)

Measurement of Energy: Construction, working principle, torque equation, errors and adjustments of single phase conventional (induction type) energy meter. Calibration of energy meter. Block diagram and operation of electronic energy meter. Three phase energy meter, TOD meter.

Unit 05 : (8 Hrs)

A. **Oscilloscope:** Introduction, various parts, front panel controls, use of CRO for measurement of voltage, current, period, frequency. Phase angle & frequency by lissajous pattern & numerical. Introduction to DSO.
B. **Transducers:** Introduction, classification, types: resistive, inductive, capacitive, basic requirements for transducers.
C. **Pressure Measurement:** Introduction, classification of pressure as low, medium & high, absolute, gauge, vacuum, static, dynamic & head pressure. High pressure measurement using electric methods, low pressure measurement by McLeod gauge and pirani gauge, capacitive pressure transducer.

Unit 06 : (8 Hrs)

A. **Level Measurement:** Introduction and importance of level measurement, level measurement methods: mechanical, hydraulic, pneumatic, electrical, nucleonic and ultrasonic.
B. **Displacement Measurement:** LVDT & RVDT – construction, working, application, null voltage, specifications, advantages & disadvantages, effect of frequency on performance.
C. **Strain Gauge**: Introduction, definition of strain, types of strain gauge: Wire strain gauge, foil strain gauge, semiconductor strain gauge etc.; their construction, working, advantages and disadvantages.

Guidelines for Instructor's Manual

- The instructor’s manual is to be developed as a hands-on resource and reference.
- The instructor's manual need to include prologue (about University / program / institute / department / foreword / preface etc), University syllabus, conduction & Assessment guidelines, topics under consideration- concept, objectives, outcomes, list of experiments, references etc.
- The feedback seeking sheet for enhancement of instructor's manual may be added as annexure.

Guidelines for Student's Lab Journal

- The laboratory experiments are to be submitted by student in the form of journal.
- Journal consists of prologue, Certificate, table of contents, and write-up of each experiment (Title, Objectives, Outcomes, List of apparatus, Circuit diagram, Theory, Observation Table, Sample Calculation, Result Table, Conclusion / Analysis, exercises - MCQs, assignments, Date of Completion, Assessment grade and assessor's sign with date).

Guidelines for Lab /TW Assessment

- Each experiment will be assigned grade based on parameters with appropriate weightage.
- Suggested parameters include- timely completion, performance, innovation, punctuality and neatness.

Guidelines for Laboratory Conduction

- The instructor is expected to shortlist necessary experiments from the suggested list of experiments. During the practical session the instructor may divide the total students in groups of 4 to 5 students and assign them with different experiments to be performed.
- Proper safety instructions and demonstration of the experiment is to be given before asking the students to perform the experiment. The experiment is carried out by the students under the supervision of the instructor.
- The instructor should take utmost care towards safety of the students, self and other hazards that may be caused by improper operation of the equipment.
- The instructor may also design an experiment which is relevant to the subject and beyond the scope of syllabus.

List of Experiments:
Compulsory Experiments: (06) Six.

1. Demonstration of working parts of various types of meter by opening the instrument & explanation of symbols & notations used on instruments.
2. Extension of instrument range: ammeter, voltmeter, watt meter using CT & PT.
3. Measurement of active & reactive power in three phase circuit using two wattmeter methods (balanced & unbalanced loads).
4. Measurement of active & reactive power in three phase balanced circuit using one wattmeter method with two way switch.
5. Calibration of single phase static energy meter at different power factors.
6. Measurement of voltage, current, time period, frequency & phase angle using CRO.

Any four experiments are to be conducted of following experiments:

1. Measurement of reactive power by one wattmeter with all possible connections of current coil and pressure coil.
2. Measurement of power in three phase, four wire system using three CTs & two wattmeter.
3. Calibration of single phase wattmeter at different power factors.
4. i) Measurement of resistance by ammeter voltmeter method.
   ii) Measurement of low resistance using Kelvin's double bridge.
5. Measurement of inductance using Anderson's bridge/ Maxwell's bridge.

6. Displacement measurement by LVDT.
7. Electrical methods for measurement of liquid level.

Industrial Visit (If Any): Minimum one visit should be arranged to electrical instrument manufacturing company or where electrical instruments are calibrated or where various measuring instruments (Electrical/Mechanical) can be seen or observed.

Text Books:

[T1] A. K. Sawhney, "A Course in Electrical and Electronic Measurements & Instrumentation" DhanpatRai& Co.

[T2] J. B. Gupta, "A Course in Electronics and Electrical Measurements and Instrumentation" S. K. Kataria& Sons,

[T3] R. K. Jain, "Mechanical and Industrial Measurements" Khanna Publishers.

[T4] B. C. Nakra& K. K. Chaudhari, "Instrumentation Measurement and Analysis", Tata McGraw Hill.

Reference Books:

[R1] E. W. Golding & F. C. Widdies, "Electrical Measurements & Measuring Instruments" Reem Publications.

[R2] Dr. Rajendra Prasad, Electronic Measurements & Instrumentation, Khanna Publishers

[R3] Arun K. Ghosh, "Introduction to Measurements and Instrumentation, PHI Publication

[R4] M. M. S. Anand "Electronics Instruments and Instrumentation Technology" by, PHI Publication.

Unit	Text Books	Reference Books
1	T1,T2,T3,T4	R1,R2,R3,R4
2	T1,T2	R1,R4
3	T1,T2	R1,R2
4	T1,T2	R1,R2
5	T1,T2,T3,T4	R2,R3,R4
6	T1,T2,T3	R2,R3

203151: Soft Skills

Teaching Scheme	Credits	Examination Scheme [Marks]
PR : 02 Hrs/ Week	PR: 01	Term Work : 25 Marks

Course Objective: The course aims to:-

- To possess knowledge ofthe concept of Self-awareness and Self Development.
- To Understand the importance of Speaking Skills, listening skills, Presentation Skills and leadership skills.
- To gain the knowledge of corporate grooming & dressing, Email & telephone etiquettes, etiquettes in social & office setting.
- To get conversant with Team work, Team effectiveness, Group discussion, Decision making.
- To recognize the importance of time management and stress management.

Course Outcome: Students will be able to :-

- DoSWOT analysis.
- Develop presentation and take part in group discussion.
- Understand andImplement etiquettes in workplace and in society at large.
- Work in team with team spirit.
- Utilize the techniques for time management and stress management.

Unit 01 : Self-Awareness & self-Development: (4Hrs)

A) **Self-Assessment , Self-Appraisal, SWOT, Goal setting - Personal & career** - Self-Assessment, Self-Awareness, Perceptions and Attitudes, Positive Attitude, Values and Belief Systems, Self-Esteem, Self-appraisal, Personal Goal setting,

B) Career Planning, Personal success factors, Handling failure, Depression and Habit, relating SWOT analysis & goal setting and prioritization.

Unit 02 : Communication Skill: (6 Hrs)

A) Importance of communication, types, barriers of communication, effective communication.

B) **Speaking Skills:** Public Speaking, Presentation skills, Group discussion- Importance of speaking effectively, speech process, message, audience, speech style, feedback, conversation and oral skills, fluency and self-expression, body language phonetics and spoken English, speaking techniques, word stress, correct stress patterns, voice quality, correct tone, types of tones, positive image projection techniques.

C) **Listening Skills:**Law of nature- you have 2 ears and 1 tongue so listen twice and speak once isthe best policy, Empathic listening, Avoid selective listening-

D) **Group Discussion:**Characteristics, subject knowledge, oral and leadership skills, team management, strategies and individual contribution and consistency.

E) **Presentation skills:**Planning, preparation, organization, delivery.

F) **Written Skills:** Formal & Informal letter writing, Report writing, Resume writing - Sentence structure, sentence coherence, emphasis. Paragraph writing. Letter writing skills – form and structure, style and tone. Inquiry letters, Instruction letters, complaint letters,

Routine business letters, Sales Letters etc.

Unit 03 : Corporate / Business Etiquettes: (2 Hrs)

Corporate grooming & dressing, Email & telephone etiquettes, etiquettes in social & office setting: Understand the importance of professional behavior at the work place, Understand andImplement etiquettes in workplace, presenting oneself with finesse and making otherscomfortable in a business setting. Importance of first impression, Grooming, Wardrobe, Bodylanguage, Meeting etiquettes (targeted at young professionals who are just entering businessenvironment), Introduction to Ethics in engineering and ethical reasoning, rights andresponsibilities.

Unit 04 : Interpersonal relationship: (4 Hrs)

A) **Team work, Team effectiveness, Group discussion, Decision making –** Team Communication. Team, Conflict Resolution, Team Goal Setting, Team Motivation Understanding Team Development, Team Problem Solving, Building the team dynamics. Multicultural team activity.
B) **Group Discussion**- Preparation for a GD, Introduction and definitions of a GD, Purpose of a GD, Types of GD, Strategies in a GD, Conflict management, Do's and Don'ts in GD

Unit 05 : Leadership skills: (2 Hrs)

Leaders' role, responsibilities and skill required - Understanding good Leadership behaviors, Learning the difference between Leadership and Management, Gaining insight into your Patterns, Beliefs and Rules, Defining Qualities and Strengths of leadership, Determining how well you perceive what's going on around you, interpersonal Skills and Communication Skills, Learning about Commitment and How to Move Things Forward, Making Key Decisions, Handling Your and Other People's Stress, Empowering, Motivating and Inspiring Others, Leading by example,effective feedback.

Unit 06 : Other skills: (2 Hrs)

A) **Time management**- The Time management matrix, apply the Pareto Principle (80/20 Rule) to time management issues, to priorities using decision matrices, to beat the most common time wasters, how to plan ahead, how to handle interruptions , to maximize your personal effectiveness, how to say "no" to time wasters, develop your own individualized plan of action.
B) **Stress management**- understanding the stress & its impact, techniques of handling stress.
C) Problem solving skill, Confidence building Problem solving skill, Confidence building

Term Work/Assignments:

Term work will consist the record of any 8 assignments of following exercises

1. SWOT analysis
2. Personal & Career Goal setting – Short term & Long term
3. Presentation Skill
4. Letter/Application writing
5. Report writing
6. Listening skills
7. Group discussion
8. Resume writing
9. Public Speaking
10. Stress management
11. Team Activity-- Use of Language laboratory

**** Perform any 8 exercises out of above 11 with exercise no. 11 as compulsory.***

Teaching Methodology:

Each class should be divided into three batches of 20-25 students each. The sessions should be activity based and should give students adequate opportunity to participate actively in each activity. Teachers and students must communicate only in English during the session. Specific details about the teaching methodology have been explained in every activity given below.

Practical Assignments (Term work)

Minimum 8 assignments are compulsory and teachers must complete them during the practical sessions within the semester. The teacher should explain the topics mentioned in the syllabus during the practical sessions followed by the actual demonstration of the exercises. Students will submit report of their exercise (minimum 8) assignments as their term work at the end of the semester but it should be noted that the teacher should assess their assignment as soon as an activity is conducted. The continual assessment process should be followed.

1. **SWOT analysis:**

   The students should be made aware of their goals, strengths and weaknesses, attitude, moral values, self-confidence, etiquettes, non-verbal skills, achievements etc. through this activity. The teacher should explain to them on how to set goals, SWOT Analysis, Confidence improvement, values, positive attitude, positive thinking and self-esteem. The teacher should prepare a questionnaire which evaluate students in all the above areas and make them aware about these aspects.

2. **Personal & Career Goal setting – Short term & Long term**

3. **Presentation Skills:**

   Students should make a presentation on any informative topic of their choice. The topic may be technical or non-technical. The teacher should guide them on effective presentation skills. Each student should make a presentation for at least 10 minutes.

4. **Letter/Application writing:**

   Each student will write one formal letter, and one application. The teacher should teach the students how to write the letter and application. The teacher should give proper format and layouts.

5. **Report writing:**

   The teacher should teach the students how to write report. The teacher should give proper format and layouts. Each student will write one report based on visit / project / business proposal etc.

6. **Listening skills:**

   The batch can be divided into pairs. Each pair will be given an article (any topic) by the teacher. Each pair would come on the stage and read aloud the article one by one. After reading by each pair, the other students will be asked questions on the article by the readers. Students will get marks for correct answers and also for their reading skills. This will evaluate their reading and listening skills. The teacher should give them guidelines on improving their reading and listening skills. The teacher should also give passages on various topics to students for evaluating their reading comprehension.

7. **Group discussion:**

Each batch is divided into two groups of 12 to 14 students each. Two rounds of a GD for each group should be conducted and teacher should give them feedback.

8. **Resume writing:**

Each student will write one formal letter, and one application. The teacher should teach the students how to write the letter and application. The teacher should give proper format and layouts.

9. **Public Speaking:**

Any one of the following activities may be conducted :

A) **Prepared speech**(topics are given in advance, students get 10 minutes to prepare the speech and 5 minutes to deliver.
B) **Extempore speech** (students deliver speeches spontaneously for 5 minutes each on a given topic)
C) **Story telling** (Each student narrates a fictional or real life story for 5 minutesearch)
D) **Oral review**(Each student orally presents a review on a story or a book read by them)

10. **Team Activity-- Use of Language laboratory**

Text Books:

[T1] Sanjay Kumar and PushpaLata, "Communication Skills", Oxford University Press.
[T2] Krishna Mohan, MeeraBanerji, "Developing Communication Skill", McMillan India Ltd.
[T3] Simon Sweeney, "English for Business Communication", Cambridge University Press

Reference Books:

[R1] Accenture, Convergys, Dell et.al, "NASSCOM-Global Business Foundation Skills, Foundation Books, Cambridge University Press.
[R2] E. H. McGrath, "Basic Managerial Skills for all", Eastern Economy Edition, Prentice hall India.
[R3] Barun K. Mitra, "Personality Development and Group Discussions", Oxford University Press.
[R4] PriyadarshiPatnaik, "Group Discussions and Interview Skills: Foundation Books", Cambridge University Press.
[R5] Napoleon Hill, "Thinks and Grow Rich", Ebury Publishing, ISBN 9781407029252.
[R6] Tony Robbins, "Awaken the Giant Within", Harper Collins Publishers, ISBN-139780743409384.

[R7] Wayne Dyer, “Change Your Thoughts, Change Your Life”, Hay House India, ISBN-139788189988050.
[R8] Stephen Covey, “Habits of Highly Effective People”, Pocket Books, ISBN-139781416502494.
[R9] Dr. Joseph Murphy, “The Power of Your Subconscious Mind”, MaanuGraphics, ISBN-13 9789381529560.
[R10] Daniel Coleman, “The new Leaders”, Sphere Books Ltd, ISBN-139780751533811.
[R11] Richard Koch, “The 80/20 Principal”, Nicholas Brealey Publishing , ISBN-13 9781857883992.
[R12] Julie Morgenstern, “Time management from inside out”, Owl Books (NY),ISBN-13 9780805075908.
[R13] SharuRanganekar, “Wonderland of Indian Manageress”, Vikas Publishing Houses, ISBN-13 9788125942603.
[R14] Shiv Khera, “You can win”, Macmillan, ISBN-139789350591932.
[R15] Gopalaswamy Ramesh, Mahadevan Ramesh, “The Ace of Soft Skills: Attitude, Communication and Etiquette for Success”.

203154:Audit Course I

Solar Thermal Systems

Course Name: Solar Thermal Systems

Prerequisite: Completion of FE or equivalent

Teaching Scheme:
Lectures: 2 h per week
Field Visit: 4 h

Examination Schemes: Audit (P/F)
Written and MCQ
Term paper

Description:

The course will introduce the basics of: solar energy, availability, applications, heat transfer as applied to solar thermal systems, various types of solar thermal systems, introduction to manufacturing of the systems, characterization, quality assurance, standards, certification and economics. The following topics may be broadly covered in the classroom. The field visits will be designed for firsthand experience and basic understanding of the system elements.

Course Objective:

- To understand basics and types of solar thermal systems.
- To get knowledge of various types of concentrators.
- To make students aware of different Standards and certification for Concentrator Solar Power.

Course Outcome: Student Will be able to

- Differentiate between types of solar Concentrators
- Apply software tool for solar concentrators
- Design different types of Solar collectors and balance of plant

Course Contents:

- Sun, Earth and seasons
- Solar Radiation
- Basics of heat transfer
- Absorption, reflection and transmission of radiation
- Types of Solar thermal systems
- Basic design of different types of systems
- Applications of solar thermal systems and their economics
- Need for solar concentration
- Various types of solar concentrators
- Movement of Sun and tracking
- Control systems for solar tracking
- Concentrating solar thermal (CSP)
- Concentrating solar PV (CPV)
- Balance of plant for CSP
- Critical points in concentrating solar system installation
- Operation and maintenance of CSP

- Typical financial analysis of CSP
- Software tools for concentrating solar power
- Environmental impact assessment
- Standards and certification for CSP
- Basics of solar thermal (STH) systems
- Elements of various STH systems
- Design, materials and manufacturing of
  - Flat plate solar collector
  - Evacuated tube solar collector
  - Parabolic trough collector
  - Dish type solar concentrators
  - Concentrating PV systems
  - Balance of plant
- Manufacturing standards
- Quality assurance and standards
- Certification
- Special purpose machines and Automation in manufacturing
- Site assembly and fabrication
- Typical shop layouts
- Inventory management
- Economics of manufacturing

References:

- Trainers Textbook Solar Thermal Systems Module, Ministry of New and Renewable Energy, Government of India
- Students Workbook for Solar Thermal Systems Module, Ministry of New and Renewable Energy, Government of India

203145: Power System I

Teaching Scheme	Credits	Examination Scheme [Marks]
Th : 04 Hrs/ Week	Th/Tut: 04	In Sem (Online) : 50 Marks
		End Sem : 50 Marks

Prerequisite:

- Power Generation.
- Various insulating materials and properties.
- Knowledge of fundamental of electrical circuit components.

Course Objective:

- To learn basic structure of electrical power systems, various electrical terms related with power system and understand various types of tariffs.
- To understand specifications and applications of major electrical equipment present in power plant.
- To get knowledge of mechanical & electrical design of overhead and underground transmission system.
- To learn representation of transmission lines for performance evaluation.

Course Outcome: Upon successful completion of this course, the students will be able to :-

- Recognize different patterns of load curve, calculate different factors associated with it and tariff structure for LT and HT consumers.
- Aware of features, ratings, application of different electrical equipment in power station and selection of overhead line insulators.
- Analyze and apply the knowledge of electrical and mechanical design of transmission lines.
- Identify and analyze the performance of transmission lines.

Unit 01 : Structure of Electrical Power Systems and tariff: (8 Hrs)

A) Structure of Electrical Power Systems: Structure of Electrical Power System**,** Different factors associated with generating stations such as Connected load, Maximum Demand, Demand Factor, average load, load factor, diversity factor, plant capacity factor, reserve capacity, plant use factor, Load curve, load duration curve, concept of base load and peak load stations, Interconnected grid system. Fitting of available generating stations into the area load duration curve.

B) Tariff : Introduction of Tariff, Tariff setting principles, desirable characteristics of Tariff, various consumer categories and implemented tariffsuch as two part, three part, Time of Day tariff for H.T. & L.T. industrial and commercialconsumers along with current electricity charges, Introduction to Availability Based Tariff (ABT), Interruptible tariff, Incentives and penalties applied to various consumers.

Unit 02 : Major Electrical Equipment's in Power Stations and Overhead line insulators : (8 Hrs)

A) Major Electrical Equipment's in Power Stations : Descriptive treatment of ratings of various equipment used in power station, Special features, field of use of equipment like alternators, necessity of exciters, various excitation systems such as dc excitation, ac excitation and static excitation systems, transformers, voltage regulators, bus-bars, current limiting reactors, circuit breakers, protective relays, current transformers, Potential transformers, Lightning arresters, Earthingswitches, isolators, carrier current equipment (P.L.C.C.), Control panels, battery rooms, metering and other control room equipment in generating stations.

B) **Overhead Line Insulators:** Types of insulators & their applications such as pin type, suspension type, strain type, Silicon Rubber insulators, post insulators, Shackle insulators, bushings, voltage distribution along string of suspension insulators, string efficiency, equalization of potential across each unit, method of improving string efficiency, insulator failure.

Unit 03 : Mechanical Design of Overhead Lines and Underground Cables: (8 Hrs)

A) **Mechanical Design of Overhead Lines:** Main components of overhead lines, Line supports, conductor spacing, length of span, calculation of sag for equal and unequal supports and effect of ice and wind loadings.

B) **Underground Cables:** Classification, Construction of cable, XLPE cables, insulation resistance, dielectric stress in single core cable, capacitance of single core and three core cable, cables used for HVDC transmission. Grading of cables, inter sheath grading, capacitance grading.

Unit 04 : Resistance and Inductance of Transmission Line: (9 Hrs)

Resistance of transmission line, skin effect and its effects, proximity effect, internal & external flux linkages of single conductor, inductance of single phase two wire line, inductance of three phase line with symmetrical and unsymmetrical spacing, concept of G.M.R. and G.M.D, necessity of transposition,inductance of three phase double circuit line with symmetrical and unsymmetrical spacing, inductance of bundled conductors.

Unit 05 : Capacitance of Transmission Line: (7 Hrs)

Electric potential at single charged conductor, potential at conductor in a group of charged conductors, capacitance of single phase line, Capacitance of single phase line with effect of earth's surface on electric field, Concept of G.M.R. and G.M.D for capacitance calculations, capacitance of three phase line with symmetrical and unsymmetrical spacing, capacitance of double circuit three phase line with symmetrical and unsymmetrical spacing.

Unit 06 : Performance of Transmission Lines: (8 Hrs)

Classification of lines based on length and voltage levels such as short, medium and long lines. Performance of short transmission line with voltage current relationship and phasor diagram, Representation of medium lines as 'Nominal Pi' and 'Nominal Tee' circuits using R, L and C parameters. Ferranti effect, Representation of 'Tee' and 'Pi' models of lines as two port networks, evaluation and estimation of generalized circuit constants (ABCD) for short and medium lines, Estimation of Efficiency & regulation of short & medium lines.

Industrial visit: Minimum one visit to HV substations is recommended.

Text Books:

[T1] J. B. Gupta, "Transmission and Distribution", S. K. Kataria& Sons, New Delhi.
[T2] V. K. Mehta, Rohit Mehta, "Principles of Power System", S. Chand Publication
[T3] J. B. Gupta, "Generation and Economic Considerations", S. K. Kataria& Sons, New Delhi.
[T4] Dr. B. R. Gupta, "Generation of Electrical Energy",S. Chand Publication
[T5] A Chakraborty, M. L. Soni, P. V. Gupta, U.S. Bhatnagar, "A text book on Power System Engineering", Dhanpatrai& Co., Delhi.
[T6] S. N. Singh, "Electric Power Generation, Transmission and Distribution", Prentice Hall of India.

Reference Books:

[R1] Nagrath& Kothari, "Power System Engineering", Tata McGraw Hill Publications.
[R2] D. Das, "Electrical Power System", New Age Publication.
[R3] W.D. Stevenson, "Power System Analysis", Tata McGraw Hill Publications.
[R4] "Know your Power – citizen's primer" – Prayas energy group

References:

www.mahadiscom.in
www.mercindia.org.in

203146: Electrical Machines I

Teaching Scheme	Credits	Examination Scheme [Marks]
Th : 04 Hrs/ Week	**Th/Tut: 04**	**In Sem (Online) : 50 Marks**
PR : 02 Hrs/ Week	**PR:01**	**End Sem : 50 Marks**
		Practical : 50 Marks
		Term Work : 25 Marks

Prerequisite:

- Magnetic circuit, mutual induced EMF, Dynamically induced EMF, Direction of magnetic field in current carrying conductor, Flemings LHR & RHR, Electromechanical energy conversion.

Course Objective:

- To understand energy conversion process.
- To understand selection of machines for specific applications.
- To test & analyze the performance of machine.
- To understand the construction, principle of operation of transformers, DC Machine & Induction Machine.

Course Outcome: Upon successful completion of this course, the students will be able to :-

- Apply energy conversion principles to different machines.
- Select machine for specific applications.
- Test the various machine for performance calculation.

Unit 01 : Transformers: (8 Hrs)

Single phase Transformer: Concept of ideal transformer. Corrugated core transformer. Toroidal core Transformer Useful and leakage flux, its effects. Resistance, leakage reactance and leakage impedance of transformer windings & their effects on voltage regulation and efficiency. Exact and approximate equivalent circuits referred to L.V. and H. V. side of the transformer. Phasor diagrams for no-load and on load conditions. Transformer ratings. Losses in a transformer, their variation with load, voltage & Frequency on no load losses Efficiency and condition for maximum efficiency. All day Efficiency. Open circuit and short circuit tests, determination of equivalent circuit parameters from the test data and determination of voltage regulation and efficiency. Autotransformers, their ratings and applications. Comparison with two winding transformer with respect to saving of copper and size.

Unit 02 : Transformers: (8 Hrs)

Polarity test. Parallel operation of single phase transformers, conditions to be satisfied, load sharing under various conditions. & Welding Transformer

Three Phase Transformers: Standard connections of three phase transformers and their suitability for various applications, voltage Phasor diagrams and vector groups. Descriptive treatment of Parallel operation of three phase transformers Scott connection and V connections. Three winding (tertiary windings) transformers

Unit 03 : D.C. Machines: (8 Hrs)

Construction, main parts, magnetic circuits, poles, yoke, field winding, armature core, Armature windings: Simple lap and wave winding, commutator and brush assembly. Generating action, E.M.F equation, magnetization curve, Flashing of Generator. Motoring action. Types of DC motors, significance of back E.M.F torque equation, working at no-load and on-load. Losses, power flow diagram and efficiency. Descriptive treatment of armature reaction.

Unit 04 : D.C. Machines: (8 Hrs)

Characteristics and applications of D.C. Shunt and Series Motors, Starting of DC motors, study of starters for series and shunt motor, solid state starters, speed control of various types of DC motors.

Commutation: Process of commutation, time of commutation, reactance voltage, straight line commutation, commutation with variable current density, under and over commutation, causes of bad commutation and remedies, inter poles, compensating windings. (Descriptive treatment only)

Unit 05 : Three Phase Induction Motor: (8 Hrs)

Production of rotating mmf by 3-phase balanced voltage fed to a symmetrical 3-phase winding. Construction: Stator, Squirrel cage & wound rotors. Principle of working, simplified theory with constant air gap flux; slip, frequency of rotor emf and rotor currents, mmf produced by rotor currents, its speed w.r.t. rotor and stator mmf. Production of torque, torque-slip relation, condition for maximum torque, torque-slip Characteristics, effect of rotor resistance on torque-slip characteristics. Relation between starting torque, full load torque and maximum torque. Losses in three phase induction motor, power-flow diagram. Relation between rotor input power, rotor copper loss & gross mechanical power developed, efficiency.

Unit 06 : Three Phase Induction Motor: (8 Hrs)

Induction motor as a generalized transformer; phasor diagram. Exact & approximate equivalent circuit. No load and blocked rotor tests to determine the equivalent circuit parameters and plotting the circle diagram. Computation of performance characteristics from the equivalent circuit and circle diagram. Performance curves. Necessity of starter for 3-phase induction motors. Starters for slip-ring and cage rotor induction motors; stator resistance starter, auto transformer starter, star delta starter and rotor resistance starter. D.O.L. starter and soft starting, with their relevant torque and current relations. Comparison of various starters. , testing of three phase induction motor as per IS 325 & IS 4029.

Guidelines for Instructor's Manual

- Prepare 4/5 sets of standard experiments. It must contain title of the experiment. Also, Aim, Apparatus including name of machines with their specifications, rheostats, ammeter, voltmeter, wattmeter if used along with their ratings / ranges and whether moving coil or moving iron etc.
  - **Theory:** Brief theory explaining the experiment
  - **Circuit / connection diagram** or construction diagram must be drawn either manually using geometrical instruments or using software on A-4 size quality graph paper / plain white paper.
  - **Procedure:** Write down step by step procedure to perform the experiment.
  - **Observation table:**
  - **Sample calculation:** For obs. number ---
  - **Result table:**
  - **Nature of graph:**
  - **Conclusion:**
  - **Comments if any:**
  - **Questions / Answers**: Write minimum 5/ 6 questions / answers based on each experiment.

Theory part must be typed on A-4 good quality paper on single side. Put these pages of experiments / circuit diagram in plastic folder and provide it to a group of 4/5 students.

Guidelines for Student's Lab Journal

1. Students should write the journal in his own hand writing.
2. Circuit / Connection diagram or construction diagram must be drawn either manually using or using software. [Do not use Xerox copy of standard journal]
3. Hand writing must be neat and clean.
4. Journal must contain certificate indicating name of the institute, student, department, subject, class/ year, number of experiments completed, signature of staff, Head of the department and the Principal.
5. Index must contain sr. number, title of the experiment, page number, and the signature of staff along with date.
6. Put one blank page in between two experiments. Prepare the parallelogram at the center of page and write experiment number, date and title of the experiment in separate line.
7. Use black or blue ink pen for writing.

Guidelines for Laboratory Conduction

1. Check whether the MCB / ELCB / main switch is off.
2. Make connections as per circuit diagram. Use flexible wire for connection of voltmeter and pressure coil connection of wattmeter. For rest of the connections, use thick wire. Do not keep loose connection. Get it checked from teacher / Lab Assistant.
3. Perform the experiment only in presence of teacher or Lab Assistant.
4. Do the calculations and get it checked from the teacher.
5. After completion of experiment, switch off the MCB / ELCB / main switch.
6. Write the experiment in the journal and get it checked within week.

Guidelines for Lab /TW Assessment

1. Do the continuous assessment. The experiment performed in a particular week, should be checked within same week or at the most in next week.
2. While assessment, teacher should put the remark by writing word "Complete" and not simply "C". Put the signature along with date at the end of experiment and in the index.
3. Assign 10 marks for each experiment as per following format
   Timely completion = 03 marks
   Neat and clean writing = 02 marks
   Depth of understanding = 03 marks
   Regular attendance = 02 marks
4. Maintain continuous assessment sheet. At the end of semester, convert these marks out of as prescribed in syllabus structure and display on the notice board.

List of Experiments:
Compulsory Experiments:

1. O.C. and S.C. test on single phase Transformer.
2. Polarity test on single phase and three phase transformer
3. Parallel operation of two single phase transformers and study of their load sharing under various conditions of voltage ratios and leakage impedances.

Any five experiments are to be conducted of following experiments:

1. Speed control of D.C. Shunt motor and study of starters.
2. Brake test on D.C. Shunt motor
3. Load characteristics of D.C. series motor.
4. Hopkinson's test on D.C. shunts machines.
5. Load test on 3-phase induction motor.
6. No load & blocked-rotor test on 3-phase induction motor :
    a) Determination of parameters of equivalent circuit.
    b) Plotting of circle diagram.
7. Calculation of motor performance from (a) & (b) above.
8. Determination of sequence impedance of the transformer
9. To study Sumpner's test.
10. Measurements of non-sinusoidal current waveform of transformer at no load Swinburne Test on DC shunt Motor.

Industrial Visit:

- Minimum One visit to above machines manufacturing industry (mentioned in syllabus) is recommended.
- Assignment based on IS 2026.

Text Books:

[T1] Edward Hughes "Electrical Technology", ELBS, Pearson Education.
[T2] Ashfaq Husain, "Electrical Machines", DhanpatRai& Sons.
[T3] S. K. Bhattacharya, "Electrical Machine", Tata McGraw Hill publishing Co. Ltd, 2nd Edition.
[T4] Nagrath& Kothari, "Electrical Machines", Tata McGraw Hill.
[T5] Bhag S Guru, Husein R. Hiziroglu, "Electrical Machines", Oxford University Press.
[T6] K Krishna Reddy, "Electrical Machines- I and II", SCITECH Publications (India) Pvt. Ltd. Chennai.

Reference Books:

[R1] A.E. Clayton and N. N. Hancock, "Performance and Design of Direct Current Machines", CBS Publishers, Third Edition.
[R2] A.E. Fitzgerald, Charles Kingsley, Stephen D. Umans, "Electrical Machines", Tata McGraw Hill Publication Ltd., Fifth Edition.
[R3] A.S. Langsdorf, "Theory and performance of DC machines", Tata McGraw Hill.
[R4] M.G. Say, "Performance and Design of AC. Machines", CBS Publishers and Distributors.
[R5] SmarajitGhosh, "Electrical Machines", Pearson Education, New Delhi.
[R6] Charles I Hubert, "Electrical Machines Theory, Application, & Control", Pearson Education, New Delhi, Second Edition.

203147: Network Analysis

Teaching Scheme	Credits	Examination Scheme [Marks]
Th : 04 Hrs/ Week	Th/Tut: 04	In Sem (Online) : 50 Marks
PR : 02 Hrs/ Week	PR:01	End Sem : 50 Marks
		Term Work : 50 Marks

Prerequisite:

- Terminology of electrical networks, Laplace transforms linear differential equations.

Course Objective:

- To develop the strong foundation for Electrical Networks.
- To develop analytical qualities in Electrical circuits by application of various theorems.
- To understand the behavior of circuits by analyzing the transient response using classical methods and Laplace Transform approach.
- To apply knowledge of Network theory for analysis of 2-port networks and design of other circuits like filters.

Course Outcome: Upon successful completion of this course, the students will be able to :-

- Developing strong basics for network theory.
- Develop the problem solving technique for networks by application of theorems.
- Understand the behavior of the network by analyzing its transient response.
- Apply their knowledge of network theory for designing special circuits like filters.

Unit 01 : Basics of Network: (8 Hrs)

Source transformation: voltage and current sources, mesh analysis, nodal analysis, Concept of super node and super mesh, coupled circuits and dot conventions. Concept of network graphs (incidence, tie set and cut set matrix), Concept of duality and dual networks.

Unit 02 : Network Theorems: (8 Hrs)

Superposition, Thevenin, Norton, Maximum Power Transfer Theorem, Reciprocity theorem, Millman theorems applied to both ac/dc circuits.

Unit 03 : Analysis of Transient Response in Circuits-Classical Method: (8 Hrs)

Initial and Final Condition of network, General and Particular Solution, time constant. Transient response of R-L, R-C and R-L-C network in time domain.

Unit 04 : Analysis of Transient Response in Circuits: Laplace Transform Approach: (8 Hrs)

Standard test inputs: Step, Ramp, Impulse, Their Laplace transform, Representation of R,L,C in S domain, transformed network, Application of Laplace transform to solve series and parallel R-L, R-C and R-L-C circuits (Source free, Source driven).

Unit 05 : Two Port Network and Network Functions: (8 Hrs)

Two port parameters: Z, Y, H and Transmission parameters Network Functions for 1 and 2 port, calculation of network functions, Poles and zeros of network functions, Restrictions on poles and zeros, Time–domain behavior from the pole and zero location, Necessary conditions for stable driving point function and Transfer function.

Unit 06 : Filters: (8 Hrs)

Classification of filters: Low pass, High Pass, Band pass, Band stop, Symmetrical networks : characteristic impedance , propagation constant, Design of constant K- low pass and constant K- high pass filters using symmetrical networks.

Guidelines for Instructor's Manual

- Specify objective(s) of the experiment.
- List out equipment required to perform the experiment with their ratings.
- Include circuit diagram with specifications.
- Related theory of the experiment must be included.
- Include step by step procedure to perform the experiment.
- Tabular representation of results taken from the experiment/observation table must be included wherever applicable.
- It should include the formulae required to calculate desired results.
- Instructions for plotting the graphs must be included wherever required.
- Provide space to write conclusion on their own.
- For simulation experiments using MATLAB, the Simulink diagram with proper details must be included.

Guidelines for Student's Lab Journal

- Students are expected to write the journal in the following sequence:
  - Aim –
  - Equipment –
  - Circuit diagram –
  - Theory –
  - Procedure –
  - Observation table –
  - Calculations –
  - Graphs –
  - Conclusion.
- Students are expected to draw the circuit diagrams on 1mm graph paper.
- For plotting the characteristics they must use 1mm graph papers.
- Students should write conclusion on their own.
- Students should get the assignment and lab write up checked within 1 week after performing the experiment.

Guidelines for Lab /TW Assessment

Assessment should be on the basis of:

- Neatness of circuit diagram.
- Completed write up including theory, procedure.
- The detail calculations to obtain results.
- Graph with title, scale, labeling of axes etc.
- Conclusion.
- Punctuality, discipline, attendance, understanding and neatness of the journal.
- Few questions on the basis of the experiment can be asked to verify the understanding of the students about that experiment.

Guidelines for Laboratory Conduction

- Give the safety instructions to students.
- Allow 4-5 students per group for performing the experiment.
- Explain theory related to the experiment to be conducted.
- Introduce the equipment required to students.
- Explain students the calibration process of equipment.
- Explain the circuit diagram of the experiment.
- Connections should be completed by the students according to circuit diagram.
- Perform the experiment in the presence of instructor.
- Verify the results obtained.

List of Experiments:

Any **four** experiments from the first five of the following and any **four** experiments from rest of the list. (Minimum four experiments should be based on simulation software PSPICE/MATLAB along with hardware verification)

1. Verification of Superposition theorem in A.C. circuits.
2. Verification of Thevenin's theorem in A.C. circuits.
3. Verification of Reciprocity theorem in A.C. circuits.
4. Verification of Millmans' theorem.
5. Verification of Maximum Power Transfer theorem in A.C. circuits.
6. Determination of time response of R-C circuit to a step D.C. voltage input. (Charging and discharging of a capacitor through a resistor)
7. Determination of time response of R-L circuit to a step D.C. voltage input. (Rise and decay of current in an inductive circuit)
8. Determination of time response of R-L-C series circuit to a step D.C. voltage input.
9. Determination of parameter of Two Port Network.
10. Frequency response of constant K- low pass filters
11. Frequency response of constant K- high pass filters.

Text Books:

[T1] M. E. Van Valkenburg, "Network Analysis", Prentice Hall of India Private Limited, Third Edition,

[T2] D Roy Choudhary, "Network and Systems", New age international publishers.

[T3] AbhijitChakroborty, "Circuit Theory", DhanpatRai and Company, 7th edition.

[T4] Ravish R Singh, "Network Analysis and synthesis", McGraw Hill education (India) Pvt. Ltd, 3rd edition 2015.

Reference Books:

[R1] William H. Hayt, Jr. Jack E. Kemmerly, "Engineering Circuit Analysis" McGraw Hill Publication.

[R2] N.C. Jagan, "Network Analysis", BS Publication, Hyderabad, Second Edition.

[R3] G. K. Mittal, "Network Analysis and Synthesis", Khanna Publication.

Unit	Text Books	Reference Books
1	T1,T2,T3,T4	R1,R3
2	T2,T3,T4	R1,R3
3	T1,T3	R2,R3
4	T2,T3	R1,R2
5	T2,T3,T4	R3
6	T2,T3,T4	R1

203148: Numerical Methods and Computer Programming

Teaching Scheme	Credits	Examination Scheme [Marks]
Th : 04 Hrs/ Week	**Th/Tut: 05**	**In Sem (Online) : 50 Marks**
PR : 02 Hrs/ Week	**PR:01**	**End Sem : 50 Marks**
Tutorial : 01 Hr/ Week		**Practical : 50 Marks**
		Term Work : 25 Marks

Prerequisite:

- Differentiation and integration of a single real variable, ordinary differential equations.
- Fundamentals of Programming languages.
- Linear Algebra.

Course Objective:

- To emphasize the need of computational techniques and analyze errors involved in the computation.
- To provide sound knowledge of various numerical methods.
- To apply various numerical methods to obtain solution of different types of equations such as transcendental, simultaneous, ODE etc. and also for interpolation, integration and differentiation.
- To impart skills to develop programs using C language.

Course Outcome: Upon successful completion of this course, the students will be able to :-

- Develop algorithms and implement programs using C language for various numerical methods.
- Demonstrate types of errors in computation and their causes of occurrence.
- Identify various types of equations and apply appropriate numerical method to solve different equations.
- Apply different numerical methods for interpolation, differentiation and numerical integration.
- Apply and compare various numerical methods to solve first and second order ODE.
- Apply and compare various numerical methods to solve linear simultaneous equations.

Unit 01 : Basics of C Language: (8 Hrs)

Revision: Basics of 'C' language - Data types, Operators and its precedence. Control statements: 'if-else' and nested 'if-else', 'for, while and do-while'.

Arrays: Introduction, one and two dimensional arrays.

Functions: Types of functions User Defined Functions - declaration and prototypes, Local and Global variables.

Pointers: Introduction, declaring and initializing pointers.

Unit 02 : Numerical Methods , Errors and Concept of root of equation: (8 Hrs)

A) Basic principle of numerical methods. Floating point algebra with normalized floating point technique, Significant digits.
Errors: Different types of errors, causes of occurrence and remedies to minimize them. Generalized error formula.

B) **Concept of roots** of an equation. Descartes' rule of signs, Sturm's theorem, Intermediate value theorem. Synthetic division, Roots of Polynomial Equations using Birge-Vieta method.

Unit 03 : Solution of Transcendental and polynomial equation and Curve Fitting: (8 Hrs)

A) **Solution of Transcendental and polynomial equation:** Bisection, Secant, Regula-Falsi, Chebyeshev and Newton-Raphson methods, Newton-Raphson method for two variables.

B) **Curve Fitting** using least square approximation – First order and second order.

Unit 04 : Interpolation and Numerical Differentiation: (8 Hrs)

A) **Interpolation:** Difference operators, Introduction to interpolation - Newton's forward, backward interpolation formulae, Stirling's and Bessel's central difference formulae, Newton's divided difference formula, Lagrange's interpolation.

B) **Numerical Differentiation** using Newton's forward and backward interpolation formulae.

Unit 05 : Solution of Ordinary Differential Equation(ODE) and Numerical Integration: (8 Hrs)

A) **Solution of First order Ordinary Differential Equation (ODE)** using Taylor's series method, Euler's, Modified Euler's methods. Runge-Kutta second and fourth order methods. **Solution of Second order ODE** using 4th order Runge-Kutta method.

B) **Numerical Integration:** Trapezoidal and Simpson's rules as special cases of Newton-Cote's quadrature technique for single and double integrals.

Unit 06 : Solution of linear simultaneous equation: (8 Hrs)

A) **Solution of simultaneous equation:** Direct methods - Gauss and Gauss-Jordan elimination methods, concept of pivoting – partial and complete. Iterative methods – Jacobi and Gauss Seidel methods.

B) **Matrix Inversion** using Jordon method and Eigen values using Power method.

Guidelines for Instructor's Manual

Practical Sessions -

The Instructor's Manual should contain following related to every program –

- Theory related to the method.
- Algorithm and Flowchart of the method.
- One or two solved numerical.
- Brief description of the few C commands used in the program.
- Seven - eight questions based on method and related C commands.
- Printout of C program and output.

Tutorial Sessions -

The Instructor's Manual should contain following related to every Tutorial –

- Algorithm, flowchart and program related to the tutorial C assignments.
- One – two solved numerical related to every method in the tutorial.

Guidelines for Student's Lab Journal

Practical Sessions -

The Student's Lab Journal should be a <u>hand written</u> containing following related to every experiment –

- Theory related to the method.
- Algorithm and Flowchart of the method.
- One solved numerical.
- Brief description of the few C commands used in the program.
- Questions & Answers based on method and related C commands.
- Printout of C program and output.

Tutorial Sessions –

The Student's Tutorial Notebook should contain following related to every Tutorial –

- Algorithm, flowchart and program related to the tutorial C assignments.
- At least one solved numerical related to every method in the tutorial.

Guidelines for Lab /TW Assessment

- There should be continuous assessment of the TW.
- TW assessment should be based on – understanding of the method, proficiency in C programming, involvement during lab sessions, neatness in journals and timely submission.
- Students performance in tutorial sessions should also be evaluated and considered for final TW assessment with due weightage.

Guidelines for Laboratory Conduction

- Detail theory and numerical related to the method should be taken in the lecture prior to the lab session.
- Algorithm should be discussed in detail in the lab session.
- Students are expected to do the program based on the discussed algorithm individually.
- Printout of the program and output should be taken on the day when the program is performed.

List of Experiments:

Term work shall consist of minimum **EIGHT** computer programs in C language with flowcharts and results.

1. Solution of a polynomial equation using Birge-Vieta method.
2. Solution of a transcendental equation using Bisection or Regula-Falsi method.
3. Solution of two variable non-linear equation using N-R method.
4. Program for interpolation using Newton's forward or backward interpolation.
5. Program for interpolation using Lagrange's or Newton's Divided difference interpolation.
6. First order curve fitting using Least square approximation.
7. Solution of simultaneous equation using Gauss Seidel or Jacobi method.
8. Solution of simultaneous equation using Gauss elimination or Jordon method.
9. To find largest Eigen value using Power method.

10. Solution of Numerical Integration using Simpson's (1/3) rd or (3/8) thrule.
11. Solution of first order ODE using 4th order RK method or Modified Euler method.

List of Tutorials:
***** Tutorials should be based on following methods.**

1. Minimum 6 'C' programs based on decision making, for, while, and do-while loops, one and two dimensional arrays and user defined functions.
2. Sturm's Theorem and BirgeVieta method.
3. RegulaFalsi method, Newton Raphson method and Second order Least Square Approximation method.
4. Any two methods of interpolation with equal interval and all methods for unequal interval.
5. One direct and one iterative method for solution of linear simultaneous equations.
6. 4th order R-K method for first order ODE and 2nd order ODE and Simpson's rule for single and double integrals.

****** A Tutorial can be extended for more than one week to include all the mentioned methods.***

Text Books:

[T1] M. K. Jain, S.R.K. Iyangar, R. K. Jain, "Numerical Methods for Scientific and Engineering Computations", New Age Publications.
[T2] T. Veerarajan and T. Ramchandran, "Numerical Methods with Programs in C and C++", Tata McGraw Hill Publication.
[T3] P.P. Gupta & G.S Malik, "Calculus of Finite Difference and Numerical Analysis", Krishna Prakashan Media Ltd, Meerut**.**
[T4] Dr. B. S. Grewal, "Numerical Methods in Engineering & Sciences", Khanna Publishers.
[T5] E. Balagurusamy, "Programming in ANSI C", Tata McGraw Hill Publication.
[T6] E. Balagurusamy, "Numerical Methods", Tata McGraw Hill Publication.

Reference Books:

[R1] J. B. Scarborough, "Numerical Mathematical Analysis", Oxford & IBH, New Delhi.
[R2] Steven Chapra, Raymond P. Canale, "Numerical Methods for Engineers", Tata McGraw Hill Publication.
[R3] YashwantKanetkar, "Let us C", BPB Publications.
[R4] S.S. Sastry, "Introductory methods of Numerical Analysis", PHI Learning Private Ltd.
[R5] P. Thangaraj, "Computer oriented Numerical Methods", PHI Learning Private Ltd.

Unit	Text Books	Reference Books
1	T5	R3
2	T6,T1,T3	R4,R2 ,R5
3	T2,T3,T4	R2 ,R1,R5
4	T2,T3,T4	R2,R1,R5
5	T2,T3,T4	R2,R1,R5
6	T2,T3,T4	R2,R1,R5

203149: Fundamentals of Microcontroller and Applications

Teaching Scheme	Credits	Examination Scheme [Marks]
Th : 04 Hrs/ Week	Th/Tut: 04	In Sem (Online) : 50 Marks
PR : 02 Hrs/ Week	PR:01	End Sem : 50 Marks
		Oral : 50 Marks

Prerequisite:

- Knowledge of numbering systems and Boolean algebra.
- Knowledge of combinational and sequential logic circuits.

Course Objective:

- To understand the differences between microcontrollers and microprocessors learn microcontroller architecture & describe the features of a typical microcontroller.
- To use the 8051 addressing modes and instruction set and apply this knowledge to perform programs - arithmetic & logic operations, data & control transfer operations, input & output operations.
- To define the protocol for serial communication and understand the microcontroller development systems.
- To build and test a microcontroller based system; interface the system to switches, keypads, displays, A/D and D/A converters.
- To provide students with the concepts and techniques required in designing computer hardware interfaces embedded software for microcontrollers and measurement of various analog parameters.

Course Outcome: Upon successful completion of this course, the students will be able to :-

- Differentiate between microprocessor and microcontroller.
- Describe the architecture and features of various types of microcontroller.
- Demonstrate programming proficiency using the various addressing modes and all types of instructions of the target microcontroller.
- Program using the capabilities of the stack, the program counter the internal and external memory, timer and interrupts and show how these are used to execute a programme.
- Write assemble assembly language programs on PC and download and run their program on the training boards.
- Design electrical circuitry to the Microcontroller I/O ports in order to interface with external devices.
- Write assembly language programs and download the machine code that will provide solutions real-world control problems such as fluid level control, temperature control, and batch processes.

Unit 01 : (8 Hrs)

Introduction to concept of microcontroller, comparison of Microprocessor and microcontroller, Comparison of all 8 bit microcontrollers, Intel 8051 microcontroller architecture, Pin diagram, Memory organization of 8051, special function registers, Internal structure of I/O ports, operation of I/O ports. Interfacing of 8051 with externalmemory.

Unit 02 : (8 Hrs)

Addressing modes of 8051, Instruction set of 8051, Stack and Stack Related instruction, Data exchange, byte level logical operations, bit level logical operations, rotate and swap operations, instruction affecting flags, incrementing, decrementing, arithmetic operations, jump and recall instruction, Call and return subroutines.

Unit 03 : (8 Hrs)

Assembly language programming of 8051. Counters and timers in 8051, timer modes and its programming.

Unit 04 : (8 Hrs)

Interrupts- timer flag interrupt, serial port interrupt, external interrupts, software generated, interrupt control and interrupt programming. Serial communication and its programming. Serial data input, output, Serial data modes, interfacing of 8051 with PC through RS232.

Unit 05 : (8 Hrs)

Microcontroller development tools- study of simulator, emulator, assemblers, programmers, cross assembler for microcontrollers. Study, interfacing and programming of PPI 8255 - mode 0, 1, BSR mode. Interfacing of 8051 with 8255 for expanding of I/O. Programming and Interfacing of 8051 with 8 bit ADC (0809) and DAC (0808).

Unit 06 : (8 Hrs)

Part A: (Theoretical Treatment only)

Measurement of parameters such as matrix (4 x 4) Keyboard pressure, temperature, flow, level, voltage, current, power (KW), power factor and frequency using 8051.

Part B: Interfacing and Programming

Interfacing of 8051 with single key, LED, Relay, voltage, current, speed control of dc motors, Stepper motor control (speed /position).

Guidelines for Instructor's Manual

1. Commands to be followed in order to operate the 8051 micro controller kit.
2. Architecture of 8051 micro controller kit-Functional block diagram & its explanation.
3. Pin Diagram of 8051 micro controller with description of all the 40 pins.
4. Addressing modes-Explanation with an example.
5. Instruction set for Data transfer, Arithmetic, Logical, Branching& Bit manipulation along with explanation.
6. User manuals of all the interfacing kits such as stepper motor, DC motor,DAC, ADC &LED.

Guidelines for Student's Lab Journal

1. Title of the program.
2. The program has to be written in the following format.Address- Instruction- Comment
3. Input data has to be specified.
4. Result of the program.
5. Flow Chart for each program has to be drawn on separate page.

Guidelines for Laboratory Conduction

1. Each group in the lab should have not more than three students.
2. Each student within the group has to enter and execute the program turn wise.
3. Staff member has to check the result of all the groups after the execution of the program.

List of Experiments:

Compulsory Experiments:

1. Study and use of 8051 Microcontroller trainer kit.
2. Assembly Language Program for arithmetic operation of 8 bit numbers.
3. Assembly Language Program for finding largest number and smallest number from a given array of 8 bit numbers.
4. Assembly Language program to arrange 8 bit numbers stored in array in ascending order and descending order.
5. Assembly Language Program for data conversion.
6. Assembly Language Program for use of Timer/Counter for various applications.

Any six experiments are to be conducted of following experiments:

1. Implementation of Serial Communication by using 8051 serial ports.
2. Programming using cross assembler.
3. Blinking display of LED's interfaced with 8051 through 8255.
4. Interfacing of 8 bit DAC 0808 with 8051 to generate various waveforms.
5. Interfacing of 8 bit ADC 0809 with 8051 Microcontroller.
6. Interfacing of relay with 8051.
7. Stepper motor control by 8051 Microcontroller.
8. Interfacing of matrix keyboard/ 7 segment display with 8051

Text Books:

[T1] V Udayashankara and M S MallikarjunaSwamy, "8051 Microcontroller, Hardware, software and applications", TATA McGraw Hill.

[T2] Muhammad Ali Mazidi, J.G. Mazidi, "The 8051 Microcontroller and Embedded Systems", Pearsons Publishers.

[T3] Ajay Deshmukh, "Microcontroller 8051" –TATA McGraw Hill.

[T4] Theagrajan," Microprocessor and Microcontroller", BS Publication.

[T5] K. J. Ayala, "The 8051 Microcontrollers- Architecture, Programming and Applications", Peram International Publications.

[T6] SubrataGhoshal, "8051 microcontroller", Pearsons Publishers.

Reference Books:

[R1] Scott Mackenzie, "8051 Microcontroller", Pearson Education.

[R2] Intel Microcontroller data book.

[R3] Intel Corporation 1990- 8 bit embedded controller handbook.

NOTE: - Text books given covers total syllabus.

203155: Audit Course II

(A) Solar Photovoltaic Systems

Course Name: Solar Photovoltaic Systems

Prerequisite: Completion of FE or equivalent

Teaching Scheme:
Theory: 02Hrs/ Week
Practical: 2 h x 3

Examination Schemes: Audit (P/F)
Written and MCQ

Description:
The course will introduce the basics of: solar energy, availability, semiconductors as photovoltaic convertors and solar cells, applications of photovoltaic, various types of solar photovoltaic systems, and introduction to manufacturing of the systems, characterization, quality assurance, standards, certification and economics. The following topics may be broadly covered in the classroom. The practical will be designed for basic understanding of the system elements.

Course Objective:

- To learn Solar PV system and its appliances
- To get knowledge of balance of PV system, batteries, inverters etc.
- To understand grid tied SPV solar plants

Course Outcome: Students

- Will be able to do design of Solar PV system for small and large installations
- Will be able to handle software tools for Solar PV systems

Course Contents:

- Physics of photovoltaic (PV) electricity
- Photodiode and solar cell
- Solar radiation spectrum for PV
- Types of solar cell and comparison
- Introduction to various types of solar module manufacturing
- Basic system design and economics
- Types of systems
- Common applications of solar PV
- Introduction to solar PV (SPV) systems
- SPV appliances
- Small capacity SPV power plants
- Grid tied SPV power plants
- Large scale SPV power plants
- Balance of system
- Solar inverters
- Batteries
- Financial modeling of SPV
- Operation and maintenance of SPV
- Software tools for SPV
- Environmental impact assessment
- Standards and certification for SPV
- Basics of SPV systems
- Elements of SPV appliances and power plants

- Procurement versus production
- Bought-outs, assemblies, sub-assemblies
- Manufacturing and assembly
- Manufacturing standards
- Quality assurance and standards
- Certification
- Special purpose machines and Automation in manufacturing
- Site assembly and fabrication
- Typical shop layouts
- Inventory management
- Economics of manufacturing

Practical:

- PV characterization
- Batteries and energy storage
- PV system design

References:

[1] A.S.Kapur -A Practical Guide for Total Engineering of MW capacity Solar PV Power Project

[2] Solanki C.S- Solar Photovoltaic Technology and Systems: A Manual for Technicians, Trainers and Engineers- PHI

[3] Solanki C.S- SolarPhotovoltaics - Fundamentals, Technologies and Applications- PHI

[4] S. Sukhatme -Solar Energy : Principles of Thermal Collection and Storage- McGraw Hill

203155: Audit Course II

(B) Course Name: Installation & Maintenance of Electrical appliances

Prerequisite: Completion of FE/DEE or equivalent

Teaching Scheme:
Theory / Practical: **02Hrs/ Week**

Examination Schemes: Audit (P/F)
Written and MCQ
Term paper

Field Visit: 4 h

Course Objective:
This course has been designed to provide the knowledge of Repairing and Maintenance of home appliances. Students will be familiar with maintenance of everyday household necessities.

Course Outcome: At the end of the course the students will be having knowledge of: -

- Observing the safety precautions while working,
- Test line cord for continuity with test lamp/ multimeter
- Dismantle and reassemble an electric iron
- Heater, kettle, room heater, toaster, hair dryer, mixer grinder etc.
- Install a ceiling fan and the regulator
- Check a fluorescent lamp chock, starter and install it
- Domestic installation testing before energizing a domestic installation

Course Contents:

- **General safety & electrical safety –**
  - What is safety, Why safety is needed,
  - Tools for electrical safety,
  - Safety rules
  - Precaution during electrical maintenance
- **Crimping & crimping tool, soldering**
  - What is crimping, crimping tool, How to use RJ-11 connector, telephone wire, UTP Cable
  - crimping technique, precaution during crimping
  - Soldering Iron, Soldering wire, Soldering Flux,
  - Soldering method, Zero defect soldering
- **Earthing& types of Earthing**
  - Introduction of Earthing ,
  - Need of Earthing, Hazard,
  - Types of Earthing
  - Advantage of Earthing, working of Earthing
- **Simple house wiring circuit**
  - Introduction of Wiring ,types of wiring,
  - need of wiring, advantage of wiring,
  - wiring methods
  - electrical panel, cable type
- **Install, service and repair of automatic electric iron, mixer grinder, ceiling and table fan, heater, iron, kettle, washing machine etc**
  - Installation procedure of electric iron,
  - Installation procedure mixer grinder
  - Installation procedure of ceiling and table fan,

- Installation procedure heater, iron, kettle
- Installation procedure washing machine
- fault finding & removal of faulty component in electric iron, mixer grinder, ceiling and table fan
- fault finding & removal of faulty component in heater, iron, kettle, washing machine

- **Assemble and install of a fluorescent lamp**
  - Parts of fluorescent lamp,
  - Working principle of fluorescent lamp,
  - assembling procedure of lamp
- **Thermostat heat controls of Automatic electric iron, steam iron, spray irons.**
  - Thermostat, Bimetal, Wax Pallet , Gas Expansion, Pneumatic,
  - Bimetallic Switching thermostat, Simple two wire thermostats
  - Combination heating/Cooling regulation, Heat Control of Steam Iron, Electric Iron
- **Maintenance of decorative serial lamp for a required supply voltage**
  - What is decorative lamp, Working of decorative lamp
  - Description of decorative serial lamp,
  - Maintenance of decorative serial lamp
- **Introduction to re- winding Insulating material used**
  - Material, Types of Material
  - Insulating Material, Types of Insulating Material
  - Need of insulating material, winding, re-winding

References:

[1] S. K. Shastri – Preventive Maintenance of Electrical Apparatus – Katson Publication House

[2] B.K.N.Rao -Hand book of condition monitoring- Elsevier Advance Tech., Oxford(UK).

[3] Eric Kleinert-Troubleshooting and Repairing Major Appliances / Edition 3- McGraw Hill

[4] Service Manual of Electrical Home Appliances

Savitribai Phule Pune University

Syllabus

FOR

S.E. Mechanical and Automobile Engineering

2015 Course

UNDER FACULTY OF ENGINEERING

EFFECTIVE FROM June 2016

Structure of S.E. (Mechanical Engineering/ Automobile Engineering)
2015 Course

Semester-I

Subject Code	Subject	Teaching Scheme Hours/Week			Examination Scheme					Total Marks	Credits	
		L	Tut.	PR	In-Sem (online)	End-Sem	TW	PR.	Oral		Lect/Tut	PR/OR
207002	Engineering Mathematics – III	04	01	-	50	50	25	-	-	125	05	-
202041	Manufacturing Process-I	03	-	**02**	50	50	50	-	-	150	03	01
202042	Computer Aided Machine Drawing	01	-	02	--	--		50	-	50	01	01
202043	Thermodynamics	04	-	**02**	50	50	-	-	50	150	04	01
202044	Material Science	03	01	-	50	50	25	-	-	125	03	01
202051	Strength of Materials	04	-	**02**	50	50	-	-	50	150	04	01
202055	Audit course											
					--	--						
	Total	**19**	**02**	**08**	**250**	**250**	100	50	100	**750**	**20**	**05**
	Total of Part-I	**29 Hrs**				**750**					**25**	

Note: Material Science and Engineering Mathematics-III practical may be carried out fortnightly for two hours, so that the tutorial hours may be used as practical.

Semester-II

Subject Code	Subject	Teaching Scheme Hours/Week			Examination Scheme					Total Marks	Credits	
		L	Tut.	PR	In-Sem (online)	End-Sem	TW	PR.	Oral		Lect/Tut	PR/OR
202045	Fluid Mechanics	04	-	02	50	50	-	50	-	150	04	01
202047	Soft Skills	-	-	02	--	--	25	-	-	25	-	01
202048	Theory of Machines – I	04	01	-	50	50	25	-	25	150	04	01
202049	Engineering Metallurgy	03	01	-	50	50	-	-	25	125	03	01
202050	Applied Thermodynamics	04	-	02	50	50	-	50	-	150	04	01
203152	Electrical and Electronics Engineering	03	-	02	50	50	25	-	-	125	03	01
202053	Machine Shop – I	-	-	02	--	--	25	-	-	25	-	01
	Total	**18**	**02**	**10**	**250**	**250**	**100**	**100**	**50**	**750**	**18**	**07**
	Total of Part-II	**30 Hrs**			**750**						**25**	

Note: Theory of Machine-I and Engineering Metallurgy practical may be carried out fortnightly for two hours, so that the tutorial hours may be used as practical.

Audit Course1

In addition to credits courses, it is recommended that there should be audit course (non-credit course) from second year of Engineering. The student will be awarded grade as AP on successful completion of audit course. The student may opt for one of the audit courses, starting in second year first semester. Though not mandatory, such audit courses can help the student to get awareness of different issues which make impact on human lives and enhance their skill sets to improve their employability. List of audit courses offered in each semester is provided in curriculum. Student can choose one audit course from the list. Evaluation of audit course will be done at institute level. Method of conduction and method of assessment for audit courses is suggested.

The student registered for audit course shall be awarded the grade AP and shall be included such grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory in-semester performance and secured a passing grade in that audit course. No grade points are associated with this 'AP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA. Evaluation of audit course will be done at institute level itself.

(Ref-http://www.unipune.ac.in/Syllabi_PDF/revised-2015/engineering/UG_RULE_REGULATIONS_FOR_CREDIT_SYSTEM-2015_18June.pdf)

Guidelines for Conduction and Assessment (Any one or more of following but not limited to)

- Lectures/ Guest Lectures
- Visits (Social/Field) and reports
- Demonstrations
- Surveys
- Mini Project
- Hands on experience on specific focused topic

Guidelines for Assessment (Any one or more of following but not limited to)

- Written Test
- Demonstrations/ Practical Test
- Presentations
- IPR/Publication
- Report

List of courses under Audit Course1

Course Code	**Audit Course Title**
202054 A	Road Safety
202054 B	Innovations in engineering field / Agriculture
202054 C	Value Education

The detail course contents of above mentioned audit courses are available in Mechanical Engineering 2015 course syllabus. Moreover students can opt for any other audit course from the list of Audit Course1 of any branch of engineering.

SEMESTER-I

207002: Engineering Mathematics III (Mechanical + SW / Production + SW / Industrial /Automobile Engineering)

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Lectures: 4 Hrs./Week	**Theory:** 04	**Ins-Sem:** 50 Marks
Tutorials: 1 Hr./Week	**Tutorial:** 01	**End-Sem:** 50 Marks
		Term work: 25 Marks

Prerequisites: - Differential and Integral Calculus, Taylor series and Infinite series, Differential equations of first order and first degree, Fourier series, Measures of central tendency and dispersion, Vector algebra

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of mathematical principles related to:

1. Ordinary and partial differential equations applied to Mechanical engineering problems such as mechanical vibrations and heat transfer.
2. Integral Transform techniques such as Laplace transform, Fourier transform and applications to ordinary and partial differential equations in Vibration theory, Fluid dynamics, Heat transfer and Thermodynamics.
3. Statistical methods such as correlation, regression analysis and probability theory in analyzing and interpreting experimental data applicable to Reliability engineering
4. Vector differentiation and integration applied to problems in Fluid Mechanics.

Course Outcomes:

At the end of this course, students will be able to:

1) Solve higher order linear differential equations and apply to modeling and analyzing mass spring systems.

2) Apply Laplace transform and Fourier transform techniques to solve differential equations involved in Vibration theory, Heat transfer and related engineering applications.

3) Apply statistical methods like correlation, regression analysis in analyzing, interpreting experimental data and probability theory in testing and quality control.

4) Perform vector differentiation and integration, analyze the vector fields and apply to fluid flow problems.
5) Solve various partial differential equations such as wave equation, one and two dimensional heat flow equations.

Unit I: Linear Differential Equations (LDE) and Applications (09 Hours)

LDE of nth order with constant coefficients, Method of variation of parameters, Cauchy's & Legendre's DE, Simultaneous & Symmetric simultaneous DE. Modeling of mass-spring systems, free and forced damped and undamped systems.

Unit II: Transforms (09 Hours)

Laplace Transform **(LT):** LT of standard functions, properties and theorems, Inverse LT, Application of LT to solve LDE.

Fourier Transform **(FT):** Fourier integral theorem, Fourier transform, Fourier Sine & Cosine transform, Inverse Fourier Transforms.

Unit III: Statistics and Probability (09 Hours)

Measure of central tendency, Standard deviation, Coefficient of variation, Moments, Skewness and Kurtosis, Correlation and Regression, Probability, Probability distributions: Binomial, Poisson and Normal distributions, Population and sample, Sampling distributions, t-distribution, Chi-square distribution.

Unit IV: Vector Differential Calculus (09 Hours)

Physical interpretation of Vector differentiation, Vector differential operator, Gradient, Divergence and Curl, Directional derivative, Solenoidal, Irrotational and Conservative fields, Scalar potential, Vector identities.

Unit V: Vector Integral Calculus and Applications (09 Hours)

Line, Surface and Volume integrals, Work-done, Green's Lemma, Gauss's Divergence theorem, Stoke's theorem. Applications to problems in Fluid Mechanics, Continuity equations, Streamlines, Equations of motion, Bernoulli's equation.

Unit VI: Applications of Partial Differential Equations (PDE) (09 Hours)

Basic concepts, modeling of Vibrating String, Wave equation, one and two dimensional Heat flow equations, method of separation of variables, use of Fourier series. Solution of Heat equation by Fourier Transforms, Two-dimensional wave equation.

Text Books:

1. Advanced Engineering Mathematics, 9e, by Erwin Kreyszig (Wiley India).
2. Advanced Engineering Mathematics, 7e, by Peter V. O'Neil (Cengage Learning).

Reference Books:

1. Advanced Engineering Mathematics, 2e, by M. D. Greenberg (Pearson Education).
2. Advanced Engineering Mathematics, Wylie C.R. & Barrett L.C. (McGraw-Hill, Inc.)
3. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi).
4. Applied Mathematics (Volumes I and II) by P. N. Wartikar & J. N. Wartikar (Pune Vidyarthi Griha Prakashan, Pune).
5. Higher Engineering Mathematics by B.V. Ramana (Tata McGraw-Hill).
6. Advanced Engineering Mathematics with MATLAB, 2e, by Thomas L. Harman, James Dabney and Norman Richert (Brooks/Cole, Thomson Learning).

Guidelines for Tutorial and Term Work:

i) Tutorial shall be engaged in four batches (batch size of 20 students maximum) per division.
ii) Term work shall be based on continuous assessment of six assignments (one per each unit) and performance in internal tests.

202041: Manufacturing Process- I

Teaching Scheme:		Credits	Examination Scheme:	
TH:	03 Hrs/week	Th: 03	In-Sem:	50
		Tut:--	End-Sem:	50
PR:	02 Hrs/week	PR/OR/TW: 01	PR:	--
			OR:	--
			TW:	50

Course Objectives:

- To make acquaintance of foundry processes pattern making and casting
- To study metal forming processes such forging, rolling, extrusion and wire drawing.
- To make study of different plastic molding processes
- To study metal joining processes
- To design and development of product with Sheet metal working process
- Introduction to center lathe

Course Outcomes:

On completion of the course, learner will be able to–

- Understand and analyze foundry practices like pattern making, mold making, Core making and Inspection of defects.
- Understand and analyze Hot and Cold Working, Rolling, Forging, Extrusion and Drawing Processes.
- Understand different plastic molding processes, Extrusion of Plastic and Thermoforming
- Understand different Welding and joining processes and its defects
- Understand, Design and Analyze different sheet metal working processes
- Understand the constructional details and Working of Centre Lathe

Course Contents

Unit I Casting Processes: (9 Hrs)

SAND CASTING – Pattern- types, material and allowances, Molding sand- types, properties and testing, Molding – types, equipment's, tools and machines, Core – types and manufacturing, Gating system and Riser – types and design (Numerical), Heating and pouring, cooling and solidification- process and time estimation (Numerical), Cleaning and Finishing, Defects and remedies, Inspection techniques. Die casting, Investment casting, Centrifugal Casting, Continuous Casting- Types, equipment, process parameters, material to cast.

Unit II Metal Forming Processes: (8 Hrs)

Hot and Cold Working – Concepts and comparative study, Material behavior in metal forming, strain rate sensitivity, friction and lubrication in metal forming Rolling – Types of rolling mills, flat rolling analysis, power required per roll for simple single pass two rollers. (Simple Numerical) Forging – Types, process parameter, Analysis of open die forging (Numerical) Extrusion – Types, process parameter, Extrusion dies, Shape factor (Numerical), Drawing – Wire drawing and its analysis (Numerical), tube drawing

Unit III Plastic Processing: (6Hrs)

Molding – Compression molding, Transfer molding, Blow molding, Injection molding – Process and equipment. Extrusion of Plastic – Type of extruder, extrusion of film, pipe, cable and sheet Thermoforming – Principle, pressure forming and vacuum forming

Unit IV Joining Processes: (6Hrs)

Surface preparation and types of joints. Welding Classification Arc welding – Theory, SMAW, GTAW, FCAW, Submerged arc welding, Stud welding. Resistance welding – Theory, Spot, seam and projection weld process. Gas welding. Soldering, brazing and braze welding. Joint through Adhesive – classification of adhesive, types of adhesive, applications. Weld inspection, Defects in various joints and their remedies.

Unit V Sheet Metal Working: (7Hrs)

Types of sheet metal operations, Types of dies and punches, material for dies and punches, Die design for Progressive and Drawing Die, clearance analysis, center of pressure, blank size determination (Numerical), strip layout, sheet utilization ratio (Numerical), method of reducing forces

Unit VI Centre lathe: (7Hrs)

Introduction to centre lathe, types of lathe, construction and working of lathe, attachments and accessories, various operations on lathe, taper turning and thread cutting methods (numerical), machining time calculation (numerical)

Books:

Text

1. Hajara Choudhari, Bose S.K. – Elements of workshop Technology Vol. I &II , Asian Publishing House
2. D. K. Singh – Fundamentals of Manufacturing Engineering – Ane's Books. Pvt. Ltd.

Reference:

1. B. Ravi – Metal Casting – Computer Aided design and analysis- Prentice Hall of India
2. Reikher – Casting: An analytical approach – Springer
3. Wang – Rapid tooling guidelines for sand casting – Springer
2. J. T. Black – Degormos Materials and process in manufacturing – John Willey and sons
3. M.P Grover – Fundamentals of modern manufacturing: Materials and systems
4. A.S Athalye – Processing of plastic – Colour Publication (Pvt.)Ltd. U.K
5. Cryil Donaldson and George H LeCain – Tool Design – Tata McGraw Hill Education Pvt. Ltd.
6. Dr. R. S. Parmar, Welding Processes And Technology, Khanna Publishers, New Delhi.

Lab Assignments

1. Manufacturing of any one assembly consisting of minimum two components and involving all the lathe operations
2. Demonstration of Sand Moulding Processes
3. Job on TIG/ MIG/ Resistance welding

Guidelines for Term Work assessment

Each student must complete and submit following Term Work

i) Assgmenyt-1 and assignment-3 w.r.t. above mentioned laboratory assignments

ii) Journal consisting of following write-ups:

a) Study of casting processes

b) Study of plasting moulding processes

c) Study of welding processes

d) Study of centre lathe and single point cutting tool geometry

202042: Computer Aided Machine Drawing

Teaching Scheme:	Credits	Examination Scheme:		
TH: 01 hr/week	Th:01	TH	In-Sem:	50
			End-Sem:	50
PR: 02 hrs/week	PR/OR/TW:01		PR:	50
			OR:	--
			TW:	--

Prerequisites: -

1. Fundamentals Engineering Drawing
2. Projection of Solids
3. Basic knowledge of 2-D drafting using graphics software

Course Objectives:

- To understand Parametric Modeling Fundamentals, Procedure, and "Shape before Size" Approach.
- To develop an ability to Create Parametric 2-D Sketches, and Create and Edit Parametric Dimensions.
- To develop an ability to Create Solid Models of machine components. The student should be able to apply these skills to the solution of a variety of practical problems and be able to employ their knowledge to solve more complicated problems.
- To develop an ability to Create assembly models of simple machine (minimum 5 components). The student should be prepared to continue the study of computer aided machine drawing through further subjects/projects in further years of engineering.
- To develop the ability to apply Limits, Fits, and Dimensional Tolerances, as well as Geometric Tolerances to components and assemblies on Engineering Drawings.
- To develop an ability to create 2D drawings from 3D models

Course Outcomes:

On completion of the course, learner will be able to–

- Understand the importance of CAD in the light of allied technologies such as CAM, CAE, FEA, CFD, PLM.
- Understand the significance of parametric technology and its application in 2D sketching.
- Understand the significance of parametric feature-based modeling and its application in 3D machine components modeling.
- Ability to create 3D assemblies that represent static or dynamic Mechanical Systems.
- Ability to ensure manufacturability and proper assembly of components and assemblies.
- Ability to communicate between Design and Manufacturing using 2D drawings.

Course Contents

Unit I Introduction (2 Hrs)
Introduction – evolution of CAD, importance of CAD in the light of allied technologies, solid modeling, introduction to Graphical User Interface (GUI) of any commercially used solid modeling software

Unit II Parametric Sketching (2 Hrs)
Parametric sketching - draw and modify 2D entities, apply/modify constraints and dimensions

Unit III Parametric Solid Modelling (2 Hrs)
Parametric solid modeling - fundamentals, transform the parametric 2-D sketch into a 3D solid, feature operations, Free form feature modeling, design by features, feature recognition.

Unit IV Assembly Modelling (2 Hrs)
Assembly modeling - defining relationship between various parts of machine, creation of constraints, generation of exploded view

Unit V Geometric Dimensioning and Tolerancing (2 Hrs)
Geometric dimensioning and tolerancing - Limits, Fits, Dimensional Tolerances, Geometric Tolerances, Introduction to ASME Y14.5 – 2009

Unit VI Production Drawing (2 Hrs)
Production drawing – generation of 2-D sketches from parts and assembly 3-D model, appropriate dimensioning and tolerancing

Books:

Text Books:

1. Bhat N. D., "Machine Drawing", Charotar Publications, New Delhi 2014
2. Ajeet Siingh, " Machine Drawing", Mc Graw Hill Publications, New Delhi 2012
3. ASME Y14.5 -2009, ASME, 2009

Lab Work:

1. Assignment on 2-D sketching with geometrical and dimensional constraints (2 hrs.)
2. Assignment on parametric solid modeling of a machine component (4 hrs.)
3. Assignment on solid modeling of the parts of a machine (min. 5 components) (10 hrs.)
4. Assignment on assembly modeling of the parts modeled in assignment 3 using proper mating conditions and generation of exploded view. (4 hrs.)
5. Generation of production drawings of the parts and assembly with appropriate tolerancing. (4 hrs.)

2043: Thermodynamics

Teaching Scheme:	Credits	Examination Scheme:		
TH: 04 Hr/week	Th:04	TH	In-Sem:	50
			End-Sem:	50
PR: 02 Hrs/week	PR/OR/TW:01		PR:	--
			OR:	50
			TW:	--

Prerequisites: -

1. Engg. Mathematics
2. Engg. Physics/Chemistry
3. Fundamental Concepts and laws of Thermodynamics.

Course Objectives:

- Identify and use units and notations in Thermodynamics.
- State and illustrate first and second laws of Thermodynamics.
- Explain the concepts of entropy, enthalpy, reversibility and irreversibility.
- Apply the first and second laws of Thermodynamics to various gas processes and cycles.
- To get conversant with properties of steam, dryness fraction measurement, vapor processes and Thermodynamic vapor cycles, performance estimation.
- To get conversant with Psychrometric Charts, Psychrometric processes, human comfort conditions.

Course Outcomes:

- On completion of the course, learner will be able to–
- Apply various laws of thermodynamics to various processes and real systems.
- Apply the concept of Entropy, Calculate heat, work and other important thermodynamic properties for various ideal gas processes.
- Estimate performance of various Thermodynamic gas power cycles and gas refrigeration cycle and availability in each case.
- Estimate the condition of steam and performance of vapour power cycle and vapour compression cycle.
- Estimate Stoichiometric air required for combustion, performance of steam generators and natural draught requirements in boiler plants.
- Use Psychromertic charts and estimate various essential properties related to Psychrometry and processes

Course Contents

Unit I Laws of thermodynamics (6 Hrs)
Introduction of thermodynamics, Review of basic definitions, Zeroth law of thermodynamics, Macro and Microscopic Approach, State Postulate, State, Process and Thermodynamic Cycles, First law of thermodynamics, Joules experiment, Applications of first law to flow and non flow processes and cycles. Steady flow energy equation and its application to different devices. Equivalence of Clausius and Kelvin Planck Statement, PMM I and II, Concept of Reversibility and Irreversibility.

Unit II Entropy (4 Hrs)
Entropy as a property, Clausius inequality, Principle of increase of Entropy, Change of entropy for an ideal gas and pure substance.

Ideal Gas (6 Hrs)
Ideal Gas definition Gas Laws: Boyle's law, Charle's law, Avagadro's Law, Equation of State, Ideal Gas constant and Universal Gas constant, Ideal gas processes- on P-V and T-S diagrams Constant Pressure, Constant Volume, Isothermal, Adiabatic, Polytropic, Throttling Processes, Calculations of heat transfer, work done, internal energy. Change in entropy, enthalpy.

Unit III Thermodynamic cycles (6 Hrs)
Gas Power Cycles: Air Standard Cycle, Efficiency and Mean Effective Pressure, Carnot Cycle, Otto Cycle, Diesel cycle, Dual cycle, Comparison of cycles, Brayton cycle, **Gas Refrigeration Cycle:** Reversed Carnot, Bell Coleman Cycle.

Availability (4 Hrs)
Available and unavailable energy, concept of availability, availability of heat source at constant temperature and variable temperature, Availability of non flow and steady flow systems, Helmholtz and Gibbs function, irreversibility and second law efficiency.

Unit IV Properties of Pure substances (5 Hrs)
Formation of steam, Phase changes, Properties of steam, Use of Steam Tables, Study of P-v, T-s and Mollier diagram for steam, Dryness fraction and its determination, Study of steam calorimeters (Barrel, Separating, Throttling and combined)
Non-flow and Steady flow vapour processes, Change of properties, Work and heat transfer.

Thermodynamic Vapour Cycle (5 Hrs)
Vapour Power Cycles: Carnot cycle, Rankine cycle, Comparison of Carnot cycle and Rankine cycle, Efficiency of Rankine cycle, Relative efficiency, Effect of superheat, boiler and condenser pressure on performance of Rankine cycle, **Vapour Refrigeration Cycles:** Reversed Carnot Vapor Cycle, Vapor Compression Cycle and representation of cycle on P-h and T-s diagram, Refrigerating effect, Compressor power and COP estimation **(Numerical treatment using R134a only and enthalpy Cp, Cv data should be provided in tabulated form).**

Unit V Steam Generators (6 Hrs)

Introduction to fuels, Theoretical amount of Oxygen / Air required for combustion. Stoichiometric Air: Fuel ratio, Excess air, lean and rich mixtures, Stoichiometric A: F ratio for petrol **(No Numerical Treatment on fuels and combustion, only basic definitions and terminologies to be covered)**.

Classification, Constructional details of low pressure boilers, Features of high pressure (power) boilers, Introduction to IBR, Boiler performance calculations-Equivalent evaporation, Boiler efficiency Energy balance, Boiler draught (natural draught numerical only).

Unit VI Psychrometry (6 Hrs)

Psychrometry and Psychrometric Properties, Basic Terminologies, Psychrometric Relations, Psychrometric Chart, Psychrometric Processes, Thermodynamics of Human Body, Comfort Conditions **(Numerical treatment using Psychrometric chart only).**

Books:

Text:

1. R. K. Rajput, Engineering Thermodynamics, EVSS Thermo Laxmi Publications
2. P. K. Nag, Engineering Thermodynamics, Tata McGraw Hill Publications
3.

Reference:

1. Y. Cengel & Boles: Thermodynamics – An Engineering Approach,
2. P. L Ballany: Thermal Engineering, Khanna Publishers
3. C.P. Arora: Engineering Thermodynamics, Tata McGraw Hill.
4. S. Domkundwar, C. P. Kothandaraman, Anand Domkundwar, Thermal Engineering, Dhanpat Rai Publishers.

List of Practical's:

1. Joule's experiment to validate first law of thermodynamics.
2. Determination of Cp and Cv for Ideal gas.
3. Performance estimation of Air standard cycle using standard simulation software's (MATLAB, VC++ etc.).
4. Determination of dryness fraction of steam (At least two Calorimeters).
5. Experiment to Calculate COP of Simple Vapor Compression Cycle (VCC).
6. Performance estimation of VCC using any professional software (CoolPack etc.)
7. Study of Boiler Mountings.
8. Study of Boiler Accessories.
9. Trial on boiler to determine boiler efficiency, equivalent evaporation and Energy Balance.
10. Industrial visit to any process industry which uses boiler and submission of detailed report.
11. Demonstration of Psychrometric processes (At least four).

Notes:

1. Minimum 8 experiments should be performed.
2. Experiment No. 9 and 10 are compulsory.

202044: Material Science

Teaching Scheme:	**Credits**	**Examination Scheme:**		
TH: 03 Hrs/week	**Theory: 03**	**TH**	**In-Sem:**	**50**
			End-Sem:	**50**
TUT: 01 Hr/week	**Tutorial: 01**		**PR:**	**50**
			OR:	**--**
			TW:	**25**

Course Objectives:

- To acquaint students with the basic concepts and properties of Material Science
- To impart a fundamental knowledge of Materials Processing
- Selection and application of different Metals & Alloys
- To understand the structure of Engineering Materials
- To develop futuristic insight into Materials

Course Outcomes:
On completion of the course, learner will be able to–

- Understand the basic concepts and properties of Material.
- Understand about material fundamental and processing.
- Select proper metal, alloys, nonmetal and powder metallurgical component for specific requirement
- Detect the defects in crystal and its effect on crystal properties.
- Evaluate the different properties of material by studying different test
- Recognize how metals can be strengthened by cold-working and hot working

Course Contents

Unit I Structure of Metals & Materials. **(6 Hrs)**

Basic concepts of Crystal structures, Types of crystal systems , Crystal structure of metals(BCC, FCC and HCP systems), ceramics & molecular arrangement of polymers , Miller indices , indexing of lattice planes & directions, Lattice parameters (coordination number, no. of atoms per unit cell, atomic packing factor, density)

Unit II Mechanical Behaviors of Metal & Materials (6 Hrs)

Introduction to Crystal imperfections & Classification , Crystal imperfections : point defects, line defects- edge and screw dislocations, surface defects, volume defects, Mechanism of Elastic & plastic deformation (slip and twinning) ,Theory of dislocation , deformation of single crystal by slip, plastic deformation of polycrystalline materials, work hardening theory, Changes in properties due to cold working & hot working.

Unit III Destructive & Non-destructive Testing (8 Hrs)

Study of destructive testing, Tensile test, engineering stress-strain curve, true stress-strain curve, types of stress-strain curves, Numerical based on Evolution of properties, compression test, different hardness tests-Vickers, Rockwell, Brinnel, Poldi, Micro Hardness Test, Durometers, Impact test, fatigue test, creep test, Erichsen Cupping Test.

Non Destructive testing: Principals & procedure, advantages, disadvantages and Industrial applications of NDT, such as Visual Inspection ,Liquid /dye penetrate test, Magnaflux test, Eddy current test, Sonic & Ultrasonic testing and Radiography testing.

Unit IV Metals Corrosion & Its Prevention (4 Hrs)

Classification of corrosion : Dry corrosion & wet corrosion, Mechanism of corrosion ,Types of corrosion : Pitting corrosion, stress corrosion , season cracking, cavitation corrosion, caustic embrittlement , intergranular corrosion , crevice corrosion , erosion corrosion, uniform corrosion, galvanic corrosion,

Corrosion prevention methods : classification of different methods, e,g, inhibitors, cathodic & anodic protection, internal & external coatings,
Low & High temperature corrosion. Design against corrosion.

Unit V Surface Modification Methods. (6 Hrs)

Importance of surface modification, classification of different methods & factors affecting : electroplating , PVD , CVD ,IVD, powder coating, shot blasting, ion implantation, plasma nitriding , anodizing, Surface preparation before coating & coating defects.

Unit VI Powder Metallurgical Technology (6 Hrs)

Basic steps of powder metallurgy process, classification & methods of powder manufacturing, characteristics of metal powders, Conditioning of metal powders (Screening, Blending & mixing, annealing), Compaction techniques (cold compaction, hot compaction, Isostatic compaction & powder rolling) , mechanism & importance of sintering , Pre-sintering & sintering secondary operations

Advantages, limitations and applications of powder metallurgy. Production of typical P/M components (with flow charts), self lubricated bearing, cemented carbides, cermets, refractory metals, electrical contact materials, friction materials, and diamond impregnated tools, friction plate, clutch plate, commutator brushes.

Books:

Text:

1. Kodgire V. D. “Material Science and Metallurgy”
2. “Material Science & Engg.” Raghvan V., Prentice Hall of India , New Delhi. 2003

Reference:

1. Science of Engineering Materials, Smith, Prentice-Hall
2. Materials Science and Engineering, Callister W. D., John Wiley
3. “Engineering Metallurgy”, Higgins R. A., Viva books Pvt. Ltd., 2004.
4. Introduction to Physical Metallurgy, Avner, S.H., Tata McGraw-Hill, 1997.
5. Mechanical Metallurgy, Dieter, G.E., McGraw-Hill, 1988.

List of Tutorials

1. Numerical based on Indexing, Atomic packing factor, Density.
2. Study and Trial of Tensile Test & numerical based on Tensile test.
3. Study of Compression Test
4. Study and Trial of Rockwell Hardness Test & Hardness conversion number.
5. Study of Ultra Sonic Test.
6. Vickers Hardness Test.
7. Brinell Hardness Test
8. Poldi Hardness Test
9. Magnetic Particle Test.
10. Dye Penetrant Test.
11. Impact Test.
12. Study of Self lubricated Bearings / Cemented carbide tips ,in Powder Metallurgy

Note : Out of above Twelve Tutorials , any Eight Tutorials should be conducted .

202051: Strength of Materials

Teaching Scheme:		Credits	Examination Scheme:		
TH:	04 hr/week	Th:04	TH	In-Sem:	50
				End-Sem:	50
PR:	02 hrs/week	PR/OR/TW:01		PR:	--
				OR:	50
				TW:	--

Prerequisites: -

1. Fundamentals of engineering mechanics
2. Analysis of forces and moments
3. Laws of motion, kinetics, kinematics
4. Algebra and trigonometry

Course Objectives:
To understand

- Mechanical behavior of the body by determining the stresses, strains and deflections produced by the loads up to the elastic limit.
- Fundamental concepts related to deformation, strain energy, moment of inertia, load carrying capacity, slope an deflection of beams, shear forces, bending moments, torsional moments, column and struts, principal stresses and strains and theories of failure

Course Outcomes:
Student should be able to

- Apply knowledge of mathematics, science for engineering applications
- Design and conduct experiments, as well as to analyze and interpret data
- Design a component to meet desired needs within realistic constraints of health and safety
- Identify, formulate, and solve engineering problems
- Practice professional and ethical responsibility
- Use the techniques, skills, and modern engineering tools necessary for engineering practice

Course Contents

Unit I Simple stresses and strains	**(8 Hrs)**

Stress, strain, Hooke's law, Poisson's ratio, Modulus of Elasticity, Modulus of Rigidity, Bulk Modulus. Interrelation between elastic constants,
Stress-strain diagram for ductile and brittle materials, factor of safety.
Stresses and strains in determinate and indeterminate, homogeneous and composite bars under concentrated loads and self weight.
Temperature stresses in simple members.

Unit II Shear Force and Bending Moment Diagrams **(8 Hrs)**

Shear force and bending moment diagrams for statically determinate beam due to concentrated load, uniformly distributed load, uniformly varying load and couple, Relationship between rate of loading, shear force and bending moment.
Maximum bending moment and position of points of contra flexure.

Unit III Stresses in Machine Elements **(8 Hrs)**

Bending stresses : Theory of simple bending, assumptions, derivation of flexural formula, second moment of area of common cross sections (rectangular, I,T,C) with respect to centroidal and parallel axes, bending stress distribution diagrams, moment of resistance and section modulus.
Shear stresses: Concept, derivation of shear stress distribution formula, shear stress distribution diagrams for common symmetrical sections, maximum and average shears stresses, shear connection between flange and web.

Unit IV **(8 Hrs)**

Slope and deflection of beams: Relation between bending moment and slope, slope and deflection of determinate beams, double integration method (Macaulay's method), derivation of formula for slope and deflection for standard cases.
Strain energy: Strain energy due to axial load (gradual, sudden and impact), strain energy due to bending and torsion.

Unit V **(8 Hrs)**

Torsion: Stresses, strain and deformations in determinate shafts of solid and hollow, homogeneous and composite circular cross section subjected to twisting moment, derivation of torsion equation, stresses due to combined torsion, bending and axial force on shafts.
Buckling of columns: Concept of buckling of columns, derivation of Euler's formula for buckling load for column with hinged ends, concept of equivalent length for various end conditions, limitations of Euler's formula, Rankine's formula, safe load on columns

Unit VI **(8 Hrs)**

Principal stresses and strains: Normal and shear stresses on any oblique plane. Concept of principal planes, derivation of expression for principal stresses and maximum shear stress, position of principal planes and planes of maximum shear.

Graphical solution using Mohr's circle of stresses. Principal stresses in shaft subjected to torsion, bending moment and axial thrust (solid as well as hollow),

Concept of equivalent torsional and bending moments.

Theories of elastic failure: Maximum principal stress theory, maximum shear stress theory, maximum distortion energy theory – their applications and limitations.

Books:

Text:

1. G. H. Ryder- Strength of Materials- 3rd Edition, Macmillan Pub, India
2. S.S. Rattan - Strength of Material – Tata McGraw Hill Publication Co. Ltd. S.
3. Ramamurtham - Strength of material - Dhanpat Rai Publication.
4. Timoshenko and Young - Strength of Materials - CBS Publication

Reference:

1. Beer and Johnston - Strength of materials - CBS Publication.
2. E.P. Popov - Introduction to Mechanics of Solids - Prentice Hall Publication.
3. Singer and Pytel - Strength of materials - Harper and row Publication.
4. B.K. Sarkar - Strength of Material - Tata McGraw Hill New Delhi.

List of Practicals:
(Any 6 out of 1 to 8 and any 2 out of 9 to 11)

1. Tension test for aluminum alloy and mild steel using extensometer.
2. Tension test for brass using extensometer
3. Shear test of ductile material on Universal Testing Machine.
4. Experimental verification of flexural formula in bending for cantilever beam.
5. Experimental verification of flexural formula in bending for simply supported beam.
6. Measurement of stresses and strains in beams for different end conditions using strain gauges.
7. Experimental verification of torsion formula for circular bar.
8. Experimental verification of von Mises theory of failure.
   Graphical simulation of - (using suitable software like MD-Solids, Matlab, MS-Excel etc.)
9. Shear force and bending moment diagrams with different end conditions.
10. Slope and deflection.
11. Principal stresses through graphical and analytical method.

202054: Value Education

Teaching Scheme:	Credits	Examination Scheme:		
TH: --	Tut:01	TH	In-Sem:	--
			End-Sem:	--
Tutorial: 01 hr/ week	TW:--		PR:	--
			OR:	--
			TW:	25

Course Objectives:

- To enable the students to understand meaning of values and select their goals by self-investigation based on personal values.
- To enable the students to understand value of truth, commitments, honesty, sacrifice, care, unity, team work and relationship.
- To educate and make the young generation students aware of their social responsibilities.
- To increase awareness among students about environment and create attitude towards sustainable lifestyle.

Course Outcomes:

On completion of the course, learner will be able to–

- Understood human values, their significance and role in life.
- Promote self-reflection and critical inquiry that foster critical thinking of one's value and the values of others.
- Practice respect for human rights and democratic principles.
- Familiarized with various living and non-living organisms and their interaction with environment.
- Understood the basics regarding the leadership and to become a conscious professional.

Course Contents

UNIT 1: Introduction of Value Education (2 Hrs)

Value Education: Definition, Need, Content, Process and relevance to present day. Concept of Human Values, self introspection.

UNIT 2: Salient values for life (2 Hrs)

Truth, commitment, honesty and integrity, forgiveness and love, empathy and ability to sacrifice, care, unity, punctuality, Interpersonal and Intra personal relationship, Team work , Positive and creative thinking.

UNIT 3: Human Rights **(2 Hrs)**

Universal Declaration of Human Rights, Right to Information Act -2005, National Integration, Peace and non-violence, Dr. A P J Kalam's ten points for enlightened Citizenship. The role of media in value building.

UNIT 4: Environment and Ecology **(2 Hrs)**

Ecological balance, interdependence of all beings – living and non-living. Man and nature, Environment conservation and enrichment...

UNIT 5: Social values & Ethical values **(2 Hrs)**

Social values - Social consciousness and responsibility, Consumer rights and responsibilities.

Ethical values - Professional ethics, Code of ethics of engineers, Influence of ethics on family life, Leadership qualities and Personality development.

Books:

Text:

1. Dr. N. Venkataiah, "Value Education", APH Publishing Corporation, 2007
2. M. Govindarajan, S. Natarajan, V. S. Senthil Kumar, "Professional Ethics & Human Values", PHI Learning Press, 2013.

References:

1. Chakravarthy S. K., "Values and ethics for Organizations: Theory and Practice", Oxford University Press, New Delhi, 1999.
2. Man Singh Das, Vijay Kumar Gupta, "Social values among young adults: A changing scenario", MD Publications Pvt. Ltd, 1995.
3. Ram Ahuja, "Social Problems in India", Rawat Publications, 2012.
4. Leah Levin, "HUMAN RIGHTS Questions and Answers", UNESCO Publishing, 2012.
5. P D Sharma, Ecology and Environment, Rastogi publications, 2005.
6. Kalam A P J, Arun Tiwari, "Wings of Fire", University Press Publications, 2003.
7. http://www.ncert.nic.in/recent/env_edu.html
8. http://www.unipune.ac.in/pdf_files/Final%20Book_03042012.pdf
9. https://engineering.purdue.edu/MSE/Academics/Undergrad/ethics.pdf

Term Work shall consist of following assignments:

1. Introduce yourself in detail. What are the goals in your life? How do you set your goals in your life? What have been your achievements and shortcomings in your life? (Observe and analyze by student themselves and write outcome.)
2. Visit to Non Governmental Organizations (NGO), charitable trusts working for welfare of people in society and submit visit report.
3. (a) Presentation given by Teacher in the class on the Dr. A P J Kalam’s ten points for enlightened Citizenship.

   (b) Conduct Guest Lecturer on: The role of media in value building and Right to Information Act - 2005 - a Tool for Good Governance. (Make report on seminars outcome)
4. Arrange a **Group Discussion** on topics:
   Energy and natural resource depletion, Environmental pollution, Global warming, Ozone depletion, Deforestation, Soil degradation, Drought, Water harvesting etc. Make a report on outcomes.
   (Each batch is divided into two groups of 12 to 14 students each. Two rounds of a GD for each group should be conducted and teacher should give them feedback. Write outcomes.)
5. Make Report on Code of ethics for engineers, Consumer rights and responsibilities and report conclude with role of Value, value Education and its relevance in present days.

202054 A: Innovations in Engineering Field/ Agriculture

Prerequisites:

1. Knowledge of Mathematics, Physics, and Chemistry is necessary.
2. Out of box/ unconventional thinking for solving typical problems.
3. Adapting analytical tools traditionally.
4. Application oriented thinking of learnt topics

Course Objectives:

- To develop holistically built thinking habit needed for innovative ideas.
- To make students aware about key field of agriculture contributing to sustenance and development of a mankind.
- To expose students to their roles and responsibilities of building a nation through engineering insights in agriculture
- To be updated with innovations and technological advancements in respective fields of engineering.

Course Outcomes:

On completion of the course, learner will be able to -

- Understand what is thinking, its tools and process and its application to innovation
- Practice application of innovation in engineering
- Understand important terms like national productivity, sustainable development and inclusive growth
- Throw a light on developing technologies in agriculture
- Learn Interdisciplinary Engineering applications in Agriculture

Course Contents

Unit I: Thinking and thinking process (2 Hrs)

Thinking and thinking tools: Thinking, Types of thinking, Top-Down (Analysis) & Bottom-Up (Synthesis) thinking and combination of both, Judgement and Creativity, Concept Maps-Connecting the ideas, Generating ideas. Communicating ideas. Systems thinking and beyond. Critical thinking. Definition of innovation. Example of application of thinking process to any one practical innovation.

Unit II: Engineering Innovation and its scope (2 Hrs)

Incremental, radical and disruptive Innovation. Scope of innovation: Product innovation, Process innovation, Position innovation, Paradigm innovation. Innovation within the engineering profession. Awareness about latest technological advancements.

Unit III: Agriculture and innovation (2 Hrs)

Definition of agriculture? Role of Agriculture in our life and in national productivity. Concept of sustainable development and inclusive growth. India's urban awakening. Innovation in agriculture and its types. Importance of agriculture innovation.

Unit IV: Developing technologies in agriculture (2 Hrs)

Favorable conditions for Agriculture innovation. Dynamics of Innovation System. Role and responsibility of Engineers in agricultural innovations and making India the net exporter of major agricultural produces. FINOvation Awards. Ideas on developing technologies in agriculture viz. Vehicle automation, Engine emissions technology, Fire suppression technology etc. The future of robotics on farms.

Unit V: Interdisciplinary Engineering in Agriculture (2 Hrs)

Technological innovations that are revolutionizing Indian agriculture. Case study presenting Interdisciplinary Engineering application in Agriculture.

Books:

Text:

1. Kasser, J., E., 2015. Holistic Thinking: Creating Innovative Solutions to Complex Problems: Volume 1 (Solution Engineering). Create Space Independent Publishing Platform; 2 edition.
2. Wenwu Zhang, 2011. Intelligent Energy Field Manufacturing: Interdisciplinary Process Innovations. CRC Press, Taylor & Francis Group.
3. Educating engineers to drive the innovation economy, 2012. Publisher: The Royal Academy of Engineering, London.

Reference:

1. Crowder, J., A., Carbone, J., N., Demijohn, R., 2016. Multidisciplinary Systems Engineering: Architecting the Design Process. Springer Publishing.
2. India's urban awakening: Building inclusive cities, sustaining economic growth, 2010. Mckinsey Global Institute report.

List of Tutorials/Assignments:

1. What is ‘thinking?’ What are different tools of thinking? Write a note on Analysis and Synthesis and combination of both. Give any one example of application of thinking process to a practical innovation.
2. What are the types of innovations? What is its scope? Write a note on Innovation within engineering. State and explain 10 engineering innovations took place in last year.
3. What is agriculture? Explain its role in our life and in national productivity. What is sustainable development? What is inclusive growth? What is innovation in agriculture? What is importance of agriculture innovation?
4. What is favorable condition for agriculture innovation? Write a note on dynamics of innovation system. Discuss the ideas of developing technologies in agriculture. Write a note on future of robotics in agriculture.
5. State and explain minimum 10 Technological innovations that are revolutionizing Indian agriculture. Discuss any one case study encompassing Interdisciplinary Engineering application in Agriculture

Notes: All above 5 tutorials/ assignments are compulsory

202054 B : Road Safety

Prerequisites:

1. Awareness about traffic rules and road accidents.
2. Understanding the need of studying such topics.
3. Considerations to other, sensitivity and care while travelling/ driving.

Course Objectives:

- To acquire knowledge and understanding of the road environment.
- To inculcate decision making and behavioral skills necessary to survive in the road environment.
- To impart knowledge and understanding of the causes and consequences of accidents.
- To understand roles and responsibilities in ensuring road safety.

Course Outcomes:

On completion of the course, learner will be able to–

- Generate awareness about number of people dyeing every year in road accidents, traffic rules and characteristics of accident.
- Gain information and knowledge about people responsible for accidents and their duties
- Understand the importance of multidisciplinary approach to planning for traffic safety and rehabilitation
- Acquire a certificate of coordination/ participation in compulsory events based on the topic under study

Course Contents

Unit I: Introduction to Road Safety (2 Hrs)

Road traffic accidents scenario in India and in world. Road Safety and its importance. Traffic Rules and Driving Behavior. Characteristics of accidents, accidents vs. crash.

Unit II: Planning for Road safety (2 Hrs)

Awareness about rules and regulations of traffic. Assisting Traffic control authorities. Multidisciplinary approach to planning for traffic safety and injury control. Vulnerable road users: crashes related to pedestrian and bicyclists, their safety, provision for disabled.

Unit III: Responsibility of Road accidents and Safety measures (2 Hrs)

People responsible for accident prevention: Police, Politicians, Community members, Policy makers, Teachers, Parents, Infrastructure authorities, Drivers and Official road safety body. Reasons of students/ children have accidents. 4 E's of Accidents Prevention: 1. Engineering - by altering the environment 2. Enforcement - by imposing laws 3. Encouragement - by the use of publicity campaigns 4. Education - by gaining and using knowledge.

Unit IV: Road Safety Education **(2 Hrs)**

Introduction to Road Safety Education. 5 P's of Road safety education: 1. Pre-school road safety education 2. Practical rather than theory education 3. Principles of own development as regards to road safety education 4. Presentations on road safety education 5. Place for road safety education in syllabus

Unit V: Road Safety Events **(2 Hrs)**

Discussions on efforts done by Government on Road Safety. Celebration of Road Safety week or Workshop on Road Safety week/ Organization of seminar on Road Safety. This is to be entirely organized by students under the mentorship of concerned Head of the Department.

Books:

Text:

4. Kadiyali L.R., Traffic Engineering & Transport Planning, Khanna Publishers, 2003
5. CROWN AGENTS Ref: TEA/A369, 1995. (Unpublished contractors report for Ministry of Transport and Communications, Ghana). Road safety study and the institutional strengthening of the vehicle examination and licensing division.
6. TRRL OVERSEAS UNIT, 1991. Towards safer roads in developing countries: a guide for planners and engineers. Crow Thorne: Transport and Road Research Laboratory.

Reference:

3. Indian Roads Congress, Highway Safety Code, IRC: SP-44:1996
4. Indian Roads Congress, Road Safety Audit Manual, IRC:SP-88-2010

List of Tutorials/ Assignments:

6. Discussion and presentations on: Road traffic accidents scenario in India. Traffic Rules and Driving Behavior. Characteristics of accidents, accidents vs. crash.
7. Discussion and presentations on: Assisting Traffic control authorities, Multidisciplinary approach to planning for traffic safety and injury control. Vulnerable road users: crashes related to pedestrian and bicyclists, their safety, provision for disabled.
8. Discussion and presentations on: People responsible for accident prevention, 4 E's of Accidents Prevention.
9. Introduction to Road Safety Education. 5 P's of Road safety education
10. Organization of One Day seminar/ workshop by students on Road Safety. Participation for every student is compulsory. They are expected to prepare brief report of about 3 to 4 pages of this event.

Notes: All above 5 tutorials/ assignments are compulsory

202054 C: Value Education

Course Contents

UNIT 1: Introduction of Value Education (2 Hrs)

Value Education: Definition, Need, Content, Process and relevance to present day. Concept of Human Values, self introspection.

UNIT 2: Salient values for life (2 Hrs)

Truth, commitment, honesty and integrity, forgiveness and love, empathy and ability to sacrifice, care, unity, punctuality, Interpersonal and Intra personal relationship, Team work , Positive and creative thinking.

UNIT 3: Human Rights (2 Hrs)

Universal Declaration of Human Rights, Right to Information Act -2005, National Integration, Peace and non-violence, Dr. A P J Kalam's ten points for enlightened Citizenship. The role of media in value building.

UNIT 4: Environment and Ecology (2 Hrs)

Ecological balance, interdependence of all beings – living and non-living. Man and nature, Environment conservation and enrichment...

UNIT 5: Social values & Ethical values (2 Hrs)

Social values - Social consciousness and responsibility, Consumer rights and responsibilities.

Ethical values - Professional ethics, Code of ethics of engineers, Influence of ethics on family life, Leadership qualities and Personality development.

Books:

Text:

3. Dr. N. Venkataiah, "Value Education", APH Publishing Corporation, 2007
4. M. Govindarajan, S. Natarajan, V. S. Senthil Kumar, "Professional Ethics & Human Values", PHI Learning Press, 2013.

References:

10. Chakravarthy S. K., "Values and ethics for Organizations: Theory and Practice", Oxford University Press, New Delhi, 1999.
11. Man Singh Das, Vijay Kumar Gupta, "Social values among young adults: A changing scenario", MD Publications Pvt. Ltd, 1995.
12. Ram Ahuja, "Social Problems in India", Rawat Publications, 2012.
13. Leah Levin, "HUMAN RIGHTS Questions and Answers", UNESCO Publishing, 2012.
14. P D Sharma, Ecology and Environment, Rastogi publications, 2005.
15. Kalam A P J, Arun Tiwari, "Wings of Fire", University Press Publications, 2003.
16. http://www.ncert.nic.in/recent/env_edu.html
17. http://www.unipune.ac.in/pdf_files/Final%20Book_03042012.pdf
18. https://engineering.purdue.edu/MSE/Academics/Undergrad/ethics.pdf

SEMESTER-II

202045: Fluid Mechanics

Teaching Scheme:		Credits	Examination Scheme:		
TH:	04 hr/week	Th:04	TH	In-Sem:	50
				End-Sem:	50
PR:	02 hrs/week	PR/OR/TW:01		PR:	50
				OR:	--
				TW:	--

Prerequisites: -

1. Engineering Mathematics
2. Engineering Physics

Course Objectives:

- To understand of various properties of fluids
- To learn fluid statics and dynamics.
- To understand of Boundary layer, Drag, and Lift
- To understand of Bernoulli's equation
- To Know of various applications of Bernoulli's equation

Course Outcomes:

On completion of the course, learner will be able to–

- Use of various properties in solving the problems in fluids
- Use of Bernoulli's equation for solutions in fluids
- Determination of forces drag and lift on immersed bodies

Course Contents

Unit I Fundamentals of Fluid Mechanics (8 Hrs)

Properties of Fluids:- Definition of fluid, concept of continuum, Density, Specific Weight, Specific Gravity, Dynamic Viscosity, Kinematic Viscosity, Newton's law of viscosity, types of fluid, Rheological diagram, Surface Tension, Capillarity, Compressibility, Vapour pressure

Fluid Statics: - Pascal's Law, Pressure at a point, Total Pressure & Centre of pressure for inclined flat plate, Buoyancy, metacenter and floatation.

(No numerical treatment for Buoyancy, metacenter and floatation)

Unit II: Kinematics of Fluid Motion (8 Hrs) Eulerian and langragian approach of fluid flow, total or material derivative for velocity field, Continuity equation, types of flows (One, two, three dimensional, steady unsteady, uniform, non-uniform, laminar, turbulent, compressible, incompressible, rotational, Irrotational) . Visualization of flow field (Stream, Path and Streak line), vorticity in two dimensional flow, stream function and velocity potential function	
Unit III: Fluid Dynamics (8 Hrs) Introduction to flow models- control volume and infinitesimally small element, Linear momentum Equation using differential Approach, Introduction to Navier – Stokes Equation, Euler equation of motion, derivation of Bernoulli's equation along stream line , concept of HGL and THL or TEL, application of Bernoulli's equation to venture meter, Pitot tube, Submerged Orifices, Orifice meter, V-notch	
Unit IV: Internal Flow (8 Hrs) Laminar and Turbulent flow physics, entrance region and fully developed flow. Velocity and shear Stress distribution for laminar flow in a pipe, fixed parallel plates and Couette flow, hydro dynamically smooth and rough boundaries, Velocity profile of Turbulent flow.	
Unit V: Flow through Pipes (8 Hrs) Energy losses through pipe-Major and Minor losses, Darcy-Weisbach equation, pipes in series, pipes in parallel and concept of equivalent pipe, Moody's diagram, Siphons, Transmission of power, (No derivations for minor losses) Dimensional Analysis: Dimensions of Physical Quantities, dimensional homogeneity, Buckingham $\boldsymbol{\pi}$ Theorem and important dimensionless numbers.	
Unit VI: External flows (8 Hrs) Boundary layer formation for flow over Flat plate, boundary layer thickness:-displacement, momentum and energy, Separation of Boundary Layer and Methods of Controlling.Forces on immersed bodies: -Lift and Drag (No derivation on lift), flow around cylinder and aerofoil (Pressure distribution and Circulation).	
Books:	

Text:

1. Fundamentals of Fluid Mechanics- Munson, Young and Okiishi- Wiley India
2. Fluid Mechanics- Potter Wiggert –Cengage Learning
3. Introduction to Fluid Mechanics- Fox, Pichard , McDonald- Wiley
4. Fluid Mechanics,- Dr. R.K. Bansal- Laxmi Publication (P) Ltd. New Delhi
5. Hydraulics and Fluid Mechanics, - Modi P. N. and Seth S. M -Standard Book House.
6. Fluid Mechanics,- Cengel&Cimbla- TATA McGraw-Hill
7. Fluid Mechanics- White- TATA McGraw-Hill

Reference:

1. Fluid Mechanics- Kundu, Cohen, Dowling- Elsevier India
2. Fluid Mechanics – Chaim Gutfinger David Pnueli-Cambridge University press.
3. Introduction to Fluid Mechanics-Edward Shaughnessy, Ira Katz James Schaffer- OXFORD University Press.

List of Practical

(Any ten of the following out of which experiment number 3 is compulsory)

1. Pressure measurement using any two types of manometer.
2. Determination of viscosity of liquids and its variation with temperature.
3. Determination of metacentric height of floating object.
4. Laminar and Turbulent flow by Reynolds's apparatus.
5. Draw flow net using electrical analogy apparatus.
6. Verification of modified Bernoulli's equation.
7. Calibration of Orifice meter/ Venturimeter.
8. Determination of hydraulic coefficients of orifice.
9. Calibration of V-notch
10. Determination of minor losses due to pipe fittings.
11. Determination of Major losses through metal & non-metal pipes.

Notes:

3. Minimum 10 experiments should be performed.
4. Experiment No. 3 is compulsory.

202047: Soft Skills

Teaching Scheme:		Credits	Examination Scheme:		
TH:	**-- hr/week**	**Th/Tut: --**	**TH**	**In-Sem:**	**--**
				End-Sem:	**--**
PR:	**02 hrs/week**	**PR: 01**		**PR:**	**--**
				OR:	**--**
				TW:	**25**

Course Objectives:

- To develop students overall personality.
- To understand and aware about importance, role and contents of soft skills through instructions, knowledge aquisitiion, demonstration and practice.To improve his writing and documentation skills.

Course Outcomes:
On completion of the course, learner will be able to–

- Improved communication, interaction and presentation of ideas.
- Right attitudinal and behaviouralchange
- Developed right-attitudinal and behavioral change

Course Contents

Term Work/Assignments
Term work will consist the record of any 6 assignments of following exercises

1. **SWOT analysis** **(4 Hrs)**
Student should do his/her SWOT analysis & submit the report.
Method of Execution
Explain the meaning & benefits of SWOT analysis to students. Give them time to think on their strength, weakesses, opportunities & threats. Ask them to write their own SWOT anlalysis

2. **Listening Skills** **(4 Hrs)**
Listen to a short audio book and make notes out of it & make a report.
Method of Execution
Ask every students to download any freely available english audio book of one hour duration. Also ask them to listen it carefully and write it's review on journal paper

3. Oral presentation skills/Speaking Skills (4 Hrs)

Hold the poster of any inspirational personality & speak about his/her life for five minutes.

Method of Execution

The personality can be from the fields like sports, politics, literature, entertainment etc. Ask every students to read & study about therespective personality & deliver the oral presentation infront of his/her batchmates.

4. **Resume writing** **(4 Hrs)**

Design a cover letter & resume for yourself.

Method of Execution

Show some of the different resumes according to respective job profiles to students & ask them to prepare their own resume. Also guide them to write a cover letter for any job application.

5. **Corporate / Business Etiquettes** **(4 Hrs)**

Apply to any five internship openings over internet by writing an email to the company HR. Students must submit email print.

Method of Execution: Tell students about any five recent internship openings & ask them to apply for same through email with resume as an attachment. Ask students to take a sent mail print for submission record

6. **Group Discussion** **(4 Hrs)**

Organize the group discussion on a current topics in a batch of ten students & ask every student to make minutes of meeting & submit.

Method of Execution: Take some of the current topics for group discussion, divide students in two batches of ten students in each, Allot 10 minutes time & one topic for discussion, meanwhile instructor have to assess each student's performance & give feedback to respective student. Also ask students to write the minutes of the meeting from same GD

7. **Team Activity** **(4 Hrs)**

Make a 20 minutes english video documentary & post it on a social media. Also provide the link of the same as submission record.

Method of Execution: Make a group of four students & guide them to choose a topic for making a video documenatry. Video can be posted on facebook, twitter or youtube.The video can be recorded on cellphone as well

Books:

Text:

1. Basics Of Communication In English : Francis Sounderaj, MacMillan India Ltd.2
2. English for Business Communication : Simon Sweeney , Cambridge University Press
3. An Introduction to Professional English And Soft Skills : Das , Cambridge University Press

Reference:

1. A course in Listening and Speaking Vol I &Vol II, V.Sasikumar, P. Kiranmai, Geetha Rajeevan, Cambridge University Press
2. Cambridge English For Job Hunting : ColmDownes, Cambridge University Press
3. The Complete Letter Writer :MacMillan India Ltd
4. E Writing – 21st Century Tools for Effective Communication :Booher , MacMillan India Ltd
5. NASSCOM-Global Business Foundation Skills: Cambridge University Press

202048: Theory of Machines – I

Teaching Scheme:	Credits	Examination Scheme:
TH: 04 hr/week	Th: 04	TH In-Sem: 50
		End-Sem: 50
Tutorial: 01 hr/week	Tut: 01	PR: --
		OR: 25
		TW: 25

Prerequisites: -

1. Engineering Mathematics
2. Engineering Physics
3. Engineering Mechanics

Course Objectives:

- To make the student conversant with commonly used mechanism for industrial application.
- To develop competency in drawing velocity and acceleration diagram for simple and complex mechanism.
- To develop analytical competency in solving kinematic problems using complex algebra method.
- To develop competency in graphical and analytical method for solving problems in static and dynamic force analysis.
- To develop competency in conducting laboratory experiments for finding moment of inertia of rigid bodies,

Course Outcomes:

On completion of the course, learner will be able to–

- Identify mechanisms in real life applications.
- Perform kinematic analysis of simple mechanisms.
- Perform static and dynamic force analysis of slider crank mechanism.
- Determine moment of inertia of rigid bodies experimentally.
- Analyze velocity and acceleration of mechanisms by vector and graphical methods.

Course Contents

Unit I Fundamentals of Kinematics and Mechanisms (10 Hrs)

Kinematic link, Types of links, Kinematic pair, Types of constrained motions, Types of Kinematic pairs, Kinematic chain, Types of joints, Mechanism, Machine, Degree of freedom (Mobility),Kutzbach crieterion, Grubler's criterion. Four bar chain and its inversions, Grashoff's law, Slider crank chain and its inversions, Double slider crank chain and its inversions. Straight line mechanisms such as: Peaucellier Mechanism, Scott Russell Mechanism, Grasshopper Mechanism, watt mechanism. Equivalent linkage of mechanisms., Steering gear mechanisms: Condition for correct steering, Davis steering gear mechanism, Ackermann steering gear mechanism.

Unit II: Static and Dynamic Force Analysis (8Hrs)

Theory and analysis of Compound Pendulum, Concept of equivalent length of simple pendulum, Bifilar suspension, Trifilar suspension.

Dynamics of reciprocating engines: Two mass statically and dynamically equivalent system, correction couple, static and dynamic force analysis of reciprocating engine mechanism (analytical method only), Crank shaft torque, Introduction to T-θ diagram.

Friction: Friction in turning pair, friction circle, friction axis, friction in slider crank mechanism.

Unit III: Friction Clutches, Brakes and Dynamometer (8 Hrs.)

Pivot and collar friction, Classification of Clutches, torque transmitting capacity of - plate clutch, cone clutch and centrifugal clutch, Classification of brakes, braking torque of - shoe brakes, internal shoe brake, disc brake, brake power of absorption and transmission type dynamometers – prony brake, rope brake, belt transmission, epicyclic train and Bevis-Gibson torsion

Unit IV: Kinematic Analysis of Mechanisms: Analytical Method (8 Hrs)

Analytical method for displacement, velocity and acceleration analysis of slider crank Mechanism.

Position analysis of links with vector and complex algebra methods, Loop closure equation, Chase solution, Velocity and acceleration analysis of four bar and slider crank mechanisms using vector and complex algebra methods.

Hooke's joint, Double Hooke's joint.

Unit V: Velocity and Acceleration Analysis of Simple Mechanisms: Graphical Methods-I (8 Hrs)

Relative velocity method: Relative velocity of a point on a link, Angular velocity of a link, Sliding velocity, Velocity polygons for simple mechanisms.

Relative acceleration method: Relative acceleration of a point on a link, Angular acceleration of a link, Acceleration polygons for simple mechanisms.

(limit to only 4 link mechanisms)

Instantaneous center of rotation (ICR) method: Definition of ICR, Types of ICRs, Methods of locating

ICRs (limit to only 6 link mechanisms), Kennedy's Theorem, Body and space centrode.

Unit VI: Velocity and Acceleration Analysis of Mechanisms: Graphical Methods-II (8 Hrs)

Velocity and acceleration diagrams for the mechanisms involving Coriolis component of acceleration. (limit to only 4 link mechanisms) Klein's construction.

Books:

Text:

5. Thomas Bevan, “Theory of Machines” CBS Publisher and Distributors, Delhi.
6. S. S. Ratan, “Theory of Machines”, Tata McGraw Hill.
7. Ashok G. Ambekar, “Mechanism and Machine Theory”, Prentice Hall, India
8. Sadhu Singh, “Theory of Machines”, Pearson

Reference:

1. Shigley J. E., and Uicker J.J., “Theory of Machines and Mechanism”, McGraw Hill Inc.
2. Shigley J. E ‘Mechanical Engineering Design’, McGraw Hill Inc.
3. Ghosh Amitabh and Mallik A. K. “Theory of Machines and Mechanism”, East- West Press.
4. Wilson C.E., Sandler J. P. Kinematics and Dynamics of Machinery”, Person Education.
5. Erdman A.G. and Sandor G.N., “Mechanism Design, Analysis and Synthesis” Volume-I, Prentice –Hall of India

Term Work based on following Tutorials to be submitted in the form of Journal:

1. Draw (any 4) configurations of mechanisms and determine types of pairs, links, degree of freedom.
2. To determine experimentally the mass moment of inertia of a connecting rod using a compound pendulum method.
3. To determine experimentally the mass moment of inertia of a flat bar using bifilar suspension method or to determine experimentally the mass moment of inertia of a flywheel/gear/circular disc using trifilar suspension method.
4. Numerical based on Friction Clutches, Brakes and Dynamometer Or to measure torque transmitting capacity of friction clutch experimentally.
5. Numerical based on - single and double Hooke’s joint.
6. One problem on velocity and acceleration analysis using: Vector algebra and Complex algebra and comparison of results.
7. **Two problems** on velocity and acceleration analysis using relative velocity and acceleration method.
8. **Two problems** on velocity analysis using ICR method.
9. **Two problems** on velocity and acceleration analysis using relative velocity and acceleration method involving Coriolis component.
10. Problems on velocity and acceleration analysis using Klein’s construction for uniform and non-uniform crank velocity.

Note: 1. Sr. No. 1,7,8,9 and 10 Problems based on Graphical methods are to be solved on half imperial drawing sheets.

2. Oral based on above Term work conducted in the tutorial class.

202048: Engineering Metallurgy

Teaching Scheme:	Credits	Examination Scheme:		
TH: 03 hr/week	Th:03	TH	In-Sem:	50
			End-Sem:	50
Tutorial: 01 hr/week	PR/OR/TW:01		PR:	--
			OR:	25
			TW:	--

Course Objectives:

- To acquaint students with the basic concepts of Metal Structure
- To impart a fundamental knowledge of Ferrous & Non Ferrous Metal Processing
- Selection and application of different Metals & Alloys
- To Know Fundamentals of Metallography
- To develop futuristic insight into Metals

Course Outcomes:

On completion of the course, learner will be able to–

- describe how metals and alloys formed and how the properties change due to microstructure
- apply core concepts in Engineering Metallurgy to solve engineering problems.
- conduct experiments, as well as to analyze and interpret data
- select materials for design and construction.
- possess the skills and techniques necessary for modern materials engineering practice
- recognize how metals can be strengthened by alloying, cold-working, and heat treatment

Course Contents

Unit I Overview of Metallurgy (6 **Hrs)**

Methods of metal extraction (Principle only of pyro , hydro & electro metallurgy), cast v/s wrought products, Related terms and their definitions : System, Phase, Variable, Component, Alloy, Solid solution, Hume Ruther's rule of solid solubility, Allotropy and polymorphism, Concept of solidification of pure metals & alloys, Nucleation : homogeneous and heterogeneous,

Dendritic growth, super cooling, equiaxed and columnar grains, grain & grain boundary effect.

Cooling curves, Plotting of Equilibrium diagrams, Lever rule, Coring, Eutectic system, Partial eutectic and isomorphous system.

Unit II: Micro & macroscopic study of Metals (6 Hrs)

Classification of metal observations: their definition, difference & importance.

Microscopy: Various sampling techniques, specimen preparation, specimen mounting (hot & cold mounting) electrolytic polishing, etching procedure and reagents, electrolytic etching.

Microscopic techniques : optical microscopy, electron microscopy, transmission electron microscopy (TEM),scanning electron microscopy (SEM), scanning probe microscopy (SPM), AFM etc. (principal & application only)

Study of Metallurgical microscope .Measurement of grain size by different methods & effect of grain size on various mechanical properties.

Macroscopy: Sulphur printing, flow line observations, spark test.

Unit III: Iron-Carbon alloy system & Cast Iron (8 Hrs.)

Iron-iron carbide equilibrium diagram, critical temperatures, solidification and microstructure of slowly cooled steels, structure & property relationship, classification and application of steels.

Cast Irons: Classification, Manufacturing, Composition , Properties & applications of white C.I., Grey cast iron, malleable C.I., S.G. cast iron, chilled and alloy cast iron, effect of various parameters on structure and properties of cast irons. Specific applications such as machine tools, automobiles, pumps, valves etc.

Introduction to non-equilibrium cooling of steels, widmanstaten structure

Unit IV: Heat- treatment Of Steels (6 Hrs)

Transformation products of Austenite, Time Temperature Transformation diagrams, critical cooling rate, continuous cooling transformation diagrams. Heat treatment of steels: Annealing, Normalising, Hardening & Tempering, quenching media, other treatments such as Martempering, Austempering, Patenting, Ausforming. Retention of austenite, effects of retained austenite. Elimination of retained austenite (Subzero treatment). Secondary hardening, temper embrittlement, quench cracks, Hardenability & hardenability testing, Defects due to heat treatment and remedial measures.

Classification of surface hardening treatments, Carburising, heat treatment after Carburizing, Nitriding, Carbo-nitriding, Flame hardening, and Induction hardening.

Unit V: Engineering Alloy Steels & designation (4 Hrs)

Classification of alloy steels & Effect of alloying elements, examples of alloy steels, stainless steels, sensitization & weld decay of stainless steel, tool steels, heat treatment of high speed steel, special purpose steels with applications, super alloys. Heat affected zone. Designation (for plane & alloy steels) : IS, AISI, SAE, DIN etc.

Unit VI: Non Ferrous Metals **(6 Hrs)**

Classification of nonferrous metals. Importance of nonferrous metals in engineering applications & compositions, study of different mechanical properties: Cu & Cu based alloys, Al and Al based alloys, Ni and Ni based alloys, Co and Co based alloys, Titanium & its alloys, Tin & Lead base alloys, Bearing materials: important properties & applications.

Books:

Text:

1. "Material Science & Metallurgy For Engineers", Dr. V.D. Kodgire & S. V. Kodgire , Everest Publication.
2. "Mechanical Behaviour & Testing Of Materials ", A . K. Bhargava, C.P. Sharma P H I Learning Private Ltd.

Reference:

1. "Engineering Metallurgy", Higgins R. A., Viva books Pvt. Ltd., 2004.
2. "Material Science & Engg." Raghvan V., Prentice Hall of India , New Delhi. 2003
3. Introduction to Physical Metallurgy, Avner, S.H., Tata McGraw-Hill, 1997.
4. Engineering Metallurgy Dr. O.P. Khanna

Term Work based on following

1 Study & Demonstration of Specimen Preparation for microscopic examination.
2 Study of Optical Metallurgical microscope.
3 Study and Drawing of Microstructure of Steels of various compositions.
4 Study and Drawing of Microstructure of Cast Irons.
5 Study and Drawing of Microstructure of Non Ferrous Metals.
6 Heat treatment of Plain Carbon Steel and determination of relative hardness.
7 Study and Drawing of Microstructure of Heat Affected Zone in Welding.
8 Jominy End Quench Test for hardenability.
9 Spark Test.
10 Sulfur Printing Test.
11 Flow Line Observation Test.
12 Characterization techniques like SEM, TEM.

Note : Out of above Twelve practical , any Eight practical should be conducted .

202050: Applied Thermodynamics

Teaching Scheme:		Credits	Examination Scheme:		
TH:	**04 hr/week**	**Th:04**	**TH**	**In-Sem:**	**50**
				End-Sem:	**50**
PR:	**02 hrs/week**	**PR/OR/TW:01**		**PR:**	**50**
				OR:	**--**
				TW:	**--**

Prerequisites: - 1. Engineering Thermodynamics.

2. Engineering Mathematics

Course Objectives:

- To get familiar with fundamentals of I. C. Engines, Construction and working Principle of an Engine and Compare Actual, Fuel-Air and Air standard cycle Performance.
- To study Combustion in SI and CI engines and its controlling factor in order to extract maximum power.
- To study emission from IC Engines and its controlling method, Various emission norms.
- Perform Testing of I. C. Engines and methods to estimate Indicated, Brake and Frictional Power and efficiencies
- To understand theory and performance Calculation of Positive displacement compressor.

Course Outcomes:

On completion of the course, learner will be able to–

- Classify various types of Engines, Compare Air standard, Fuel Air and Actual cycles and make out various losses in real cycles.
- Understand Theory of Carburetion, Modern Carburetor, Stages of Combustion in S. I. Engines and Theory of Detonation, Pre-ignition and factors affecting detonation.
- Understand Fuel Supply system, Types of Injectors and Injection Pumps, Stages of Combustion in CI Engines, Theory of Detonation in CI Engines and Comparison of SI and CI Combustion and Knocking and Factors affecting, Criteria for good combustion chamber and types.
- Carry out Testing of I. C. Engines and analyze its performance.
- Describe construction and working of various I. C. Engine systems (Cooling, Lubrication, Ignition, Governing, and Starting) also various harmful gases emitted from exhaust and different devices to control pollution and emission norms for pollution control.
- Describe construction, working of various types of reciprocating and rotary compressors with performance calculations of positive displacement compressors.

Course Contents

Unit I Basics of IC Engines **(5 Hrs)**

Heat Engine, IC and EC engines, I.C. Engine construction - components and materials, Engine nomenclature, Valve timing diagram, Intake and exhaust system, Engine classification, Applications.

Fuel Air Cycle and Actual Cycle **(5 Hrs)**

Fuel air cycle, Assumptions, Comparison with air standard cycle, Effect of variables on performance,
Actual cycle and various losses, Comparison of Air standard Vs Fuel Vs Actual cycle.

Unit II SI Engines **(5 Hrs)**

Theory of Carburetion, Types of carburetors, Electronic fuel injection system, Combustion in spark
Ignition engines, stages of combustion, flame propagation, rate of pressure rise, abnormal combustion,
Phenomenon of Detonation in SI engines, effect of engine variables on Detonation. Combustion chambers, Rating of fuels in SI engines, Additives.

Unit III CI Engines **(5 Hrs)**

Fuel supply system, types of fuel pump, injector and distribution system, Combustion in compression ignition engines, stages of combustion, factors affecting combustion, Phenomenon of knocking in CI engine. Effect of knocking, Methods of knock control, Types of combustion chambers, rating of fuels in
CI engines. Dopes & Additives, Comparison of knocking in SI & CI engines.

Unit IV Testing of IC Engines **(6 Hrs)**

Objective of testing, Various performance parameters for I.C. Engine - Indicated power, brake power, friction power, SFC, AF ratio etc. Methods to determine various performance parameters, characteristic curves, heat balance sheet.

Supercharging **(**2 Hrs)

Supercharging and turbo-charging methods and their limitations

Unit V I.C. Engine Systems **(6 Hrs)**

Cooling System, Lubrication System, Ignition System, Governing system, Starting System

I.C. Engine Emissions and Control **(**4 Hrs)

Air pollution due to IC engine and its effect, Emissions from petrol/gas and diesel engines,
Sources of emissions, Euro norms, Bharat stage norms, Emission control methods for SI and CI engines

Unit VI Positive Displacement Compressors (Reciprocating and Rotary) (10 Hrs)

Reciprocating Compressor - Single stage compressor – computation of work done, isothermal efficiency, effect of clearance volume, volumetric efficiency, Free air delivery, Theoretical and actual

indicator diagram, Multistaging of compressor, Computation of work done, Volumetric efficiency, Condition for maximum efficiency, Inter-cooling and after cooling, Capacity control of compressors

Rotary Compressor – Introduction, vane compressors, roots blower, screw compressor. **(Numerical treatment on Reciprocating compressor single stage and multistage only)**

Books:

Text:

1) V. Ganesan: Internal Combustion Engines, Tata McGraw-Hill
2) M.L. Mathur and R.P. Sharma: A course in Internal combustion engines, Dhanpat Rai
3) H.N. Gupta, Fundamentals of Internal Combustion Engines, PHI Learning Pvt. Ltd.

Reference:

1. Heywood: Internal Combustion Engine Fundamentals, Tata McGraw-Hill
2. Domkundwar & Domkundwar: Internal Combustion Engine, Dhanpat Rai
3. R. Yadav: Internal Combustion Engine, Central Book Depot, Ahmedabad.
3. S. Domkundwar, C. P. Kothandaraman, A. Domkundwar, Thermal Engineering, Dhanpat Rai & Co.

List of Practical's:

1. Study of Carburetor
2. Study of Fuel pump and injector
3. Study of Ignition System
4. Demonstration & study of commercial exhaust gas analyzers.
5. Morse Test on Multi cylinder Petrol/ Diesel engine for determination of Friction power.
6. Variable load test on diesel engine to determine various efficiencies, SFC and Heat balance sheet.
7. Test on variable compression ratio engine.
8. Visit to Automobile service station
9. Test on Positive Displacement Air Compressor
10. Assignment on any one advanced technology related to I.C. Engine such as VVT, VGT, HCCI
11. Assignment on alternative fuels used in I.C. Engines.

Notes:

1. Minimum 8 experiments should be performed.
2. Perform any 3 from 1 to 4.
3. Perform any 2 from 5, 6, and 7.
4. Experiment 8 and 9 are compulsory.

203152: Electrical and Electronics Engineering

Teaching Scheme:		Credits	Examination Scheme:		
TH:	03 hr/week	Th:03	TH	In-Sem [Online]:	50
				End-Sem:	50
PR:	02 hrs/week	PR/OR/TW:01		PR:	--
				OR:	--
				TW:	25

Prerequisites: - 1. Basic Electrical Engineering 2. Basic Electronics Engineering

Course Objectives:
To understand
1. Principle of operation and speed control of DC machines
2. Induction motor principle and its applications
3. Working principle of special purpose motors
4.Microcontrollers
5. Embedded systems terminologies and sensors
6. Data acquisition system for mechanical applications

Course Outcomes:
Student should be able to
1.Develop the capability to identify and select suitable DC motor / induction motor / special purpose motor and its speed control method for given industrial application.
2. Program Arduino IDE using conditional statements
3. Interfacing sensors with Arduino IDE

Course Contents

Electrical Engineering

Unit I D. C. Machines (6Hrs)
Construction, working principle of D.C. generator, emf equation of D. C. generator (derivation not expected), working principle of D.C. motor, types of D.C. motor, back emf, torque equation for D.C. motor, characteristics of D.C. motor (series and shunt only), three-point starter for D.C shunt motor, methods for speed control of D.C. shunt and series motors, industrial applications.

Unit II Three Phase Induction Motors (6Hrs)
Constructional feature, working principle of three phase induction motors, types; torque equation, torque slip characteristics; power stages; efficiency, starters (auto transformer starter, star delta starter); methods of speed control and industrial applications.

Unit III Special Purpose Motors (6 Hrs)
Construction, working principle, characteristic and applications of stepper motors, A.C. and D.C servomotors, universal motors, industrial applications, brushless DC motors, linear induction motors, single phase induction motors,(types, construction, working principle of split phase and shaded pole type induction motors), descriptive treatment for AC series motor (difference between AC series and DC series motor, construction and working).

Electronics Engineering

Unit IV Introduction to Microcontrollers (6 Hrs)
Introduction to microcontroller and microprocessors, role of embedded systems, open source embedded platforms, Atmega 328P- features, architecture, portstructure, sensors and actuators, data acquisition systems, introduction to Arduino IDE- features, IDE overview, programming concepts: variables, functions, conditional statements.

Unit V Peripheral Interface-1 (6 Hrs)
Concept of GPIO in Atmega 328P based Arduino board, digital input and output, UART concept, timers, interfacing with LED, LCD and keypad, serial communication using Arduino IDE

Unit VI Peripheral Interface-2 (6Hrs)
Concept of ADC in Atmega 328P based Arduino board, interfacing with temperature sensor (LM35), LVDT, strain gauge, accelerometer, concept of PWM, DC motor interface using PWM

Books:

Text:

[T1] Edward Hughes “Electrical Technology”, ELBS, Pearson Education.
[T2] Ashfaq Husain, “Electrical Machines”, Dhanpat Rai & Sons.
[T3] S. K. Bhattacharya, “Electrical Machine”, Tata Mc Graw Hill publishing Co. Ltd, 2nd Edition.
[T4] Nagrath & Kothari, “Electrical Machines”, Tata Mc Graw
[T5]Electrical Machines, R. K. Rajput, Laxmi Publications, 2002
[T6] Ajay Deshmukh, ‘Microcontrollers Theory and Applications’, TATA McGraw Hill
[T7]Arduino microcontroller processing for everyone-Steven F Barret,Morgan and Claypool Publisher.
[T8] C programming with ardino-Warwick Smith Elektor Publication.

Reference:

[R1] Electrical Machines, Lowe, Nelson Publications.
[R2] A.E. Fitzgerald, Charles Kingsley, Stephen D. Umans, "Electrical Machines", Tata McGraw Hill Publication Ltd. Fifth Edition.
[R3]Permanent Magnet Synchronous and Brushless DC Motor Drives, R. Krishnan, CRC press.
[R4]Smarajit Ghosh, "Electrical Machines", Pearson Education, New Delhi.
[R5]Kenneth J. Ayala, 'The 8051 Microcontroller', Cengage Learning.
[R6]Started with Arduino by Massimo Banzi and Michael Shiloh Published by Maker Media, Inc.
[R7]Getting Started With Arduino: A Beginner's Guide by by Brad Kendall (Author), Justin Pot (Editor), Angela Alcorn (Editor)
[R8]Arduino Cookbook, 2nd Edition by Michael Margolis published by O'Reilly Media.
[R9] Application notes from "ATMEL micro controller data book."
[R10]

Web References

1) www. alldatasheet.com
2) w ww.atmel.com/products

Unit	Textbooks	Reference books
1	T1,T2,T3,T4	R1,R2,R4
2	T1,T2,T3,T4,T5	R1,R2,R4
3	T1,T2,T3,T4	R1,R2,R3,R4
4	T6,T7,T8	R5,R6,R7,R10
5	T7,T8	R6,R7,R8,R9,R10
6	T7,T8	R6,R7,R8,R9,R10

List of Practicals:
(Any 4 out of 1 to 6 and any 4 out of 7 to 12)
Electrical Engineering

01) Speed control of DC shunt motor.
02) Brake test on DC shunt motor.
03) No load and blocked rotor test on 3 phase Induction Motor.
04) Load test on 3 phase Induction Motor.
05) Load test on single phase Induction Motor.
06) Study of starters for AC and DC motors.

Electronics Engineering

07) Interfacing of LED to blink after every 1 sec.
08) Display data using serial communication.
09) Interfacing of LCD to display the message and interface with keypad to display the key pressed.
10) Interfacing of temperature sensor (LM35) and show output on LCD/serial terminal.
11) Interfacing of strain gauge sensor and LVDT to measure the parameters.
12) Study of interfacing accelerometer to change the speed of DC Motor.

Guidelines for Instructor's Manual

Practical Sessions -

The Instructor’s Manual should contain following related to every experiment –

- Brief theory related to the experiment.
- Connection diagram /circuit diagram
- Observation table
- Sample calculations for one reading
- Result table
- Graph and Conclusions.
- Data sheets of the ICs used(if any)

Guidelines for Student's Lab Journal

For Electrical Practical

1. Lab journal should be hand written
2. All the diagrams should be drawn on graph paper
3. Specifications of the instrument used for conduction of practicalshould be mentioned in respective write up.

For Electronics Practical:

1. Title of the program.
2. The program has to be written in the following format.
Address- Instruction- Comment
3. Input data has to be specified.
4. Result of the program.
5. Flow Chart for each program has to be drawn on separate page.

Guidelines for Lab /TW Assessment

1. There is **Term Work** for the subject, so continuous assessment should be carried out such as checking of previous experiment.
2. While assessment, teacher should put the remark by writing word “Complete” and not simply “C”. Put the signature along with date at the end of experiment and in the index.

3. Assign 10 marks for each experiment as per following format.
Timely completion = 03 marks
Neat and clean writing = 02 marks
Depth of understanding = 03 marks
Regular attendance = 02 marks

Maintain continuous assessment sheet. At the end of semester, convert these marks out of as prescribed in syllabus structure.

Guidelines for Laboratory Conduction

Electrical Engineering Practicals

1. Check whether the MCB / ELCB / main switch is off.

2. Make connections as per circuit diagram. Use flexible wire for connection of voltmeter and pressure coil connection of wattmeter. For rest of the connections, usethick wire. Do not keep loose connection. Get it checked from teacher / Lab Assistant.

3. Perform the experiment only in presence of teacher or Lab Assistant.
4. Do the calculations and get it checked from the teacher.

5. After completion of experiment, switch off the MCB / ELCB / main switch.

6. Write the experiment in the journal and get it checked within the week.

Electronics Engineering Practicals

1. The instructor is expected to shortlist necessary experiments from the suggested list of experiments.
2. During the practical session the instructor may divide the total students in groups of 4 to 5 students and assign them with different experiments to be performed.
3. Each student within the group has to enter and execute the program turn wise.

4. Staff member has to check the result of all the groups after the execution of the program.

203153 : Machine Shop - I

Teaching Scheme:		Credits	Examination Scheme:	
TH:	-- hr/week	Th/Tut:--	TH In-Sem [Online]:	--
			End-Sem:	--
PR:	02 hrs/week	PR/OR/TW:01	PR:	--
			OR:	--
			TW:	25

List of Practical's:

1. Manufacture of spur gear on milling machine using indexing head.
2. Surface grinding using table grinder.
3. Manufacturing any one sheet metal component involving minimum three different operation (use dies and press).
4. Any two plastic component like bottle, bottle caps, machine handles, etc.

Faculty of Engineering

Syllabus

S.E. (Information Technology) 2015 Course

(With effect from Academic Year 2016 - 17)

SAVITRIBAI PHULE PUNE UNIVERSITY

THE SYLLABUS IS PREPARED BY:

B.O.S. in Information Technology, SavitribaiPhule Pune University

PROGRAM EDUCATIONAL OBJECTIVES

The students of Information Technology course after passing out will

1. Possess strong fundamental concepts in mathematics, science, engineering and Technology to address technological challenges.
2. Possess knowledge and skills in the field of Computer Science and Information Technology for analyzing, designing and implementing complex engineering problems of any domain with innovative approaches.
3. Possess an attitude and aptitude for research, entrepreneurship and higher studies in the field of Computer Science and Information Technology.
4. Have commitment to ethical practices, societal contributions through communities and life-long learning.
5. Possess better communication, presentation, time management and team work skills leading to responsible & competent professionals and will be able to address challenges in the field of IT at global level.

PROGRAM OUTCOMES

The students in the Information Technology course will attain:

1. an ability to apply knowledge of mathematics, computing, science, engineering and technology;
2. an ability to define a problem and provide a systematic solution with the help of conducting experiments, analyzing the problem and interpreting the data;
3. an ability to design, implement, and evaluate a software or a software/hardware system, component, or process to meet desired needs within realistic constraints;
4. an ability to identify, formulate, and provide systematic solutions to complex engineering/Technology problems;
5. an ability to use the techniques, skills, and modern engineering technology tools, standard processes necessary for practice as a IT professional;
6. an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems with necessary constraints and assumptions;
7. an ability to analyze and provide solution for the local and global impact of information technology on individuals, organizations and society;
8. an ability to understand professional, ethical, legal, security and social issues and responsibilities;
9. an ability to function effectively as an individual or as a team member to accomplish a desired goal(s);
10. an ability to engage in life-long learning and continuing professional development to cope up with fast changes in the technologies/tools with the help of electives, professional organizations and extra-curricular activities;
11. an ability to communicate effectively in engineering community at large by means of effective presentations, report writing, paper publications, demonstrations;
12. an ability to understand engineering, management, financial aspects, performance, optimizations and time complexity necessary for professional practice;
13. an ability to apply design and development principles in the construction of software systems of varying complexity.

S.E. (Information Technology) 2015 Course to be implemented from June 2016

SEMESTER – I

Subject Code	Subject	Teaching Scheme			Examination Scheme					Total Marks	Credits
		Lecture	Tutorial	Practical	Theory Paper	Theory Online	TW	PR	OR		
214441	Discrete Structures	4	--	--	50	50	--	--	--	100	4
214442	Computer Organization & Architecture	4	--	--	50	50				100	4
214443	Digital Electronics and Logic Design	4	--	--	50	50	--	--	--	100	4
214444	Fundamentals of Data Structures	4	--	--	50	50	--	--	--	100	4
214445	Problem Solving and Object Oriented programming	4	--	--	50	50	--	--	--	100	4
214446	Digital Laboratory	--	--	2	--	--	25	50	--	75	1
214447	Programming Laboratory	--	--	4	--	--	25	50	--	75	2
214448	Object Oriented programming Lab.	--	--	2	--	--	25	50		75	1
214449	Communication Skills	--	--	2	--		25	--	--	25	1
	Audit Course	--	--	--	--	--	--	--	--	Grade	
	Total	**20**	**--**	**10**	**250**	**250**	**100**	**150**	**--**	**750**	**25**
	Total of Part-I	**30 Hours**				**750**					

SEMESTER – II

Subject Code	Subject	Teaching Scheme			Examination Scheme					Total Marks	Credits
		Lecture	Tutorial	Practical	Theory Paper	Theory Online	TW	PR	OR		
207003	Engineering Mathematics -III	4	1	--	50	50	25	--	--	125	5
214450	Computer Graphics	3	-	--	50	50	--	--	--	100	3
214451	Processor Architecture and Interfacing	4	-	-	50	50	--	--	--	100	4
214452	Data Structures & Files	4	-	-	50	50	--	--	--	100	4
214453	Foundations of Communication and Computer Network	4	-	-	50	50	--	--	--	100	4
214454	Processor Interfacing Laboratory	--	--	4	--	--	25	50	--	75	2
214455	Data Structure and Files Laboratory	--	--	4	--	--	25	50	--	75	2
214456	Computer Graphics Laboratory	--	--	2	--	--	25	50	--	75	1
	Audit Course	--	--	--	--	--	--	--	--	Grade	
	Total	**19**	**01**	**10**	**250**	**250**	**100**	**150**	**--**	**750**	**25**
	Total of Part-II	**30 Hours**			**750**						

TW: Term Work **PR: Practical** **OR: Oral**

SEMESTER - I

214441 : DISCRETE STRUCTURES

Teaching Scheme:	Credit	Examination Scheme:
Lectures: 4 Hours/Week	04	In-Semester (Online): 50 Marks End-Semester: 50 Marks

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Prerequisites: Basic Mathematics

Course Objectives :

1. Learn the use of set, proof techniques and determine logical possibilities in a given situation.
2. Learn relations, functions among various entities in real world.
3. Learn to apply relations and functions in real life.
4. Learn to formulate problem mathematically using graph theory and trees.

Course Outcomes :

By the end of the course, students should be able to

1. Use set, relation and function to formulate a problem and solve it
2. Use graph theory and trees to formulate the problems and solve them
3. Use mathematical propositions and proof techniques to check the truthfulness of a real life situation.

Course Contents

UNIT - I PERMUTATIONA, COMBINATIONS & DISCRETE PROBABILITY — 6 Hours

Permutations and Combinations: rule of sum and product, Permutations, Combinations, Algorithms for generation of Permutations and Combinations. Discrete Probability, Conditional Probability, Bayes' Theorem, Information and Mutual Information.

UNIT - II SETS AND PROPOSITIONS — 6 Hours

Sets, Combinations of sets, Venn Diagrams, Finite and Infinite sets, Uncountable infinite sets, Principle of inclusion and exclusion, multisets. Propositions, Conditional Propositions, Logical Connectivity, Propositional calculus, Universal and Existential Quantifiers, Normal forms, methods of proofs, Mathematical Induction

UNIT - III RELATIONS AND FUNCTIONS — 6 Hours

Properties of Binary Relations, Closure of relations, Warshall's algorithm, Equivalence Relations and partitions, Partial ordering relations and lattices, Chains and Anti chains.

Recurrence Relations

Recurrence Relation, Linear Recurrence Relations With constant Coefficients, Homogeneous Solutions, Total solutions, solutions by the method of generating functions

Functions

Functions, Composition of functions, Invertible functions, Pigeonhole Principle, Discrete Numeric functions and Generating functions, Job scheduling Problem.

UNIT IV GRAPH THEORY — 6 Hours

Basic terminology, representation of graph in computer memory, multi graphs and weighted graphs, Subgraph, Isomorphic graph, Complete, regular and bipartite graphs, operation on graph, paths and circuits, Hamiltonian and Euler paths and circuits, shortest path in weighted graph(Dijkstra's algorithm), factors of a graph, planer graph and Travelling salesman problem, Graph coloring.

UNIT - V TREES **6 Hours**

Trees, rooted trees, path length in rooted trees, prefix codes and optimal prefix codes, binary search trees, tree traversals, spanning trees, Fundamental circuits and cut set, minimal spanning trees, Kruskal's and Prim's algorithms for minimal spanning tree, The Max flow –Min cut theorem (transport network).

UNIT – VI GROUPS AND RINGS **6 Hours**

Algebraic Systems, Groups, Semi Groups, Monoid, Subgroups, Permutation Groups, Codes and Group codes, Isomorphism and Automorphisms, Homomorphism and Normal Subgroups, Ring, Integral Domain, Field, Ring Homomorphism, Polynomial Rings and Cyclic Codes

Text Books

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", 7^{th}edition, McGraw-Hill, ISBN0-07-289905-0
2. C. L. Liu and D. P. Mohapatra, "Elements of Discrete Mathematics", 4^{th} Edition, McGraw-Hill

Reference Books

1. N. Biggs,"Discrete Mathematics", 2^{nd} Edition, Oxford University Press
2. Singh, "Discrete Mathematical Structures", Wiley, ISBN-9788126527908
3. Eric Gossett, "Discrete Mathematics with Proof", Wiley, 2^{nd} Edition, ISBN-9788126527588
4. Edgar G. Goodaire, Michael M. Parmenter, Discrete Mathematics with Graph Theory, Pearson Education, 3^{rd}Edition, ISBN-13: 978-0131679955
5. Richard Johnsonbaugh, "Discrete Mathematics" 7^{th} Edition, Person Education, ISBN : 9332535183

214442 : COMPUTER ORGANIZATION &ARCHITECTURE

Teaching Scheme:	**Credits**	**Examination Scheme:**
Lectures: 4 Hours/Week	04	In-Semester (Online): 50 Marks End-Semester: 50 Marks

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Prerequisites : Fundamental of Programming Languages

Course Objectives :

1. To understand the structure, function & characteristics of computer systems.
2. To understand the design of the various functional units of digital computers.
3. To understand instruction level parallelism & parallel organization of multi-processor & multi core systems

Course Outcomes :

On completion of the course, learner will be able to–

1. Solve problems based on computer arithmetic.
2. Explain processor structure & its functions.
3. Obtain knowledge about micro-programming of a processor.
4. Understand concepts related to memory & IO organization.
5. Acquire knowledge about instruction level parallelism & parallel organization of multi-processors & multi core systems.

Course Contents

UNIT – I COMPUTER EVOLUTION, PERFORMANCE MEASUREMENT & ARITHMETIC 8 Hours

A Brief History of Computers, Von Neumann Architecture, Harvard Architecture.

Computer Performance Measurement – Benchmarks (SPEC) for Evaluation, Metrics such as CPU Time, Throughput, etc., Aspects & Factors affecting Computer Performance, Comparing Computer Performances, Marketing Metrics – MIPS & MFLOPS, Speedup & Amdahl's Law

Booths Algorithm For Signed Multiplication & it's Hardware Implementation, Restoring And Non Restoring Division Algorithms & it's Hardware Implementation

UNIT – II THE CENTRAL PROCESSING UNIT 8 Hours

Arithmetic & Logic Unit.

Instruction Sets: - Machine Instruction Characteristics, Types of Operands and Types of Operations, Addressing Modes, Instruction Formats, Instruction Types

Processor Structure and Function - Processor Organization, Register Organization, The Instruction Cycle and Instruction Pipelining.

RISC: Instruction Execution Characteristics, RISC Vs CISC, RISC Architecture - MIPS.

UNIT – III THE CONTROL UNIT 8 Hours

Instruction Cycle & Micro Operations, Functional Requirements & Operations of the Control Unit, Block Schematic & Control Signals, Single Bus Processor Organization, Control Signal example with Micro Operations and Register Transfer.

Control Unit Design Methods - Hardwired Control – State Table Method, Design example - Multiplier CU.

Micro-Programmed Control - Basic Concepts, Microinstructions & Formats, Control Memory, Micro-

Programmed Control Unit Schematic, Microinstruction Sequencing - Design Considerations, Sequencing Techniques, Address Generation, Microinstruction Execution - A Taxonomy of Microinstructions, Microinstruction Encoding.

UNIT – IV Memory & I/O Organization — 8 Hours

Characteristics of Memory Systems, Internal and External Memory Types.
Memory Hierarchy, Principle Of Locality, Cache Memory – Basics, Performance Metrics & Improvements, Organization and Mapping Techniques, Handling Cache Misses & Writes, Replacement Algorithms, Multilevel Caches, Cache Coherence, Snooping & MESI Protocols, Memory Segmentation & Interleaved Memory System.
Virtual Memory: Main Memory Allocation, Virtual to Physical Address Translation, Paging, Page Placement & Location, Page Faults, TLB in Address Translation, Handling TLB Misses & Page Faults.
Input / Output Systems, Programmed I/O, Interrupt Driven I/O, Direct Memory Access (DMA).

UNIT – V Instruction level Parallelism — 8 Hours

MIPS Implementation Overview, Digital Logic for MIPS Implementation, Single Data path for MIPS Architecture, Simple MIPS Implementation with Control Signals.
Overview of Instruction Pipelining, Performance Improvement, MIPS Instruction Set for Pipelining, Pipeline Hazards: Structural, Data – Forwarding & Code Reordering, Control – Branch Prediction, 5 Stage Pipeline with Data path & Control for MIPS Architecture, Graphical Representation of Pipelines, Data Hazards – Forwarding & Stalling for MIPS Pipeline, Control Hazards – Dynamic Branch Prediction & Delayed Branch for MIPS Pipeline. Superscalar Processors.

UNIT - VI Parallel Organization — 8 Hours

Parallel Organization – Multiprocessors, Multicores & Clusters. Flynn's Taxonomy for Multiple Processor Organizations, Closely and Loosely Coupled Multiprocessors Systems, Symmetric Multiprocessor (SMP) Organization, Multithreading – Fine Grained, Coarse Grained & Simultaneous (SMT) Threading, Chip Multiprocessing, Cluster Configuration, UMA, NUMA & CC-NUMA.
Multicore Architectures – Hardware & Software Issues in Multicore Organization, Multicore Organizations, Intel X86 Multicore Organizations – Core Duo & Core i7.

Text Books

1. W. Stallings, "Computer Organization and Architecture: Designing for Performance", 8^{th} Edition, Prentice Hall of India, 2010, ISBN 13: 978-0-13-607373-4
2. D. Patterson, J. Hennessy, "Computer Organization and Design: The Hardware Software Interface", 4th Edition, Morgan Kaufmann, Oct 2013, ISBN 978-0-12-374750-1

Reference Books

1. C. Hamacher, V. Zvonko, S. Zaky, "Computer Organization", 5th edition, McGraw Hill, 2002, ISBN: 007-120411-3
2. M. Usha, T. S. Srikanth, Computer System Architecture and Organization", Wiley, 2014, ISBN: 978-81-265-2284-2
3. A. S. Tanenbaum "Structured Computer Organization", 4th Edition, Prentice Hall of India, 1991 ISBN: 81–203–1553–7.
4. G. George, "Computer Organization: Hardware and Software", 2nd Edition, Prentice Hall of India, 1986.
5. J. Hays, "Computer Architecture and Organization", 2nd Edition, McGraw-Hill, 1988 ISBN 0–07–100479–3

214443 : DIGITAL ELECTRONICS AND LOGIC DESIGN

Teaching Scheme:	Credits	Examination Scheme:
Lectures: 4 Hours/Week	04	In-Semester (Online): 50 Marks End-Semester: 50 Marks

Prerequisites : Basic Electronics Engineering

Course Objectives :

1. To learn and understand basic digital design techniques.
2. To develop design and implementation skills of combinational and sequentiallogic circuits.
3. To introduce digital logic design software such as VHDL Programming.

Course Outcomes :

1. Spectacle an awareness and apply knowledge of number systems, codes, Boolean algebra and use necessary A.C, D.C Loading characteristics as well as functioning while designing with logic gates.
2. Use logic function representation for simplification with K-Maps and analyze as well as design Combinational logic circuits using SSI & MSI chips.
3. Analyze Sequential circuits like Flip-Flops (Truth Table, Excitation table), their conversion & design the applications.
4. Identify the Digital Circuits, Input/Outputs to replace by FPGA
5. Use VHDL programming technique with different modeling styles for any digital circuits.

Course Contents

UNIT – I NUMBER SYSTEM AND LOGIC FAMILIES **8 Hours**

Introduction to digital electronics & Boolean algebra.
Number Systems - Binary, Octal, Hexadecimal and their conversions.
Signed Binary number representation and Arithmetic's: Signed & True Magnitude, 1's complement, 2's complement representation and arithmetic's.
Codes: BCD, Excess-3, Gray code, Binary Code and their conversion.
Switching characteristics of BJT & FET, IC Characteristics.
TTL: Standard TTL characteristics, Operation of TTL NAND gate, Subfamilies, Configurations-Active pull-up, Wired AND, totem pole, open collector.
CMOS: Standard CMOS characteristics, operation of CMOS NAND, Subfamilies, CMOS configurations Wired Logic, Open drain outputs.
Comparison of TTL & CMOS, Interfacing: TTL to CMOS and CMOS to TTL

UNIT – II COMBINATIONAL LOGIC DESIGN **8 Hours**

Logic minimization: Representation of truth-table, SOP form, POS form, Simplification of logical functions, Minimization of SOP and POS forms, don't care Conditions.
Reduction techniques: K-Maps up to 4 variables and Quine - McClusky technique.
CLC design using SSI chips – Code converters, Half- Adder, Full Adder, Half Subtractor, Full Subtractor, n bit Binary adder, Look ahead carry generator.Magnitude comparator using IC 7485.
Introduction to MSI functions & chips - Multiplexers (IC 74151 and IC 74153), Decoder / Demultiplexer (IC 74138), Encoder (IC 74147), Binary adder (IC 7483).

CLC design using MSI chips – BCD & Excess 3 adder & subtractor using IC 7483, Implementation of logic functions using IC 74151,74153& 74138.

UNIT – III SEQUENTIAL LOGIC **8 Hours**

Introduction to sequential circuits. Difference between combinational circuits and sequential circuits, memory element – latch.

Flip- Flops: Design, truth table, excitation table of SR, JK, D, T flip flops. Study of flip flops with asynchronous and synchronous Preset & Clear, Master Slave configuration, conversion from one type to another type of flip flop. Study of flip flop ICs - 7473, 7474, 7476

Application of flip-flops – Bounce elimination switch, Counters- asynchronous, synchronous and modulo counters study of modulus n counter ICs- 7490, 74191 & their applications to implement mod counters.

UNIT – IV SEQUENTIAL LOGIC DESIGN **8 Hours**

Registers- Buffer register, shift register types - SISO, SIPO, PISO & PIPO, applications of shift registers - ring counter, twisted ring counter, study of universal shift register IC – 74194,

Sequence generators using counters & shift register, Pseudo Random Binary Sequence Generator.

Basic design steps-State diagram, State table, State reduction, State assignment, Mealy and Moore machines representation, Implementation, finite state machine implementation, sequence detector using Moore & Mealy model.

UNIT – V PROGRAMMABLE LOGIC DEVICES AND INTRIDUCTION TO HDL **6 Hours**

Algorithmic State Machines- ASM notations, charts (eg- counters, washing machine, lift controller, vending machine), design using multiplexer controller method (eg- counters).

Introduction to PLD's – ROM, PAL, PLA, Design of 4 variable SOP using PLDs, Basic architecture of SPLD and CPLD, Study of CPLD architecture XC9572, Basic architecture of FPGA, CPLD. Design flow (Basic Concept of Simulation and Synthesis)

Introduction to HDL – Necessity, Characteristics & Types.

UNIT - VI VHDL PROGRAMMING **6 Hours**

Introduction to VHDL - Library, Package, Entity, Architecture, Data Objects (Variable, signal & constant), Data Types (scalar, composite array type & predefined data types, Attributes (necessity and use. 'event attribute). **VHDL Modeling styles –** Dataflow, behavioral & structural

VHDL statements - Concurrent Statements (With. Select, When..Else), Sequential Statements (if..else, case)

VHDL design Examples - Multiplexer, binary adder, counter, shift register.

Text Books

1. "Modern Digital Electronics ", R.P. Jain, 3rd Edition, Tata McGraw-Hill, ISBN: 0–07–049492–4
2. "Fundamentals of Digital Logic with VHDL Design", Stephen Brown, ZvonkoVranesic McGraw-Hill, ISBN: 978–0–07–352953–0

Reference Books

1. "Digital Principles", Flyod, Pearson EducationISBN:978-81- 7758-643-6.
2. "Digital Design", M Morris Mano, Prentice Hall, 3rd Edition, ISBN: 0130621218.
3. "Digital Logic applications and Design", John Yarbrough, Thomson Publication ISBN: 978-0314066756
4. "Digital Principles and Applications", Malvino, D. Leach, 5th edition, Tata McGraw Hill
5. "VHDL Primer", J.Bhaskar, Pearson Education,3rd Edition, ISBN: 0071226249
6. "Switching and Finite Automata Theory", Kohavi Z., Jha N.K,, Cambridge University Press, India, 2nd Edition, ISBN: 978-0-521-85748-2

214444 : FUNDAMENTAL OF DATA STRUCTURES

Teaching Scheme:	Credits	Examination Scheme:
Lectures: 4 Hours/Week	04	In-Semester (Online): 50 Marks End-Semester: 50 Marks

Prerequisites : Fundamental knowledge of 'C' and basics of algorithms

Course Objectives :

1. To learn C language constructs and pointers in depth.
2. To learn algorithm development and analysis of algorithms.
3. To learn linear data structures and their applications
4. To learn different searching and sorting techniques

Course Outcomes :

After successful completion of this course, student will be able to

1. Apply appropriate constructs of C language, coding standards for application development.
2. Use dynamic memory allocation concepts and file handling in various application developments.
3. Perform basic analysis of algorithms with respect to time and space complexity
4. Select appropriate searching and/or sorting techniques in the application development
5. Select and use appropriate data structures for problem solving and programming
6. Use algorithmic foundations for solving problems and programming

Course Contents

UNIT – I C BASICS **6 Hours**

Control structures, arrays, functions and parameter passing Structure and Union, String manipulation, matrix operations.

UNIT – II POINTERS IN C AND FILE HANDLING **9 Hours**

Introduction to Pointers, dynamic memory allocation, pointer to pointer, pointer to single and multidimensional arrays, array of pointers, string and structure manipulation using pointers, pointer to functions. Pointer to file structure and basic operations on file, file handling in C.

UNIT – III INTRIDUCTION TO DATA STRUCTURES AND ANALYSIS OF ALGORITHMS **5 Hours**

Introduction to Data Structures: Concept of data, Data object, Data structure, Abstract Data Types, realization of ADT in 'C'. Concept of Primitive and non-primitive, linear and Non-linear, static and dynamic, persistent and ephemeral data structures.

Analysis of algorithm: frequency count and its importance in analysis of an algorithm, Time complexity & Space complexity of an algorithm, Big 'O', 'Ω' and 'Θ' notations, Best, Worst and Average case analysis of an algorithm.

UNIT – IV SEARCHING AND SORTING TEHNIQUES **7 Hours**

Need of searching and sorting, Concept of internal and external sorting, sort stability. Searching methods: Linear and binary search algorithms their comparison and complexity analysis

Sorting methods: Bubble, selection, insertion, merge, quick, bucket sort and their time and space complexity analysis

UNIT – V LINEAR DATA STRUCTURES USINF SEQUENTIAL ORGANIZATION 8 Hours

Concept of sequential organization, Concept of Linear data structures, Concept of ordered list, Multidimensional arrays and their storage representation: row major and column major form and address calculation. Representation of sparse matrix using arrays, algorithms for sparse matrix addition, simple and fast transpose, polynomial representation using arrays. Analysis of these algorithms. Introduction to Stack and Queue, and their implementation using sequential organization, use of stack in recursion.

UNIT - VI LINEAR DATA STRUCTURES USING LINKED ORGANIZATION 8 Hours

Concept of linked organization, singly linked list, doubly linked list, circular linked list. Linked list as an ADT. Representation and manipulations of polynomials using linked lists, comparison of a sequential and linked memory organization, concept of Generalized Linked List, representation polynomial using GLL.

Text Books

1. E. Horowitz, S. Sahani, S. Anderson-Freed "Fundamentals of Data Structures in C", Universities Press, 2008
2. R. Gilberg, B. Forouzan, "Data Structures: A pseudo code approach with C", Cenage Learning, ISBN 9788131503140.
3. YashwantKanetkar, “Let us C” and “Pointers in C” , BPB Publication

Reference Books

1. R S Bichkar, “Programming with C”, University Press, ISBN 978-81-7371-771-0
2. Dennis Ritchie, Kernighan, “The C Programming Language”, Prentice Hall
3. Treamblay, Sorenson, “An introduction to data structures with applications”, Tata McGraw Hill, Second Edition
4. Seymour Lipschutz, “Data structures with C”, Schaum’s Publication
5. Aaron Tanenbaum, “Data Structures using C”, Pearson Education
6. G. A.V, PAI , “Data structures and Algorithms “, McGraw Hill, ISBN -13: 978-0-07-066726-6
7. Venkatesan, “Data Structures, w/cd”, Wiley, ISBN-9788126553044
8. Langsam,Augenstein, Tenenbaum ,Data Structures Using C and C++, 2e, Pearson Pub.
9. Kamthane, Introduction to Data Structures in C, Pearson Publistion
10. Kruse ,Data Structures and Program Design in C, ISBN, 9788177584233, Pearson Publications,.

214445 : PROBLEM SOLVING AND OBJECT ORIENTED PROGRAMMING

Teaching Scheme:	Credits	Examination Scheme:
Lectures: 4 Hours/Week	04	In-Semester (Online): 50 Marks End-Semester: 50 Marks

Prerequisites : Principles of Programming Languages, Fundamentals of Data Structures

Course Objectives :

1. Employ a problem-solving strategy to breakdown a complex problem into a series of simpler tasks.
2. Execute problem-solving actions appropriate to completing a variety of sub problems.
3. Apply analytical and logical thinking to extract facts from a problem description and determine how they relate to one another and to the problems to be solved.
4. Design and implement an object oriented solution to solve a real life problem.
5. Develop problem-solving and programming skills using OOP concept.

Course Outcomes :

After studying this subject student should be able to

1. Develop algorithms for solving problems by using modular programming concepts
2. Abstract data and entities from the problem domain, build object models and design software solutions using object-oriented principles and strategies
3. Discover, explore and apply tools and best practices in object-oriented programming.
4. Develop programs that appropriately utilize key object-oriented concepts

Course Contents

UNIT – I Problem Solving Concepts **6 Hours**

General Problem Solving Concepts-Types of problems, problems solving with computers, difficulties with problem solving, Problem Solving Aspects, Problem Solving Concepts for computer- constants and variables, data types, functions, operators, expressions and equations, Programming Concepts – communicating with computers, organizing the problem, using the tools, testing the solution, coding the program, Top down design

UNIT – II Problem Solving with Logic Structures **6 Hours**

Programming Structure - modules and their functions, cohesion & Coupling, Local and global variable, parameters, return values, variable names and data dictionaries, four logic structures. Problem solving with sequential logic structure - The sequential logic structure, solution development. Problem Solving with Decisions – decision logic structure, multiple if/then/else instructions, straight-through logic, positive logic, negative logic, logic conversion, decision tables. Problem solving with loops and case logic structures

UNIT – III Foundations of Object Oriented Programming **6 Hours**

Introduction: Introduction to procedural, modular, object-oriented and generic programming techniques, Limitations of procedural programming, Need of object-oriented programming, fundamentals of object-oriented programming: objects, classes, data members, methods, messages, data encapsulation, data abstraction and information hiding, inheritance, polymorphism

++ Extensions to C : Variable declarations, global scope, ‘const’, reference variables, operators in C++(scope resolution, new , delete), dynamic memory allocation, function prototypes, default and constant arguments, ‘cin’, ‘cout’, inline functions

Class: Defining a class, data members and member functions, public, private and protected members, inline member functions, static data members, static member functions, constructors, destructors, array of objects, classes, objects and memory, class as ADTs and code reuse

UNIT – IV Overloading and Inheritance — 8 Hours

Function overloading, friend function, friend class

Operator Overloading : Introduction, Need of operator overloading, rules for operator overloading, overloading the unary and binary operators using member function, operator overloading using friend function, overloading relational and logical operators, overloading new, delete and assignment operator, type conversions

Inheritance : Introduction, Need of inheritance, base and derived classes, member access control, types of inheritance, derived class constructor, constructors in multiple inheritance, overriding member functions, ambiguity in multiple inheritance, virtual base class

UNIT – V Virtual Functions and Templates — 7 Hours

Virtual functions : Pointers to objects, 'this' pointer, Pointers to derived class, virtual function, rules for virtual function, pure virtual function, abstract class, virtual destructors, early and late binding, container classes

Templates : Introduction, Function template and class template, overloading function template, member function templates and template arguments, Introduction to Standard Template Library (STL), containers, iterators and algorithms

UNIT - VI Exception Handling and File I/O — 7 Hours

Namespaces: Introduction, Rules of namespaces

Exception Handling: Introduction, Exception handling mechanism: try, catch and throw, Multiple Exceptions, Exceptions with arguments

Managing Console I/O Operations: Introduction, C++ streams, stream classes, unformatted I/O, formatted I/O and I/O manipulators

File I/O: Introduction, Classes for file stream operations, file operations (open, close, read, write, detect end of file), file modes, File pointers and their manipulations, error handling during file operations

Text Books

1. R G Dromey, "How to Solve it by Computer", Pearson Education, 2008, ISBN-13: 978-8131705629.
2. Maureen Spankle, "Problem Solving and Programming Concepts", Pearson, 2011, ISBN-13**:** 978-0132492645.
3. Robert Lafore, "Object-Oriented Programming in C++", SAMS Techmedia.

Reference Books

1. Joyce Farrell, "Programming Logic and Design", Cengage Learning, ISBN-13: 978-1285776712.
2. E. Balaguruswamy, "Object-oriented Programming with C++", Tata McGraw Hill, 5th edition.
3. Herbert Schildt, "C++: The Complete Reference", McGraw-Hill.
4. Shukla, "Object-Oriented Programming in C++, w/cd", Wiley, ISBN-9788126516582.
5. Kogent, "Object Oriented Programming Methodology", Wiley, ISBN-9789351191841.
6. Venugopal, "Mastering C++", McGraw-Hill, ISBN-9781259029943.

214446 : DIGITAL LABORATORY

Teaching Scheme:	Credits	Examination Scheme:
Practical :2 Hours/Week	01	Term Work : 25 Marks Practical : 50 Marks

Prerequisites: Basic Electronics Engineering

Course Objectives :

1. To learn and understand basic digital design techniques.
2. To learn and understand design and construction of combinational and sequential circuits.
3. To introduce digital logic design software such as VHDL Programming.

Course Outcomes :

After completion of this course student will be able to

1. Spectacle an awareness and apply knowledge and concepts and methods of digital system design techniques as hands-on experiments with the use of necessary A.C, D.C Loading characteristics.
2. Use logic function representation for simplification with K-Maps and analyze as well as design Combinational logic circuits using SSI & MSI chips.
3. Analyze Sequential circuits like Flip-Flops (Truth Table, Excitation table) & design the applications like Asynchronous and Synchronous Counters.
4. Design Sequential Logic circuits: Sequence generators, MOD counters with registers/Counters using synchronous /asynchronous counters.
5. Understand the need of skills, techniques and learn state-of-the-art engineering tools through hands-on experimentation on the Xilinx tools for design as well as the basics of VHDL.
6. Understand and implement the design Steps, main programming technique with different modeling styles for any digital circuits with VHDL Programming.

Guidelines for Instructor's Manual

The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant. The instructor's manual should include prologue, university syllabus, conduction & Assessment guidelines, topics under consideration-concept, objectives, outcomes, data sheets of various ICs, 8051 simulator and references.

Guidelines for Student's Lab Journal

1) The laboratory assignments are to be submitted by student in the form of journal. The Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory-Concept, circuit diagram, pin configuration, conclusion/analysis).
2) Practical Examination will be based on the term work
3) Candidate is expected to know the theory involved in the experiment
4) The practical examination should be conducted if the journal of the student is completed in all respects and certified by concerned faculty and head of the department
5) All the assignment mentioned in the syllabus must be conducted

Guidelines for Lab /TW Assessment

1) Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for

implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.

2) Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out
3) Appropriate knowledge of usage of necessary simulation software and hardware such as ICs, Registers, digital trainer kits, IC tester should be checked by the faculty member

Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications. Use of open source software is encouraged
The guidelines published by BOS time to time regarding conduction of laboratory assignments and Practical/Oral examination is mandatory.

Guidelines for Practical Examination

Both internal and external examiners should jointly set problem statements for practical examination. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at the time of evaluation to judge the student‘s understanding of the fundamentals, effective and efficient implementation. The evaluation should be done by both external and internal examiners.

Suggested List of Laboratory Assignments

Group A

Combinational Logic Design

1. Design (truth table, K-map) and implementation of 4-bitBCD to Excess-3 and Excess-3 to BCD Code converters.
2. Design (truth table, K-map) and implementation of 4 bit BCD & Excess 3 Adder using IC7483.
3. Implementation of logic functions using multiplexer IC 74153 & decoder IC 74138. (Verification, cascading & logic function implementation)

Group B

Sequential Logic Design

1. Design (State diagram, state table & K map) and implementation of 3 bit Up and Down Asynchronous and Synchronous Counter using master slave JK flip-flop IC 7476
2. Design and implementation of Module ‘n’ counter with IC7490 and IC 74191.
3. Design (State Diagram, State Table, K Map) and implementation of Sequence Generator using Shift Register IC 74194.

Group C

VHDL Programming

Simulation of

1. 4:1 multiplexer using data flow & structural modeling.
2. Full adder using behavioral & structural modeling.
3. 3 bit controlled up / down synchronous counter with preset & clear

Group D

Design, construct digital logic circuits and analyze their behavior through simulation of any one assignment from either Group A or Group B with simulation software like Digital Works 3.0

Student should submit term work in the form of a journal based on the above assignments (Group A,Band C). Practical examination will be based on the term work. Questions will be asked during the examination to judge the understanding of the practical performed in the examination. Candidate is expected to know the theory involved in the experiment.

Note - Instructor should take care that datasheets of all the required ICs are available in the laboratory & students are verifying the functionality of ICs being used.

Reference Books

1. R.P. Jain, "Modern Digital Electronics", 3rd Edition,Tata McGraw-Hill, ISBN: 0-07-049492-4
2. Stephen Brown, Zvonko Vranesic, "Fundamentals of Digital Logic with VHDL Design", McGraw-Hill, ISBN: 978-0-07-352953-0
3. John Yarbrough, "Digital Logic applications and Design", Thomson Publication, ISBN: 978-0314066756

214447 : PROGRAMMING LABORATORY

Teaching Scheme:	Credits	Examination Scheme:
Practical: 4 Hours/Week	02	Term Work: 25 Marks Practical : 50 Marks

Prerequisites:

1. Fundamentals of programming languages

Course Objectives :

1. To learn C language constructs and pointers in depth.
2. To learn algorithm development and analysis of algorithms.
3. To learn linear data structures and their applications
4. To learn different searching and sorting techniques

Course Outcomes :

After successful completion of this course, student will be able to

1. Apply appropriate constructs of C language, coding standards for application development.
2. Use dynamic memory allocation concepts and file handling in various application developments.
3. Perform basic analysis of algorithms with respect to time and space complexity
4. Select appropriate searching and/or sorting techniques in the application development
5. Select and use appropriate data structures for problem solving and programming
6. Use algorithmic foundations for solving problems and programming

Guidelines for Instructor's Manual

The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant. The instructor's manual should include prologue, university syllabus, conduction & Assessment guidelines, topics under consideration-concept, objectives, outcomes, algorithm written in pseudo language, sample test cases and references.

Guidelines for Student's Lab Journal

1) The laboratory assignments are to be submitted by student in the form of journal. The Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory-Concept, algorithms, printouts of the code written using coding standards, sample test cases etc.
2) Practical Examination will be based on the term work
3) Candidate is expected to know the theory involved in the experiment
4) The practical examination should be conducted if the journal of the candidate is completed in all respects and certified by concerned faculty and head of the department
5) All the assignment mentioned in the syllabus must be conducted

Guidelines for Lab /TW Assessment

1) Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.
2) Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out
3) Appropriate knowledge of usage of software and hardware such as compiler, debugger, coding standards, algorithm to be implemented etc. should be checked by the concerned faculty member(s)

Guidelines for Laboratory Conduction

1) The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications.
2) The guidelines published by BOS time to time regarding conduction of laboratory assignments and Practical/Oral examination is mandatory.
3) All the assignments should be conducted on multicore hardware and 64-bit open-source software

Guidelines for Practical Examination

Both internal and external examiners should jointly set problem statements for practical examination. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at the time of evaluation to judge the student‘s understanding of the fundamentals, effective and efficient implementation. The evaluation should be done by both external and internal examiners.

Suggested List of Laboratory Assignments

1. Represent sets using one dimensional arrays and implement functions to perform
   i. Union
   ii. Intersection
   iii. Difference
   iv. Symmetric difference of two sets
2. Represent matrix using two dimensional arrays and perform following operations **with and without pointers**:
   i. Addition
   ii. multiplication
   iii. transpose
   iv. Saddle point
3. Implement following operations on string **with / without pointers (without using library functions)**
   i. Length
   ii. Palindrome

    iii. String comparison
    iv. Copy
    v. Reverse
    vi. Substring
4. Create a Database using array of structures and perform following operations on it:
    i. Create Database
    ii. Display Database
    iii. Add record
    iv. Search record
    v. Modify record
    vi. Delete record
5. a) Sort the set of strings in ascending order using Bubble sort and descending order by using Selection sort or Insertion sort. (Display pass by pass output)
   b) Search a particular string using binary search **with and without recursion.**
6. Implement sequential file and perform following operations:
    i. Display
    ii. Add records
    iii. Search record
    iv. Modify record
    v. Delete record
7. Implement Quick Sort / **Merge Sort** to sort the given list of numbers. Display corresponding list in each pass. (with and without recursion)
8. Accept conventional matrix and convert it into sparse matrix using structure and perform **addition**, simple and fast transpose
9. Implement a singly linked list with following options
    i. Insertion of a node at any location
    ii. Deletion of a node from any location
    iii. display a list
    iv. Display in reverse
    v. Reverse the list without using additional data structure.
10. Implement polynomial using CLL and perform
    i. Addition of Polynomials
    ii. Multiplication of polynomials and
    iii. Evaluation of polynomial
11. Implement any database using doubly linked list with following options
    i. Insert a record
    ii. delete a record
    iii. modify a record
    iv. Display list forward
    v. Display list backward
12. Implement Generalized Linked List to create and display the book index.

Note:

1. For all programs implementations students are expected to use meaningful identifiers, proper indentation, use of functions, minimal use of global variables and writing time complexity using any one notation is mandatory.
2. Student should submit term work in the form of a journal based on the above assignments.
3. Practical examination will be based on the term work.
4. Questions will be asked during the examination to judge the understanding of the practical performed in the examination.
5. Candidate is expected to know the theory involved in the experiment.
6. Students are expected to implement at least 3 test cases for each assignment.

Note: This list of assignments is indicative. Concerned faculty member may frame different assignments if required maintaining similar difficulty level.

Reference Books

1. E. Horowitz, S. Sahani, S. Anderson-Freed "Fundamentals of Data Structures in C", Universities Press, 2008
2. R. Gilberg, B. Forouzan, "Data Structures: A pseudo code approach with C", Cenage Learning, ISBN 9788131503140.
3. Yashwant Kanetkar, “Let us C” and “Pointers in C” , BPB Publication

214448 : OBJECT ORIENTED PROGRAMMING LABORATORY

Teaching Scheme:	Credits	Examination Scheme:
Practical :2 Hours/Week	01	Term Work : 25 Marks Practical : 50 Marks

Prerequisites : Principles of Programming Languages, Fundamentals of Data Structures

Course Objectives :

1. Employ a problem-solving strategy to breakdown a complex problem into a series of simpler tasks.
2. Execute problem-solving actions appropriate to completing a variety of sub problems.
3. Apply analytical and logical thinking to extract facts from a problem description and determine how they relate to one another and to the problems to be solved.
4. Design and implement an object oriented solution to solve a real life problem.
5. Develop problem-solving and programming skills using OOP concept.

Course Outcomes :

After studying this subject student should be able to

1. Develop and implement algorithms for solving simple problems using modular programming concept.
2. Abstract data and entities from the problem domain, build object models and design software solutions using object-oriented principles and strategies.
3. Discover, explore and apply tools and best practices in object-oriented programming.
4. Develop programs that appropriately utilize key object-oriented concepts
5. Create a data base using files

Guidelines for Instructor's Manual

The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant. The instructor's manual should include prologue, university syllabus, conduction & Assessment guidelines, topics under consideration-concept, objectives, outcomes, algorithm written in pseudo language, sample test cases and references.

Guidelines for Student's Lab Journal

1) The laboratory assignments are to be submitted by student in the form of journal. The Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory-Concept, algorithms, printouts of the code written using coding standards, sample test cases etc.
2) Practical Examination will be based on the term work submitted by the student in the form of journal
3) Candidate is expected to know the theory involved in the experiment
4) The practical examination should be conducted if the journal of the candidate is completed in all respects and certified by concerned faculty and head of the department
5) All the assignment mentioned in the syllabus must be conducted

Guidelines for Lab /TW Assessment

1) Examiners will assess the term work based on performance of students considering the

parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.

2) Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out
3) Appropriate knowledge of usage of software and hardware such as compiler, debugger, coding standards, algorithm to be implemented etc. should be checked by the concerned faculty member(s)

Guidelines for Laboratory Conduction

1) The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications.
2) The guidelines published by BOS time to time regarding conduction of laboratory assignments and Practical/Oral examination is mandatory.
3) All the assignments should be conducted on multicore hardware and 64-bit open-source software

Guidelines for Practical Examination

Both internal and external examiners should jointly set problem statements for practical examination. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at the time of evaluation to judge the student‘s understanding of the fundamentals, effective and efficient implementation. The evaluation should be done by both external and internal examiners.

Suggested List of Laboratory Assignments

1. Create a class named weather report that holds a daily weather report with data members day_of_month, hightemp, lowtemp,a mount_rain and amount_snow. Use different types of constructors to initialize the objects. Also include a function that prompts the user and sets values for each field so that you can override the default values.
   Write a menu driven program in C++ with options to enter data and generate monthly report that displays average of each attribute.
2. A Book shop maintains the inventory of books that are being sold at the shop. The list includes details such as title, author, publisher, price and available stock.
   Write a program in C++ which will have a class called books with suitable member functions for
   i. Add
   ii. Update
   iii. Search a book
   iv. Purchase a book (update the stock and display the total cost)
   v. Record number of successful/unsuccessful transactions (use static data members to keep count of transactions)

   Use new operator in constructors to allocate memory space required.
3. Design a class ‘Complex ‘with data members for real and imaginary part. Provide default and

parameterized constructors. Write a program to perform arithmetic operations of two complex numbers using operator overloading.

i. Addition and subtraction using friend functions
ii. Multiplication and division using member functions

4. Design a base class with name, date of birth, blood group and another base class consisting of the data members such as height and weight. Design one more base class consisting of the insurance policy number and contact address. The derived class contains the data members' telephone numbers and driving license number.
   Write a menu driven program to carry out the following things:
   i. Build a master table ii. Display iii. Insert a new entry
   iv. Delete entry v. Edit vi. Search for a record

5. Create a base class shape with two double type values and member functions to input the data and compute_area() for calculating area of figure. Derive two classes' triangle and rectangle. Make compute_area() as a virtual function and redefine this function in the derived class to suit their requirements.
   Write a program that accepts dimensions of triangle/rectangle and display calculated area.

6. Write a program in C++ which includes the code for following operations :
   i. A function to read two double type numbers from keyboard
   ii. A function to calculate the division of these two numbers
   iii. A try block to detect and throw an exception if the condition "divide-by-zero" occurs
   iv. Appropriate catch block to handle the exceptions thrown

7. Write a program in C++ using function/class template to read two matrices of different data types such as integers and floating point values and perform simple arithmetic operations on these matrices separately and display it.

8. Write a program in C++ to implement sequential file for students' database and perform following operations on it
   i) Create Database
   ii) Display Database
   iii) Add a record
   iv) Delete a record
   v) Modify a record

9. Create employee bio-data using following classes i) Personal record ii))Professional record iii) Academic record Assume appropriate data members and member function to accept required data & print bio-data. Create bio-data using multiple inheritance using C++

10. Write a C++ program that creates an output file, writes few records into it, closes the file and open it again as an input file and read the information from the file

Note:

While performing the assignments following care should be taken

1. Proper indenting, coding styles, commenting, naming conventions should be followed.
2. Avoid using global variables as far as possible
3. Faculty should prepare a lab manual including standard test cases & should be available for reference to students.

4. Student should submit term work in the form of a journal based on the above assignments.
5. Practical examination will be based on the term work. Questions will be asked during the examination to judge the understanding of the practical performed at the time of examination.
6. Candidate is expected to know the theory involved in the experiment.

Note: This list of assignments is indicative. Concerned faculty member may frame different assignments if required maintaining similar difficulty level.

Reference Books

1. Robert Lafore, "Object-Oriented Programming in C++", SAMS Techmedia.
2. E. Balaguruswamy, "Object-oriented Programming with C++", Tata McGraw Hill, 5th edition.
3. Shukla, "Data Structures using C & C++", Wiley, ISBN-9788126519972.

214449 : COMMUNICATION SKILLS

Teaching Scheme:	Credits	Examination Scheme:
Practical :2 Hours/Week	01	Term Work : 25 Marks

Prerequisites: Basic knowledge of English Language

Course Objectives :

1. Improve students' overall linguistic & communicative competence in English
2. Enhance their pronunciation, vocabulary and LSRW skills
3. Foster their confidence in public speaking and group communication skills

Course Outcomes :

After successful completion of this course, student will be able to

1. Provides an ability to understand, analyze and interpret the essentiality of grammar and its proper usage.
2. Build the students' vocabulary by means of communication via web, direct Communication and indirect communication.
3. Improves Students' Pronunciation skills and understanding between various phonetic sounds during communication.
4. Understanding the various rules and means of written communication.
5. Effective communication with active listening, facing problems while communication and how to overcome it.

Course Contents

Overview

The course has been designed for the students of second year Information Technology for enhancing their linguistic and communicative competence. It attempts to give them exposure to the essential linguistic and communication skills by focusing upon the key areas of immediate significance. Students will also be given a theoretical knowledge through lectures about the fundamental concepts in the English language & communication such as grammar, vocabulary, pronunciation and LSRW skills. At the same time adequate practical exposure to these skills will be provided through laboratory sessions. The course aims at striking a fine balance between theory and practice to ensure the all-round improvement of students in these skills. Students will be able to improve their command over communicative English which will enable them to enhance their academic performance and will contribute to their growth as engineering professionals.

Teaching Methodology in the Language Laboratory

1. Direct Method – Use of English for communication between the teacher and students. Teachers must emphasize on the use of English in the lab. All the instructions and Interactions must be given in English.
2. Theory lectures should also be interactive and the teacher should encourage students' participation in the classroom sessions.
3. Laboratory sessions should be activity based and should be conducted in groups and pairs. Guidelines for conducting laboratory sessions have been given below each activity.

Unit I: ESSENTIAL GRAMMAR AND PHONETICS (5 hrs)

Tenses: Basic forms and use, sentence formation (general & Technical), Common errors, Parts of speech through context, Direct and reported speech structures and voices, stress & intonation, voice modulation, exercises on pronunciation, use of software for exercises on pronunciation.

Activities:-

- The class of students will always have some students with adequate knowledge of basic grammar and rest with no/poor knowledge.
- The basic grammar exercises can be taught by giving students sentences in their mother tongue and telling them to convert it to English thereby covering parts of speech, tenses, voices, etc
- The students with acceptable understanding of grammar can be engaged in some advanced grammar exercises like the ones in 'word power made easy' or any online exercises mentioned in the references below.
- For intonation, voice modulation, videos by decent orators /movie clips can be shown to the students.
- For pronunciation, exercises based on Homonyms, homophones can be conducted.

Unit II: VOCABULARY ENRICHMENT (5 hrs)

Exposure to words from General Service List (GSL) by West, Academic word list (AWL) by Averil Coxhead (2000) and specific technical terms related to the field of Information technology. Phrases, idioms, proverbs, significant abbreviations, formal (business) vocabulary.

Activities:-

- Students should be given 10 idioms, proverbs and phrases each and should be told to form story using them.
- Students can be divided into teams. Each team should be told to find out 10 new words/phrases the meanings of which should be discussed in the lab. This exercise can be repeated in the last 10 minutes of each lab session so as to add to the students' vocabulary.

Unit III: WRITING SKILLS

Letter Writing - Business letters, Application letters, Covering letters, Report Writing -Academic and Business reports, Technical Project writing, Job application letter and Resume writing

Activities:- students should be made to write letters in formal and informal way like letters, resume, technical report writing.

Unit IV: LISTENING SKILLS (5 hrs)

Types of listening, Levels of Listening, Listening Barriers, Listening Ethics, activities to strengthen students' listening skills

Activity:-Chinese whisper

Audio activity:-students should listen to any audio and try to answer question based on that audio.

Unit V: READING SKILLS

Definition, need for reading Skills, techniques for reading, how to develop fluency in Reading.

Lab Activities:

Students can be given some text to read and answer questions related to that text.

Students can be made to read a passage aloud and others can be asked questions based on the passage read.

Unit VI: SPEAKING SKILLS

Difference between talking and Speaking, Attributes /characteristics of public speaking, barriers to effective speaking, Types of speaking: Technical and Non-Technical speaking.

Activities:

- **Prepared speech** (topics are given in advance, students get 10 minutes to prepare the speech and 5 minutes to deliver.
- **Extempore speech (**students deliver speeches spontaneously for 5 minutes each on a given topic)
- **Story telling** (Each student narrates a fictional or real life story for 5 minutes each)
- **Oral review** (Each student orally presents a review on a story or a book read by them)

2. Power-point Presentations

Students should make a presentation on any informative topic of their choice. The topic may be technical or non-technical

3. Formal Group Discussion

Each batch is divided into two groups of 12 to 14 students each. Two rounds of a GD for each group should be conducted and teacher should give them feedback.

4. Mock Meetings

In order to enhance students' formal oral communication, mock meetings can be conducted. Teacher should give a topic for the meeting and teach students how a notice and agenda for a meeting is prepared. Students will participate in the meeting assuming the roles assigned by the teacher. After the meeting, teacher should guide students on how minutes of meeting are recorded.

6. Reading and Listening skills

The batch can be divided into pairs. Each pair will be given an article (any topic) by the teacher. Each pair would come on the stage and read aloud the article one by one. After reading by each pair, the other students will be asked questions on the article by the readers. Students will get marks for correct answers and also for their reading skills. This will evaluate their reading and listening skills. The teacher should give them guidelines on improving their reading and listening skills.

7. Pronunciation through software or web-based applications

Teachers should make use of software and web-based applications for giving exercises on pronunciation to students.

8. Vocabulary exercises through web-based applications

Teachers should make use of software and web-based applications for giving exercises on vocabulary to students.

9. Letter, Report & review writing

Each student will write one formal letter, one report and a review on the topics given by the teacher.

10. Grammar exercises through web-based applications

Teachers should make use of software and web-based applications for giving exercises on grammar to students. The term work shall consist of 10 activities carrying 10 marks each. The total marks earned by the students out of 100 will be scaled down to 50. The online exam and term work marks will be further scaled down to 50. Students will have to submit journals or files containing record of each activity performed in laboratory, at the term end.

References

1. Rutherford A. J., " Communication skills for Technical Communication", Pearson Education
2. Meenakshi Raman, Sangeeta Sharma, "Technical Communication – Principles and practice", Oxford
3. Kishna Mohan, "Developing Communications Skills", MacMillan Publishers, 2nd Edition
4. M.S. Rao, " Strategies for improving your business communication", SPD
5. Murphy, " Essential English Grammar", Cambridge
6. Duttet.al, " A course in Communication Skills", Foundation Books
7. Priyadarshani Patnaik, " Group Discussion and Interview Skills", 1st edition, Foundation Books
8. Peter Roach, " English Phonetics and Phonology", 4th Edition, Cambridge

9. Lynch, “ listening”,, Cambridge
10. Malcom Goodale, “ Professional Presentations”, Cambridge
11. Ham-Lyons & Heasley, “Writing”, 2nd Edition, Cambridge
12. “Idioms and proverbs are fun”, Wilco books(author)
13. Whitbeck, “ Ethics in Engineering Practice and Research”, Cambridge, ISBN-9780521897976
14. Chauhan, “Soft Skills: An Integrated Approach to Maximize”, Wiley, ISBN-9788126556397
15. Mishra, “Communication Skills for Engineers”, 2e, ISBN – 9788131733844, Pearson

ESL Sites (Web-based applications) for vocabulary learning

1. http://www.nottingham.ac.uk/%7Ealzsh3/acvocab/awlhighlighter.htm
2. http://www.visuwords.com/
3. http://www.vocabulary.com/
4. http://www.uefap.com/vocab/exercise/exercise.htm
5. www.englishvocabularyexercises.co

Guidelines for Student's Lab Journal

1) Student should submit term work in the form of journal which should include handwritten Write-up, printouts of the code written using coding standards, sample test cases, etc.
2) Term Work assessment will be based on the term work
3) The Term of the candidate should be granted if journal of the candidate is completed in all respects and certified by concerned faculty and head of the department
4) All the assignment mentioned in the syllabus must be conducted

Guidelines for Lab /TW Assessment

1) Faculty will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.
2) Faculty will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out
3) Appropriate knowledge of usage of software and hardware such as Word, Powerpoint, knowledge of different aspects of the communication mentioned in the syllabus etc. should be checked by the concerned faculty member(s)

Guidelines for Laboratory Conduction

1) The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications.

2) The guidelines published by BOS time to time regarding conduction of laboratory assignments and Term Work assessment are mandatory.

Audit Course1

In addition to credits course, it is recommended that there should be audit course (non-credit course) preferably in each semester from second year. The student will be awarded grade as AP on successful completion of audit course. The student may opt for one of the audit courses per semester, starting in second year first semester. Though not mandatory, such audit courses can help the student to get awareness of different issues which make impact on human lives and enhance their skill sets to improve their employability. List of audit courses offered in each semester is provided in curriculum. Each student has to choose one audit course from the list per semester. Evaluation of audit course will be done at institute level. Method of conduction and method of assessment for audit courses is suggested.

The student registered for audit course shall be awarded the grade AP and shall be included such grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory in-semester performance and secured a passing grade in that audit course. No grade points are associated with this 'AP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA. Evaluation of audit course will be done at institute level itself.

(Ref-http://www.unipune.ac.in/Syllabi_PDF/revised-2015/engineering/
UG_RULE_REGULATIONS_FOR_CREDIT_SYSTEM-2015_18June.pdf)

Guidelines for Conduction and Assessment (Any one or more of following but not limited to)

- Lectures/ Guest Lectures
- Visits (Social/Field) and reports
- Demonstrations
- Surveys
- Mini Project
- Hands on experience on specific focused topic

Guidelines for Assessment (Any one or more of following but not limited to)

- Written Test
- Demonstrations/ Practical Test
- Presentations
- IPR/Publication
- Report

List of courses under Audit Course1

Course Code	**Audit Course Title**
210250:AC1-I	Road Safety
210250:AC1-II	Humanities and Social Sciences
210250:AC1-III	Environmental Studies
210250:AC1-IV	Smart Cities

The detail course contents of above mentioned audit courses are available in Computer Engineering 2015 course syllabus.

Moreover students can opt for any other audit course from the list of Audit Course of any branch of engineering.

SEMESTER - II

207003 : ENGINEERING MATHEMATICS – III (Information Technology/Computer Engineering)

Teaching Scheme:	Credits	Examination Scheme:
Lectures: 4 Hours/Week	05	In-Semester (Online): 50 Marks
Tutorial: 1 Hour/Week		End-Semester: 50 Marks
		Term Work – 25 Marks

Prerequisites :

Differential and Integral Calculus, Taylor series and Infinite series, Differential equations of first order and first degree, Fourier series, Measures of Central tendency and dispersion, Vector algebra, Algebra of complex numbers.

Course Objectives :

After completing this course, students will have adequate mathematical background, conceptual clarity, computational skills and algorithm design for problem solving related to:

1. Linear differential equations of higher order applicable to Control systems, Computer vision, and Robotics.
2. Transform techniques such as Fourier transform, Z-transform and applications to Image processing.
3. Statistical methods such as correlation, regression analysis and probability theory to analyze data and to make predictions applicable to machine intelligence.
4. Vector calculus necessary to analyze and design complex electrical and electronic devices as appropriate to Computer engineering.
5. Complex functions, conformal mappings and contour integration applicable to Image processing, Digital filters and Computer graphics.

Course Outcomes :

At the end of this course, students will be able to:

1. Solve higher order linear differential equation using appropriate techniques for modeling and analyzing electrical circuits.
2. Solve problems related to Fourier transform, Z-Transform and applications to Signal and Image processing.
3. Apply statistical methods like correlation, regression analysis and probability theory for analysis and prediction of a given data as applied to machine intelligence.
4. Perform vector differentiation and integration to analyze the vector fields and apply to compute line, surface and volume integrals.
5. Analyze conformal mappings, transformations and perform contour integration of complex functions required in Image processing, Digital filters and Computer graphics.

Course Contents

UNIT – I Linear Differential Equations (LDE) and Applications — 9 Hours

LDE of n^{th} order with constant coefficients, Method of variation of parameters, Cauchy's & Legendre's DE, Simultaneous & Symmetric simultaneous DE. Modeling of Electrical circuits.

UNIT – II Transforms — 9 Hours

Fourier Transform (FT): Complex exponential form of Fourier series, Fourier integral theorem, Fourier Sine & Cosine integrals, Fourier transform, Fourier Sine and Cosine transforms and their inverses, Discrete Fourier Transform.

Z - Transform (ZT): Introduction, Definition, Standard properties, ZT of standard sequences and their inverses. Solution of difference equations.

UNIT – III Statistics **9 Hours**

Measures of central tendency, Standard deviation, Coefficient of variation, Moments, Skewness and Kurtosis, Curve fitting: fitting of straight line, parabola and related curves, Correlation and Regression, Reliability of Regression Estimates.

UNIT – IV Probability and Probability Distributions **9 Hours**

Probability, Theorems on Probability, Bayes Theorem, Random variables, Mathematical Expectation, Probability density function, Probability distributions: Binomial, Poisson, Normal and Hypergeometric, Test of Hypothesis: Chi-Square test, t-distribution.

UNIT – V Vector Calculus **9 Hours**

Vector differentiation, Gradient, Divergence and Curl, Directional derivative, Solenoidal and Irrotational fields, Vector identities. Line, Surface and Volume integrals, Green's Lemma, Gauss's Divergence theorem and Stoke's theorem.

UNIT - VI Complex Variables **9 Hours**

Functions of Complex variables, Analytic functions, Cauchy-Riemann equations, Conformal mapping, Bilinear transformation, Cauchy's integral theorem, Cauchy's integral formula, Laurent's series, and Residue theorem.

Text Books

1. Advanced Engineering Mathematics, 9e, by Erwin Kreyszig (Wiley India).
2. Advanced Engineering Mathematics, 7e, by Peter V. O'Neil (Cengage Learning).

Reference Books

1. Advanced Engineering Mathematics, 2e, by M. D. Greenberg (Pearson Education).
2. Advanced Engineering Mathematics, Wylie C.R. & Barrett L.C. (McGraw-Hill, Inc.)
3. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi).
4. Applied Mathematics (Volumes I and II) by P. N. Wartikar& J. N. Wartikar (Pune Vidyarthi Griha Prakashan, Pune).
5. Higher Engineering Mathematics by B.V. Ramana, Tata McGraw-Hill
6. Advanced Engineering Mathematics with MATLAB, 2e, by Thomas L. Harman, James abney and Norman Richert (Brooks/Cole, Thomson Learning)

Guidelines for Tutorial and Term Work

i. Tutorial shall be engaged in four batches (batch size of 20 students maximum) per division
ii. Term work shall be based on continuous assessment of six assignments (one per each unit) and performance in internal tests

214450 : COMPUTER GRAPHICS

Teaching Scheme:	Credits	Examination Scheme:
Lectures: 3 Hours/Week	03	In-Semester (Online): 50 Marks End-Semester: 50 Marks

Prerequisites:

1. Basic Geometry, Trigonometry, Vectors and Matrices
2. Basics of Data Structures and Algorithms

Course Objectives :

1. To acquaint the learners with the basic concepts of Computer Graphics
2. To learn the various algorithms for generating and rendering graphical figures
3. To get familiar with mathematics behind the graphical transformations
4. To understand and apply various methods and techniques regarding projections, animation, shading, illumination and lighting

Course Outcomes :

On completion of the course, learner will be able to –

1. Apply mathematics and logic to develop Computer programs for elementary graphic operations
2. Develop scientific and strategic approach to solve complex problems in the domain of Computer Graphics
3. Develop the competency to understand the concepts related to Computer Vision and Virtual reality
4. Apply the logic to develop animation and gaming programs

Course Contents

UNIT – I BASIC CONCEPTS **8 Hours**

Introduction to Computer Graphics, Basics of graphics systems, Raster scan & Random scan displays, basic display processor

Display Files: display file structure, algorithms and display file interpreter. Primitive operations on display file

Plotting Primitives: Scan conversions, lines, line segments, vectors, pixels and frame buffers, vector generation

Line drawing Algorithms: DDA, Bresenham

Circle drawing Algorithms: - DDA, Bresenham

Character Generation: Stroke Principle, Starburst Principle, Bit map method, Introduction to aliasing and anti-aliasing

UNIT – II POLYGONS AND GRAPHICAL TRANSFORMATIONS **6 Hours**

Polygon and its types, inside test, polygon filling methods: Seed fill, Scan Line, Flood fill and Boundary fill

2D Geometric Transformations - translation, scaling, rotation, other transformations such as reflection, shearing, matrix representation and homogeneous coordinate system, Composite transformations

UNIT – III 3D TRANSFORMATIONS AND PROJECTIONS 6 Hours

Translation, scaling, rotation, rotation about X, Y, Z and arbitrary axis reflection about XY, YZ, XZ and arbitrary plane.

Projections: Types Parallel - Oblique: Cavalier, Cabinet and orthographic :Isometric, Dimetric, Trimetric and Perspective - Vanishing Points as 1 point, 2 point and 3 point

UNIT – IV SEGMENTS, WINDOWING AND CLIPPING 6 Hours

Segment: Introduction, Segment table, Segment creation, closing, deleting and renaming, Visibility

Windowing: Concept of window and viewport, viewing transformations

Line Clipping: Cohen Sutherland Method, Midpoint subdivision method

Polygon Clipping : Sutherland Hodgman method for clipping convex and concave polygons

UNIT – V SHADING, ANIMATION AND GAMING 6 Hours

Shading: Halftoning, Gouraud and Phong Shading

Computer Animation: Animation sequences, functions & Languages, Key-frame Systems, Motion Specifications.

Gaming platforms: Graphics Memory Pipeline, Block diagram of NVIDIA workstation and i860

Introduction to OpenGL ES

UNIT - VI CURVES AND FRACTALS 6 Hours

Introduction, Curve generation, Interpolation, interpolating algorithms, interpolating polygons, B-Splines and corners, Bezier curves, Fractals, fractal lines and surfaces

Interactive Graphics & usage of the tools of computer graphics – 3D Studio and Maya

Text Books

1. S. Harrington, “Computer Graphics”, 2nd Edition, McGraw-Hill Publications, 1987, ISBN 0 – 07 – 100472 – 6.
2. D. Rogers, “Procedural Elements for Computer Graphics”, 2nd Edition, Tata McGraw-Hill Publication, 2001, ISBN 0 – 07 – 047371 – 4.

Reference Books

1. J. Foley, V. Dam, S. Feiner, J. Hughes, “Computer Graphics Principles and Practice”, 2nd Edition, Pearson Education, 2003, ISBN 81 – 7808 – 038 – 9.
2. D. Hearn, M. Baker, “Computer Graphics – C Version”, 2nd Edition, Pearson Education, 2002, ISBN81 – 7808 – 794 – 4.
3. D. Rogers, J. Adams, “Mathematical Elements for Computer Graphics”, 2nd Edition, Tata McGraw-Hill Publication, 2002, ISBN 0 – 07 – 048677 – 8.
4. Zhigang Xiang, Roy Plastock, “Computer Graphics”, Schaum’s Series outlines
5. Shirley, Marschner, “Fundamentals of Computer Graphics”, Third Ed, A K Peters SPD
6. F.S. Hill JR, “Computer Graphics Using Open GL”, Pearson Education
7. D.P. Mukharjee, Debasish Jana, “Computer Graphics Algorithms and implementation”, PHI Learning
8. Samuel R. Buss, “3D Computer Graphics”, Cambridge University Press
9. Mario Zechner, Robert Green, “Beginning Android 4 Games Development”, Apress, ISBN: 978-81-322-0575-3
10. Maurya, “Computer Graphics with Virtual Reality Systems, 2ed.”, Wiley, ISBN-9788126550883
11. Foley, “Computer Graphics: Principles & Practice in C”, 2e, ISBN 9788131705056, Pearson Edu.

214451 : PROCESSOR ARCHITECTURE AND INTERFACING

Teaching Scheme:	Credits	Examination Scheme:
Lectures: 4 Hours/Week	04	In-Semester (Online): 50 Marks End-Semester: 50 Marks

Prerequisites : Computer Organization & Architecture

Course Objectives :

1. To study architecture and features of 80386 microprocessors and 8051 microcontroller
2. To learn design of minimum system using 8051 micro-controller.

Course Outcomes :

After successful completion of this course, student will be able to

1. Learn architectural details of 80386 microprocessor
2. Understand memory management and multitasking of 80386 microprocessor
3. Understand architecture and memory organization of 8051microcontroller
4. Explain timers and interrupts of 8051 microcontroller and its interfacing with I/O devices

Course Contents

UNIT – I INTRODUCTION TO ASSEMBLY LANGUAGE PROGRAMMING & 80386 PROCESSOR **8 Hours**

Introduction to assembly language programming, ALP tools- Assembler, Linker, Loader, Debugger, Emulator, Assembler directives, Far and near procedure, Macros, DOS Internals, DOS Calls.

80386 - Features and Architecture, Register Set, 80386 Real mode segmentation and Address translation, Addressing modes, Instruction set.

UNIT – II 80386 MEMORY MANAGEMENT **8 Hours**

Pin Description of 80386, 16/32-bit data transfer mechanism, Pipelined & Non pipelined bus cycles.

Segmentation - support registers and Data structures, Descriptors, Memory management through segmentation, Logical to linear/physical address translation.

Privileged instructions, Protection in segmentation, Inter-privilege level transfer using Call gates and confirming code segment.

UNIT – III 80386 – PRIVILEGE PROTECTION, MULTITASKING & INTERRUPTS, EXCEPTIONS **8 Hours**

Paging - support registers and Data structures, Descriptors, Linear to physical address translation, Page level protection.

Multitasking - Support registers and Data structures, Descriptors, Task switching.

Real and Protected mode Interrupt structure - IVT, IDT, Type of exceptions and Processing.

UNIT – IV INTRODUCTION TO 8051 MICROCONTROLLER **8 Hours**

Difference between microprocessor and microcontroller, 8051 microcontroller - Features, Architecture, Pin Description.

On-Chip data memory and program memory organization - Register set, Register bank and Special Function Registers (SFRs).

Addressing modes, Instruction set. External data memory and program memory organization.

UNIT – V PORTS, INTERRUPTS & TIMERS/COUNTERS OF 8051 8 Hours

I/O ports programming - Structures, Related SFRs and Configuration.
Interrupt programming - Structure and Response, Related SFRs and Configuration.
Timers/counters programming - Structure, Related SFRs, Operating modes, Delay calculations and Configuration.
Serial port programming - Related SFRs, Operating modes, Baud rate calculation and Configuration.

UNIT - VI 8051 INTERFACING & APPLICATIONS 8 Hours

PPI 8255 – Features, Architecture, Operating modes & Programming.
Interfacing of displays: LED, LCD, Seven segments.
Keyboard Interfacing, Interfacing of ADC and DAC, Interfacing of stepper motor, Interfacing of Sensors (temperature, pressure), External data memory and program memory interfacing, Design of minimum system using 8051 micro-controller for various applications.

Text Books

1. James Turley, "Advanced 80386 Programming Techniques", McGraw Hill Education.
2. M. A. Mazidi, J. G. Mazidi, "The 8051 Microcontroller and Embedded Systems", Pearson Education

Reference Books

1. Walter A. Tribel, Avtar Singh, "The 8088 and 8086 Microprocessors", 4th edition, Prentice Hall of India
2. Ray Duncan, "Advanced MS DOS Programming", 2nd edition, BPB Publications
3. Peter Abel, NiyazNizamuddin, "IBM PC Assembly Language and Programming", Pearson Education
4. Kenneth Ayala ,"The 8051 Micro Controller", 3rd edition, Delmar Cengage Learning
5. I. Scott MacKenzie, Raphael C.-W. Phan, "8051 Microcontroller", 4th edition, Pearson Education
6. Joshi, “Processor Architecture and Interfacing”, Wiley, ISBN-9788126545605

214452 : DATA STRUCTURES AND FILES

Teaching Scheme:	**Credits**	**Examination Scheme:**
Lectures: 4 Hours/Week	04	In-Semester (Online): 50 Marks End-Semester: 50 Marks

Prerequisites : Fundamentals of Data Structures, Discrete Structures

Course Objectives :

1. To study data structures and their implementations using OOP (C++) and their applications.
2. To study some advanced data structures such as trees, graphs and tables.
3. To learn different file organizations.

Course Outcomes :

After successful completion of this course, student will be able to

1. Analyze algorithms and to determine algorithm correctness and time efficiency class.
2. Understand different advanced abstract data type (ADT) and data structures and their implementations.
3. Understand different algorithm design techniques (brute -force, divide and conquer, greedy, etc.) and their implementation
4. Apply and implement learned algorithm design techniques and data structures to solve problems.

Course Contents

UNIT – I STACKS AND QUEUES — 8 Hours

Concept of stack, stack as ADT, Implementation of stack using linked organization. Concept of implicit and explicit stack, Applications of stack.

Concept of queues as ADT, Implementation of queue using linked organization. Concept of circular queue, double ended queue and priority queue. Applications of queues.

UNIT – II TREES — 10 Hours

Difference in linear and non-linear data structure, Trees and binary trees-concept and terminology. Expression tree. Conversion of general tree to binary tree. Binary tree as an ADT. Recursive and non-recursive algorithms for binary tree traversals, Binary search trees, Binary search tree as ADT, Applications of trees

UNIT – III GRAPHS — 8 Hours

Graph as an ADT, Representation of graphs using adjacency matrix and adjacency list, Depth First Search and Breadth First Search traversal. Prim’s and Kruskal’s algorithms for minimum spanning tree, shortest path using Warshall’s and Dijkstra's algorithm, topological sorting.

UNIT – IV TABLES — 8 Hours

Symbol Table: Notion of Symbol Table, OBST, Huffman's algorithm, Heap data structure, Min and Max Heap, Heap sort implementation, applications of heap

Hash tables and scattered tables: Basic concepts, hash function, characteristics of good hash function, different key-to-address transformations techniques, synonyms or collisions, collision resolution techniques- linear probing, quadratic probing, rehashing, chaining without replacement and chaining with replacement

UNIT – V ADVANCE TREES **7 Hours**

Concept of threaded binary tree. Preorder and In-order traversals of in-order threaded binary tree, Concept of red and black trees, AVL Trees, B trees, B+ trees, Splay trees

UNIT - VI FILE ORGANIZATION **7 Hours**

External storage devices, File, File types and file organization (sequential, index sequential and Direct access), Primitive operations and implementations for each type and comparison

Text Books

1. R. Gilberg, B. Forouzan, "Data Structures: A pseudo Code Approach with C++", Cengage Learning, ISBN 9788131503140.
2. E. Horowitz, S. Sahni, D. Mehta, "Fundamentals of Data Structures in C++", Galgotia Book Source, New Delhi, 1995, ISBN 16782928.

Reference Books

1. Bruno R Preiss, “Data Structures and Algorithms with Object-Oriented Design Patterns in C++”, Wiley India Edition
2. G. A.V, PAI , “Data Structures and Algorithms “, McGraw Hill, ISBN -13: 978-0-07-066726-6
3. Y. Langsam, M. Augenstin, A. Tannenbaum, "Data Structures using C and C++", 2nd Edition, Prentice Hall of India, 2002, ISBN-81-203-1177-9.
4. A. Tharp ,"File Organization and Processing", 2008 ,Willey India edition, 9788126518685
5. J. Tremblay, P. Soresan, "An Introduction to Data Structures with Applications", 2nd edition, Tata McGraw Hill International Editions, 1984, ISBN-0-07-462471-7.
6. M. Folk, B. Zoellick, G. Riccardi, "File Structure An Object Oriented Approach with C++", Pearson Education, 2002, ISBN 81 - 7808 - 131 - 8.
7. M. Weiss, "Data Structures and Algorithm Analysis in C++", 2nd edition, Pearson Education, 2002, ISBN-81-7808-670-0
8. Goodrich, “Data Structures and Algorithms in C++ “, Wiley, ISBN-9788126512607

214453 : FOUNDATIONS OF COMMUNICATION AND COMPUTER NETWORK

Teaching Scheme:	Credits	Examination Scheme:
Lectures: 4 Hours/Week	04	In-Semester (Online): 50 Marks End-Semester: 50 Marks

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Prerequisites : Discrete Structures, Engineering Mathematics I and II

Course Objectives :

1. To understand fundamentals of communication systems
2. To acquaint themselves with layered model used computer networks

Course Outcomes :

After successful completion of this course, student will be able to

1. Understand data/signal transmission over communication media
2. Recognize usage of various modulation techniques in communication
3. Analyze various spread spectrum and multiplexing techniques
4. Use concepts of data communication to solve various related problems
5. Understand error correction and detection techniques.
6. Acquaint with transmission media and their standards

Course Contents

UNIT – I INTRODUCTION TO COMMUNICATION AND NETWORKING — 9 Hours

Introduction To Communication Theory: Terminologies, Elements Of Analog Communication System, Baseband signal, Band-pass signal, Need For Modulation, Electromagnetic Spectrum And Typical Applications, Basics Of Signal (Analog And Digital,) Representation And Analysis (Time and frequency)
Introduction To basics of networking: Computer network fundamentals, ISO OSI Model: All Layers, TCP/IP Protocol Suite: All Layers, Addressing (Physical, Logical Port and Other), LAN, WAN And MAN, Network Topologies. Guided Media: Twisted-Pair Cable, Coaxial Cable and Fiber-Optic Cable, Unguided Media: Wireless, Radio Waves, Microwaves And Infrared, Wireless frequency spectrum.
Noise: External Noise, Internal Noise, Noise Calculations, Communication Channel. Discrete and Continuous Channel, Shannon-Hartley Theorem, Channel Capacity, Nyquist and Shanon Theorem, Bandwidth S/N Trade Off

UNIT – II AMPLITUDE AND ANGLE MODULATION — 8 Hours

Amplitude Modulation: Amplitude Modulation Techniques (DSBFC, DSBSC, SSB), Generation Of Amplitude Modulated Signals, Frequency Spectrum.
Angle Modulation Techniques: Theory Of Angle Modulation Techniques, Practical Issues In Frequency Modulation, Generation Of Frequency Modulation, Frequency Spectrum

UNIT – III PULSE AND DIGITAL MODULATION TECHNIQUES — 8 Hours

Pulse Modulation Techniques: Pulse Analog Modulation Techniques, sampling
Pulse Digital Modulation Techniques: PCM, DM, DPCM
Average Information, Entropy, Information Rate. Source coding: Shanon-Fano, Huffman and Limpel-Ziv
Digital-to-digital Conversion: Line Coding, Line Coding Schemes, Block Coding, Scrambling
Digital-to-analog Conversion: Aspects of Digital-to-Analog Conversion, Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), Quadrature Amplitude Modulation (QAM)
Analog-to-analog Conversion: Amplitude Modulation, Frequency Modulation, Phase Modulation

UNIT – IV ERROR CONTROL CODING AND DATA LINK CONTROL — 8 Hours

Error Detection and Correction:Introduction, Error Detection, Error Correction
Linear Block Codes: hamming code, Hamming Distance, parity check code
Cyclic Codes: CRC (Polynomials), Advantages Of Cyclic Codes, Other Cyclic Codes As Examples: CHECKSUM: One's Complement, Internet Checksum
Framing: fixed-size framing, variable size framing.
Flow control: flow control protocols.
Noiseless channels: simplest protocol, stop-and-wait protocol.
Noisy channels: stop-and-wait automatic repeat request, go-back-n automatic repeat request, Selective repeat automatic repeat request, piggybacking

UNIT – V MULTIPLEXING AND MULTIPLE ACCESS — 6 Hours

Multiplexing: FDM, TDM, Synchronous Time-Division Multiplexing, Statistical Time-Division Multiplexing, WDM, Spread Spectrum: FHSS and DSSS
Random access: ALOHA, CSMA, CSMS/CD and CSMA/ CA
Controlled Access: Reservation, Polling and Token Passing
Channelization: FDMA, TDMA and CDMA

UNIT - VI PHYSICAL, MAC LAYER STANDARDS AND SWITCHING — 6 Hours

LAN hardware: (Switches, routers, hubs, bridges and their types)
IEEE 802.3, Fast Ethernet (MAC Sublayer & Physical Layer), Gigabit Ethernet (MAC Sublayer, Physical Layer) Ten-Gigabit Ethernet, Token ring and token bus standards.
Circuit Switched Networks, Packet (Datagram) Networks, Virtual Circuits, Structure of Circuit and Packet Switches

Text Books

1. George Kennedy, Brendan Davis, srm Prasanna, “Electronic Communication Systems”, 5th Edition,ISB N: 9780071077828, MGH Education
2. Behrouz A Forouzan , “Data Communications and Networking”, 4th Ed, MGH

Reference Books

1. Simon Haykin and Michael Moher, “Introduction to Analog and Digital Communications” John Wiley & Sons, Inc.
2. Louis E. Frenzel, “Principles Of Electronic Communication Systems (SIE)”, 3rd Edition, ISBN: 9780070667556
3. A S Tanenbaum, “Computer Networks”, Pearson Education, 4th Edition
4. Roddy & Coolen, “Electronic communications”, PHI
5. Kenedy & Davis, “ Electronic Communication System”, TMH
6. B.P. Lathi, “Modern Digital & Analogue Communication Systems”, Ed.-3, Oxford Press.
7. H. Taub And K.L. Shiling, “Principles of Communication System”, 3rd Edition, Tata Mcgraw Hill Education Private Limited
8. Irvine, “Data Communications and Networks: An Engineering Approach”, Wiley, ISBN-9788126507658.
9. Keshav, “An Engineering Approach to Computer Networking”, ISBN-9788131711453, Pearson Education.

214454 : PROCESSOR INTERFACING LABORATORY

Teaching Scheme:
Practical : 4 Hours/Week

Credits:
02

Examination Scheme:
Term Work : 25 Marks
Practical : 50 Marks

Prerequisites: Processor Architecture and Interfacing, Computer Organization and Architecture

Course Objectives :

1. To learn assembly language programming of 80386 microprocessors and 8051 microcontrollers.
2. To learn interfacing of real world input and output devices to 8051 microcontroller

Course Outcomes :

After successful completion of this course, student will be able to

1. Learn and apply concepts related to assembly language programming
2. Write and execute assembly language program to perform array addition, code conversion, block transfer, sorting and string operations
3. Learn and apply interfacing of real world input and output devices to 8051 microcontroller

Guidelines for Instructor's Manual

The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant. The instructor's manual should include prologue, university syllabus, conduction & Assessment guidelines, topics under consideration-concept, objectives, outcomes, algorithm, sample test cases and references etc.

Guidelines for Student's Lab Journal

1) The laboratory assignments are to be submitted by student in the form of journal. The Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory-Concept, circuit diagram, pin configuration, conclusion/analysis), printouts of the code written using coding standards, sample test cases etc.
2) Practical Examination will be based on the term work submitted by the student in the form of journal
3) Candidate is expected to know the theory involved in the experiment
4) The practical examination should be conducted if the journal of the candidate is completed in all respects and certified by concerned faculty and head of the department
5) All the assignment mentioned in the syllabus must be conducted

Guidelines for Lab /TW Assessment

1) Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.
2) Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out
3) Necessary knowledge of usage of software and hardware such as assembler, linker, debugger,

8051 microcontrollers and its interfacing kits should be checked by the concerned faculty member

Guidelines for Laboratory Conduction

1) The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications.
2) The guidelines published by BOS time to time regarding conduction of laboratory assignments and Practical/Oral examination is mandatory.

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Guidelines for Practical Examination

Both internal and external examiners should jointly set problem statements for practical examination. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at the time of evaluation to judge the student's understanding of the fundamentals, effective and efficient implementation. The evaluation should be done by both external and internal examiners.

Suggested List of Laboratory Assignments

Group A: Microprocessor Programming

1. Write Assembly Language Program (ALP) to add array of N numbers stored in the memory.

2. Write menu driven ALP to convert 4-digit Hex number into its equivalent BCD number and 5-digit BCD number into its equivalent HEX number. Make your program user friendly to accept the choice from user for
   i. HEX to BCD ii. BCD to HEX iii. EXIT.
   Display proper strings to prompt the user while accepting the input and displaying the result. Write near procedures to complete the task.

3. Write ALP to perform following operation on string:
   i. Find and display length
   ii. Display reverse
   iii. Check whether string is palindrome or not.

   Display proper strings to prompt the user while accepting the input and displaying the result. Write near procedures to complete the task.

4. Write menu driven ALP to perform string manipulations. The strings to be accepted from the user is to be stored in code segment Module_1 and write FAR PROCEDURES in code segment Module_2 to perform any two of the following string operations:
   i. Concatenation of two strings.
   ii. Comparison of two strings.
   iii. Finding Number of occurrences of a sub-string in the given string
   iv. Finding number of alphabets, digits, special characters, lower & upper case alphabets, words and number of lines from the text.

   Note: Use PUBLIC and EXTERN directives. Create .OBJ files of both the modules and link them to create an .EXE file.

5. Assignment on file operations
   Select any one of the following assignments
   a. Write menu driven program in C using int86, int86x, intdos and intdosx functions for implementing following operations on file.
      i. To delete a file
      ii. To create a directory
      iii. To copy a file
   b. Write 8086 ALP to read command line arguments using Program Segment Prefix (PSP) and simulate “DOS COPY Command". Use file handle function for handling the files. Handle all the errors and display appropriate message if user does not enter proper command line argument.

Group B: Microcontroller Programming

Assignment 6 and 7. Select any two of the following assignments:

i. Write 8051 ALP to add n, 8 bits numbers found in internal ram location 40H onwards and store results in R6 and R7.
ii. Write 8051 ALP to multiply 16 bit number by 8 bit number and store the result in internal memory location.
iii. Write 8051 ALP for block transfer for internal / external memory.
iv. Write 8051 ALP for sorting byte array in ascending / descending order.

8. Select any one of the following assignments.
   i. Timer programming: ISR based
      Write ALP to generate 2 KHz square wave using Timer interrupt on any port pin.
   ii. Serial port programming: ISR based
      Connect two 8051 microcontrollers using serial ports. Send FFh and 00H alternatively to receiver. Output received byte to port1, see port1 pin waveform on CRO.

9 & 10. Select any two of the following assignments:

Write ALP to interface 8051 with:

i. DAC to generate square, triangular and trapezoidal waveforms.
ii. ADC to read and display equivalent digital output.
iii. Stepper motor to rotate motor with different step angles and speeds.
iv. Sensors (temperature, pressure) to read and display values of the physical parameters sensed.
v. LCD to display message.

Note: This list of assignments is indicative. Concerned faculty member may frame different assignments if required maintaining similar difficulty level.

Reference Books

1. Peter Abel, Niyaz Nizamuddin, "IBM PC Assembly Language and Programming", Pearson Education
2. Ray Duncan, "Advanced MS DOS Programming", 2nd edition, BPB Publications
3. Intel 8051 Microcontroller manual.

214455 : DATA STRUCTURE AND FILES LABORATORY

Teaching Scheme:	Credits:	Examination Scheme:
Practical : 4 Hours/Week	02	Term Work : 25 Marks Practical : 50 Marks

Prerequisites : Fundamentals of Data Structures, Discrete Structures

Course Objectives :

1. To study data structures and their implementations using OOP (C++) and their applications
2. To study some advanced data structures such as trees, graphs and tables
3. To learn different file organizations

Course Outcomes :

After successful completion of this course, student will be able to

1. Apply and implement algorithm to illustrate use of linear data structures such as stack, queue
2. Apply and implement algorithms to create/represent and traverse non-linear data structures such as trees, graphs etc
3. Apply and implement algorithms to create and manipulate database using different file organizations
4. Learn and apply the concept of hashing in database creation and manipulation

Guidelines for Instructor's Manual

The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant. The instructor's manual should include prologue, university syllabus, conduction & Assessment guidelines, topics under consideration-concept, objectives, outcomes, algorithm written in pseudo language, sample test cases and references.

Guidelines for Student's Lab Journal

1) The laboratory assignments are to be submitted by student in the form of journal. The Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory-Concept, algorithms, printouts of the code written using coding standards, sample test cases etc.
2) Practical Examination will be based on the term work submitted by the student in the form of journal
3) Candidate is expected to know the theory involved in the experiment
4) The practical examination should be conducted if the journal of the candidate is completed in all respects and certified by concerned faculty and head of the department
5) All the assignment mentioned in the syllabus must be conducted

Guidelines for Lab /TW Assessment

1) Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.

2) Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out
3) Appropriate knowledge of usage of software and hardware such as compiler, linker, debugger, coding standards, algorithms to be implemented should be checked by the concerned faculty member(s)

Guidelines for Laboratory Conduction

1) The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications.
2) The guidelines published by BOS time to time regarding conduction of laboratory assignments and Practical/Oral examination is mandatory
3) All the assignments should be implemented using C++
4) All the assignments should be conducted on multicore hardware and 64-bit open-source software

Guidelines for Practical Examination

Both internal and external examiners should jointly set problem statements for practical examination. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at the time of evaluation to judge the student‘s understanding of the fundamentals, effective and efficient implementation. The evaluation should be done by both external and internal examiners.

Suggested List of Laboratory Assignments

1. Implement stack as an abstract data type using linked list and use this ADT for conversion of infix expression to postfix, prefix and evaluation of postfix and prefix expression.
2. Implement priority queue as ADT using single linked list for servicing patients in an hospital with priorities as i) Serious (top priority) ii) medium illness (medium priority) iii) General (Least priority).
3. Create Binary tree and perform following operations:
    a. Insert
    b. Display
    c. Depth of a tree
    d. Display leaf-nodes
    e. Create a copy of a tree
4. Construct and expression tree from postfix/prefix expression and perform recursive and non-recursive In-order, pre-order and post-order traversals.
5. Implement binary search tree and perform following operations:
    a. Insert
    b. Delete
    c. Search
    d. Mirror image
    e. Display
    f. Display level wise

6. Consider a friends' network on face book social web site. Model it as a graph to represent each node as a user and a link to represent the fried relationship between them. Store data such as date of birth, number of comments for each user.
    1. Find who is having maximum friends
    2. Find who has post maximum and minimum comments
    3. Find users having birthday in this month.

    Hint: (Use adjacency list representation and perform DFS and BFS traversals)
7. Represent any real world graph using adjacency list /adjacency matrix find minimum spanning tree using Kruskal's algorithm.
8. Represent a given graph using adjacency matrix /adjacency list and find the shortest path using Dijkstra's algorithm (single source all destination).
9. Store data of students with telephone no and name in the structure using hashing function for telephone number and implement chaining with and without replacement.
10. A business house has several offices in different countries; they want to lease phone lines to connect them with each other and the phone company charges different rent to connect different pairs of cities. Business house want to connect all its offices with a minimum total cost. Solve the problem by suggesting appropriate data structures
11. Department maintains a student information. The file contains roll number, name, division and address. Write a program to create a sequential file to store and maintain student data. It should allow the user to add, delete information of student. Display information of particular employee. If record of student does not exist an appropriate message is displayed. If student record is found it should display the student details.
12. Implement direct access file using hashing (chaining without replacement) perform following operations on it
    a. Create Database
    b. Display Database
    c. Add a record
    d. Search a record
    e. Modify a record

Note: This list of assignments is indicative. Concerned faculty member may frame different assignments if required maintaining similar difficulty level.

Reference Books

1. R. Gilberg, B. Forouzan, "Data Structures: A pseudo Code Approach with C++", Cengage Learning, ISBN 9788131503140
2. E. Horowitz, S. Sahni, D. Mehta, "Fundamentals of Data Structures in C++", Galgotia Book Source, New Delhi, 1995, ISBN 16782928

214456 : COMPUTER GRAPHICS LABORATORY

Teaching Scheme:	Credits	Examination Scheme:
Practical : 2 Hours/Week	01	**Term Work** : 25 Marks **Practical** : 50 Marks

Prerequisites:

1. Basic Geometry, Trigonometry, Vectors and Matrices
2. Basics of Data Structures and Algorithms

Course Objectives :

1. To acquaint the learners with the basic concepts of Computer Graphics
2. To learn the various algorithms for generating and rendering graphical figures
3. To get familiar with mathematics behind the graphical transformations
4. To understand and apply various methods and techniques regarding projections, animation, shading, illumination and lighting

Course Outcomes :

On completion of the course, learner will be able to –

1. Apply and implement line drawing and circle drawing algorithms to draw specific shape given in the problem
2. Apply and implement polygon filling algorithm for a given polygon
3. Apply and implement 2-D and 3-D transformation algorithms for given input shape
4. Apply and implement polygon clipping algorithm for given input polygon
5. Apply and implement fractal generation algorithm for a given input
6. Apply and implement animation concepts for generating simple animation without using any animation tool

Guidelines for Instructor's Manual

The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant. The instructor's manual should include prologue, university syllabus, conduction & Assessment guidelines, topics under consideration-concept, objectives, outcomes, algorithm written in pseudo language, sample test cases and references.

Guidelines for Student's Lab Journal

1) The laboratory assignments are to be submitted by student in the form of journal. The Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory-Concept, algorithms, printouts of the code written using coding standards, sample test cases etc.
2) Practical Examination will be based on the term work submitted by the student in the form of journal
3) Candidate is expected to know the theory involved in the experiment
4) The practical examination should be conducted if the journal of the candidate is completed in all respects and certified by concerned faculty and head of the department
5) All the assignment mentioned in the syllabus must be conducted

Guidelines for Lab /TW Assessment

1) Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.
2) Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out
3) Appropriate knowledge of usage of software and hardware such as compiler, linker, debugger, coding standards, algorithms to be implemented should be checked by the concerned faculty member(s)

Guidelines for Laboratory Conduction

5) The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications.
6) The guidelines published by BOS time to time regarding conduction of laboratory assignments and Practical/Oral examination is mandatory
7) All the assignments should be conducted on multicore hardware and 64-bit open-source software
8) All the assignments should be conducted preferably using OpenGL or Linux platform
9) **Implement any 4 assignments from group A and any 4 assignments from group B**

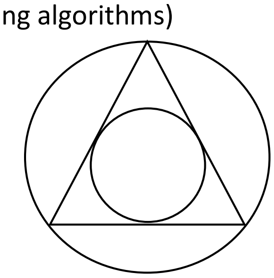
Guidelines for Practical Examination

Both internal and external examiners should jointly set problem statements for practical examination. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at the time of evaluation to judge the student's understanding of the fundamentals, effective and efficient implementation. The evaluation should be done by both external and internal examiners.

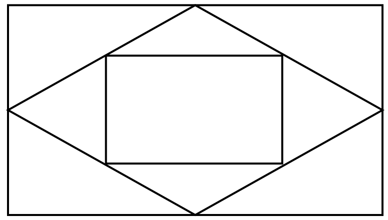
Suggested List of Laboratory Assignments

Group A

1. A Mandelbrot Set is a set of complex number z that does not diverge under the transformation $x_{n+1} = x_n^2 + z$with $x_0 = 0$. Where, both x and z represent the complex numbers.
   a)Plot the Mandelbrot set for the threshold |x|= 2.
   b) Plot Julia set choosing z ≠ 0. Use 254 colors for plotting in both cases. Change the threshold to observe different patterns.
2. Draw the polygons by using the mouse. Choose colors by clicking on the designed color pane. Use window port to draw. (Use DDA algorithm for line drawing)
3. Draw inscribed and Circumscribed circles in the triangle as shown as an example below (Use any Circle drawing and Line drawing algorithms)



4. Draw the following pattern using any Line drawing algorithms.



5. Draw a 4X4 chessboard rotated 45˚ with the horizontal axis. Use Bresenham algorithm to draw all the lines. Use seed fill algorithm to fill black squares of the rotated chessboard

Group B

1. Implement Cohen Sutherland Hodgman algorithm to clip any given polygon. Provide the vertices of the polygon to be clipped and pattern of clipping interactively.
2. Implement translation, sheer, rotation and scaling transformations on equilateral triangle and rhombus.
3. Implement Cube rotation about vertical axis passing through its centroid.
4. Generate fractal patterns by using Koch curves.
5. Animation : Implement any one of the following animation assignments,
   i) Clock with pendulum
   ii) National Flag hoisting
   iii) Vehicle/boat locomotion
   iv) Falling Water drop into the water and generated waves after impact
   v) Kaleidoscope views generation (at least 3 colorful patterns)

Note: This list of assignments is indicative. Concerned faculty member may frame different assignments if required maintaining similar difficulty level.

Reference Books

1. S. Harrington, "Computer Graphics", 2nd Edition, McGraw-Hill Publications, 1987, ISBN 0 – 07 – 100472 – 6.
2. D. Rogers, "Procedural Elements for Computer Graphics", 2nd Edition, Tata McGraw-Hill Publication, 2001, ISBN 0 – 07 – 047371 – 4.

Audit Course2

In addition to credits course, it is recommended that there should be audit course (non-credit course) preferably in each semester from second year. The student will be awarded grade as AP on successful completion of audit course. The student may opt for one of the audit courses per semester, starting in second year first semester. Though not mandatory, such audit courses can help the student to get awareness of different issues which make impact on human lives and enhance their skill sets to improve their employability. List of audit courses offered in each semester is provided in curriculum. Each student has to choose one audit course from the list per semester. Evaluation of audit course will be done at institute level. Method of conduction and method of assessment for audit courses is suggested.

The student registered for audit course shall be awarded the grade AP and shall be included such grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory in-semester performance and secured a passing grade in that audit course. No grade points are associated with this 'AP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA. Evaluation of audit course will be done at institute level itself.
(Ref-http://www.unipune.ac.in/Syllabi_PDF/revised-2015/engineering/
UG_RULE_REGULATIONS_FOR_CREDIT_SYSTEM-2015_18June.pdf)

Guidelines for Conduction and Assessment (Any one or more of following but not limited to)

- Lectures/ Guest Lectures
- Visits (Social/Field) and reports
- Demonstrations
- Surveys
- Mini Project
- Hands on experience on specific focused topic

Guidelines for Assessment (Any one or more of following but not limited to)

- Written Test
- Demonstrations/ Practical Test
- Presentations
- IPR/Publication
- Report

List of courses under Audit Course2

Course Code	**Audit Course Title**
210258:AC2-I	Water Management
210258:AC2-II	Intellectual Property Rights and Patents
210258:AC2-III	The Science of Happiness
210258:AC2-IV	Stress Relief: Yoga and Meditation

The detail course contents of above mentioned audit courses are available in Computer Engineering 2015 course.

Moreover students can opt for any other audit course from the list of Audit Course of any branch of engineering.

Savitribai Phule University of Pune

Third Year Civil Engineering
(2015 Course)

Semester I

Course Code	Course	Teaching Scheme hour/week			Semester Examination Scheme of marks						Credit	
		Theory	Tutorial	Practical	In-Sem	End-Sem	T W	OR	PR	Total	TH/TUT	PR/OR/TW
301001	Hydrology and water resource engineering.	03	--	02	30	70	--	50	--	**150**	03	01
301002	Infrastructure Engineering and Construction Techniques	03	--	--	30	70	--	--	--	**100**	04	--
301003	Structural Design-I	04	--	04	30	70	50	50	--	**200**	04	02
301004	Structural Analysis-II	04	--	--	30	70	--	--	--	**100**	03	--
301005	Fluid Mechanics-II	04	--	02	30	70	--	50	--	**150**	04	01
301006	Employability Skills development	--	--	02	--	--	50	--	--	**50**	--	01
	Total	18	--	10	**150**	**350**	**100**	**150**		**750**	**18**	**05**

Semester II

Course Code	Course	Teaching Scheme hour/week			Semester Examination Scheme of marks						Credit	
		Theory	Tutorial	Practical	In-Sem	End-Sem	T W	OR	PR	Total	TH/TUT	PR/OR/TW
301007	Advanced Surveying	03	--	02	30	70	50	--	--	**150**	03	01
301008	Project Management and Engineering Economics	04	--	--	30	70	--	--	--	**100**	04	--
301009	Foundation Engineering	03	--	--	30	70	--	--	--	**100**	03	--
301010	Structural Design-II	04	--	04	30	70	50	50	--	**200**	04	02
301011	Environmental Engineering-I	04	--	02	30	70	--	--	50	**150**	04	01
301012	Seminar	--	--	01	--	--	--	50	--	**50**	--	01
	Total	18	--	09	**150**	**350**	**100**	**100**	**50**	**750**	**18**	**05**

Savitribai Phule Pune University

TE Civil (2015 Course) w.e.f. June 2017

301001 Hydrology and Water Resource Engineering

Teaching scheme	Examination scheme
Lectures: 3 hours/week	In semester exam: 30 marks---1 hour Paper
Practical: 2 hours/week	End semester exam: 70 marks—2.5 hours Paper
	Oral: 50 Marks

Unit – I **(06 hours)**

Introduction to Hydrology:
Hydrological cycle, Application of hydrology

Precipitation:
Types of precipitation, measurement, Rain gauge network, Preparation of data-estimation of missing data, Consistency test, Presentation of rainfall data-mass rainfall curves, Hyetograph, Point rainfall, Moving average, Mean precipitation over an area- arithmetic mean method, Thiessen's polygon, isohyetel method, Concepts of depth-area-duration analysis, Frequency analysis - frequency of point rainfall and plotting position, Intensity-duration curves, Maximum Intensity-duration- frequency analysis

Abstractions of Precipitation: Intersection, Depression storage, Evaporation**-** Elementary concepts, factors affecting, Measurement of evaporation, Transpiration, Evapotranspiration- process and measurement, Infiltration –introduction, Infiltration capacity, Infiltrometer, Horton's method and infiltration indices

Stream Gauging:
Selection of site, various methods of discharge measurement (velocity-area method, dilution method, slope-area method), Advance techniques/equipments used in gauge discharge measurements such as Radar, Current meter, ADCP (Acoustic Doppler Current Profiler)

Unit – II **(06 hours)**

Introduction to Irrigation:
Definition, Functions, Advantages and Necessity, Methods of Irrigation, Surface Irrigation, Subsurface Irrigation, Micro-Irrigation

Water Requirements of Crops:
Soil moisture and Crop water relationship, Factors governing Consumptive use of water, Principal Indian crops, their season and water requirement, Crop planning, Agricultural practices, Calculations of canal and reservoir capacities – duty, delta, irrigation efficiency

Assessment of Canal Revenue:
Various methods (Area basis or crop rate basis, volumetric basis, seasonal basis, composite rate basis, permanent basis or betterment levy basis)

Unit III **(06 hours)**

Ground Water Hydrology:
Occurrences and distribution of ground water, Specific yield of aquifers, Movement of ground water, Darcy's law, Permeability, Safe yield of basin, Hydraulics of wells under steady flow condition in confined and unconfined aquifers, Specific capacity of well, Well Irrigation: Tube wells, Open wells and their construction

Unit – IV **(06 hours)**
Runoff:
Introduction, Factors affecting runoff, Rainfall-Runoff relationships, Empirical Techniques to determine runoff, Runoff hydrograph- Introduction, Factors affecting Flood Hydrograph, Components of Hydrograph, Base flow separation, Effective rainfall,
Unit hydrograph theory, S-curve hydrograph, uses and limitations of Unit Hydrograph
Floods:
Estimation of peak flow, Rational formula and other methods, Flood frequency analysis, Gumbel's method, Design floods

Unit – V **(06 hours)**
Reservoir Planning: Introduction, Term related to reservoir planning (Yield, Reservoir planning and operation curves, Reservoir storage, Reservoir clearance), Investigation for reservoir planning, Significance of mass curve and demand curves, Applications of mass curve and demand curves, Fixation of reservoir capacity from annual inflow and outflow, Fixation of reservoir capacity using elevation capacity curve and dependable yield, Reservoir regulation, Flood routing- Graphical or I.S.D method, Trial and error method, Reservoir losses, Reservoir sedimentation- Phenomenon, Measures to control reservoir sedimentation, Density currents Significance of trap efficiency, Useful life of reservoir, Costs of reservoir, Apportionment of total cost, Use of facilities method, Equal apportionment method, Alternative justifiable expenditure method

Unit VI **(06 hours)**
Water Management:
Distribution, Warabandi, Rotational water supply system, Participatory Irrigation Management, Cooperative water distribution systems, Introduction to auto weather station
Water Logging and Drainage:
The process of water logging**,** Causes of water logging, Effects of water logging, preventive and curative measures, Land drainage, Reclamation of water logged areas, Alkaline and saline lands.
Reference Books
1. Irrigation Engineering - S. K. Garg, Khanna Publishers
2. Irrigation, Water Resources and water power engineering- P. N. Modi, Standard Book House.
3. Irrigation and water power Engineering- Dr. Punmia and Dr. Pande, Standard Publisher
4. Elementary Engineering Hydrology- M.J.Deodhar-Pearson Education

5. Engineering Hydrology. –Ojha—Oxford University Press
6. Engineering hydrology – K. Subramanyam Tata McGraw Hill.
7. Hydrology- Principles, Analysis and Desin, Raghunath, New Age International
8. Irrigation Engineering-Raghunath--Wiley
9. Groundwater Hydrology, 3ed—Todd--Wiley
10. Applied Hydrology – Chow, Maidment, Mays, McGraw-Hill
11. Principles of Hydrology- Ward and Robinson, Tata McGraw Hill
12. Irrigation Engineering - Bharat Singh

Term Work

Assignments (Hydrology and Water Resources Engineering)

Term work will consist of a journal giving the detailed report on assignments performed and visit report. **(any 8)**

1. Analysis of rainfall data (Double mass curve technique/Missing rainfall data).
2. Marking catchment area on a topo-sheet and working out average annual precipitation and determining yield by various methods.
3. Analytical method of measurement of infiltration
4. Flood frequency studies assuming Gumbel's extreme value distribution.
5. Determination of peak flood discharge in a basin using unit hydrograph technique.
6. Determination of storage capacity of a reservoir using mass curve of inflow and outflow.
7. Application of HEC-RAS for Hydrologic routing.
8. Site visit to Meteorological station
9. Measurement of / video demonstration of evaporation by Pan Evaporimeter
10. Measurement of / video demonstration of infiltration by Infiltrometer

Savitribai Phule Pune University TE Civil (2015 Course) w.e.f. June 2017 301002
Infrastructure Engineering and Construction Techniques

Teaching scheme	Examination scheme
Lectures: 3 hours/week	In semester exam: 30 marks---1 hour Paper
	End semester exam: 70 marks—2.5 hours Paper

Unit I - Infrastructure Engineering (06 hours)

a) Meaning and scope of Infrastructure Engineering: Scope of infrastructure engineering in national and global development, Forthcoming infrastructure projects at national and global level, Necessity, advantages and disadvantages of PPP (Public Private Partnership), Salient features of smart city , Bus rapid transit system.

b) Railways: Permanent way, Track structure of BG, Functions of rail, Standard rail, Tilting of rail, Coning of wheels, Types of sleepers, Fastenings, Ballast, Modern development in railways- metro rails, mono rails, bullet train.

Unit II- Railways (06 hours)

Rail joints, types, evil effects, remedial measures, Welding of rails, Short and long welded rails, Types of gradients, Curves, Grade compensation on curves, Alignment, Super elevation, Equilibrium cant, Equilibrium speed, Maximum permissible limits for cant, Cant deficiency, Cant excess, Speed on curves, Safe speed on curves using Indian railways formula only for fully transition curves, Concept of negative cant, Points, crossings and turnouts- functions, Components, elements of points, Types of crossings and turnouts, Track maintenance: Regular and Periodic. **(Site visit is recommended to learn this topic)**

Unit III - Construction Techniques (06 hours)

Necessity of mechanization, Dredging techniques, Use of barges, Dewatering techniques- Well Point system, Vacuum dewatering, Electro osmosis, Underwater drilling and blasting, Grouting methods in soft and hard soil, Diaphragm walls- purpose and construction methods, Prefabrication – applications, advantages and disadvantages.

Unit IV – Tunneling (06 hours)

Tunneling, functions & types of tunnel, Criteria for selection of size & shape of tunnels. Pilot tunnel, shaft, addit and portal, Needle beam, NATM, TBM & earth pressure balance method of tunneling in soft soil, Drilling & blasting method of tunneling including various operations like mucking, Drainage in tunneling- Pre drainage and permanent drainage, Ventilation in tunneling-temporary and permanent, Micro tunneling and trenchless tunneling.

Unit V- Docks & Harbors (06 hours)

Introduction, Requirements of harbors and ports, Classification of harbors with examples, Selection of site for harbor, Various components of ports, Break waters- types, comparison, design criteria , methods of construction, Tetra pod, Tri bar, Hexapod, Quay wall, Wet & dry dock, Floating dock, Wharves, Jetties, Types of fenders, Dolphins, Marin railway.

Unit VI - Construction Equipments **(06 hours)**

Dozers, Power shovels, Excavators, Loaders, Scrapers, Dumpers, Drag line, Clamp shell, Compactors, Pavers, Factors affecting performance, selection of equipment, Various types of hoists and cranes and selection, Boom placers, Simple numerical problems on cycle time and production rate, Economic maintenance & repair of construction equipment.

Reference books

1. Construction Planning Methods & Equipment:Puerifoy –Tata MC Graw Hill
2. Construction Equipments & its Management: S.C Sharma,Khanna Publication
3. Railway Engineering, 2/E by Chandra—Oxford University Press
4. Railway Track Engineering: J.S.Mundrey,Tata McGraw Hill
5. Harbour,Dock & Tunnel Engineering:R. Srinivasan
6. Dock & Harbour Engineering:Hasmukh P.Oza & Gautam H.Oza-Charoter Book Stall
7. Construction Project Scheduling & Control, 2ed—Mubarak--Wiley

University of Pune---TE Civil (2015 Course)---w.e.f. June 2017

301003 Structural Design I

Teaching scheme	Examination scheme
Lectures: 4 hours/week	In semester exam: 30 marks---1.5 hour Paper
Practical: 4 hours/week	End semester exam: 70 marks—3 hours Paper
	Oral based on T.W. : 50 Marks Term Work: 50 Marks

Design shall be based on IS: 800-2007

Unit I **(08 hours)**

a) Types of steel structures, grades of structural steel, various rolled steel sections, relevant IS specifications such as IS:800-2007, IS:808-1989, IS:875 part I to III, SP: 6(1), SP: 6(6), SP38. IS:4000- 1992, codes for welded connections (mention code) . Philosophy of limit state design for strength and serviceability, partial safety factor for load and resistance, various design load combinations, classification of cross section such as plastic, compact, semi-compact and slender.

b) Tension member: various cross sections such as solid threaded rod, cable and angle sections. Limit strength due to yielding, rupture and block shear. Design of tension member: using single and double angle sections, connections of member with gusset plate by bolts and welds.

Unit II **(08 hours)**

a) Buckling classification as per geometry of cross section, buckling curves, design of struts in trusses using single and double angle section, connections of members with gusset plate by bolts and welds.

b) Design of axially loaded column using rolled steel section. Design of built-up column, lacing and battening, connection of lacing/battening with main components by bolts and welds.

Unit III **(08 hours)**

a) Design of eccentrically loaded column providing uniaxial and biaxial bending (check for section strength only).

b) Design of column bases: Design of slab base, gusseted base, and moment resistant base. (axial load and uni-axial bending)

Unit IV **(08 hours)**

a) Design of laterally supported beams using single rolled steel section with and without flange plate, curtailment of flange plates, strength in flexure, low and high shear, check for web buckling, web crippling and deflection.

b) Design of laterally unsupported beams using single rolled steel section with and without flange plate, curtailment of flange plates, strength in flexure and shear, check for deflection.

Unit V **(08 hours)**

a) Secondary and main beam arrangement for floor of a building, design of beam to beam and beam to column connections using bolt / weld.

b) Design of welded plate girder: design of cross section, curtailment of flange plates, stiffeners and connections.

Unit VI **(08 hours)**

a) Design of gantry girder: Selection of gantry girder, design of cross section, check for moment capacity, buckling resistance, bi-axial bending, deflection at working load and fatigue strength.
b) Roof truss: assessment of dead load, live load and wind load, design of purlin, design of members of a truss, detailing of typical joints and supports

Term work

Term work will consists of the following.

A) Four full imperial size drawing sheet showing structural detailing of 16 sketches based on syllabus. (Hand drawn)
B) Design of industrial building including roof truss, purlin, bracings, gantry girder, column, column base and connections.
Three full imperial size drawing sheets. (Hand drawn)
C) Design of welded plate girder, design of cross section, curtailment of flange plates, stiffeners and connections. One full imperial size drawing sheets.
Site visit is recommended to learn this topic.
OR
C) Design of building including primary and secondary beams, column, column base and connections. One full imperial size drawing sheets. (Using suitable software)
D) Two site visits: Report should contain structural details with sketches.

Oral Examination shall be based on the above term work.

Note: 1. Maximum number of students in a group, if any, should not be more than three to five for the term work design assignments.
2. Draw any one sheet from (B) and (C) Using suitable software.

Reference Books

1. Design of Steel Structure by N Subramanian, Oxford University Press, New Delhi.
2. Limit state design of Steel Structure by V L Shah & Gore, Structures Publication, Pune
3. Limit state design in Structural Steel by M.R. Shiyekar, PHI, Delhi
4. Structural Design in Steel—Sarwar Alam ,Raz—New Age International Publishers
5. Analysis and Design: Practice of Steel Structures—Karuna Ghosh-- PHI Learning Pvt. Ltd .Delhi
6. Limit state design of steel structures by S K Duggal, Tata McGraw Hill Education, New Delhi.
7. Design of Steel Structures by K. S. Sai Ram, Pearson, New Delhi.
8 Fundamentals of structural steel design M L Gambhir, Tata McGraw Hill Education Private limited, New Delhi.
9. Limit state design of Steel Structure by Ramchandra & Gehlot, Scientific Publishers, Pune.
10. Design of steel structure by Limit State Method as per IS: 800- 2007 by Bhavikatti S S, I.K. International Publishing House, New Delhi

Savitribai Phule Pune University
TE Civil (2015 Course) w.e.f. June 2017
301004 Structural Analysis II

Teaching scheme	Examination scheme
Lectures:4 hours/week	In semester exam: 30 marks---1 hour Paper
	End semester exam: 70 marks—2.5 hours Paper

Unit I **(08 hours)**

a) Slope-deflection method of analysis: Slope-deflection equations, equilibrium equation of Slope-deflection method, application to beams with and without joint translation and rotation, yielding of support, application to non-sway rigid jointed rectangular portal frames, shear force and bending moment diagram.
b) Sway analysis of rigid jointed rectangular portal frames using slope-deflection method (Involving not more than three unknowns)

Unit II **(08 hours)**

a) Moment distribution method of analysis: Stiffness factor, carry over factor, distribution factor, application to beams with and without joint translation and yielding of support, application to non-sway rigid jointed rectangular portal frames, shear force and bending moment diagram.
b) Sway analysis of rigid jointed rectangular single bay single storey portal frames using moment distribution method (Involving not more than three unknowns).

Unit III **(08 hours)**

a) Fundamental concepts of flexibility method of analysis, formulation of flexibility matrix, application to pin jointed plane trusses (Involving not more than three unknowns).
b) Application of flexibility method to beams and rigid jointed rectangular portal frames (Involving not more than three unknowns).

Unit IV **(08 hours)**

a) Fundamental concepts of stiffness method of analysis, formulation of stiffness matrix, application to trusses by member approach. Application to beams by structure approach only, (Involving not more than three unknowns).
b) Application to rigid jointed rectangular portal frames by structure approach only (Involving not more than three unknowns).

Unit V **(08 hours)**

a) Finite Difference Method – Introduction, application to deflection problems of determinate beams by central difference method
b) Approximate methods of analysis of multi-storied multi-bay 2 - D rigid jointed fames by substitute frame method, cantilever method and portal method.

Unit VI **(08 hours)**

a) Finite element method: Introduction, discretization, types of elements-1D, 2D, 3D, isoparametric and axisymmetric, convergence criteria, Pascals triangle, direct stiffness method, principal of minimum potential energy, principal of virtual work. (No numerical)
b) Shape functions: CST elements by using polynomials, 1D, 2D elements by using Lagrange's method

Reference Books

1. Structural Analysis: Deodas Menon---Narosa Publishing House.
2. Structural Analysis: Thandavamoorthy---Oxford University Press.
3. Structural Analysis: A Matrix Approach by Pundit and Gupta, McGraw Hills.
4. Structural Analysis by Hibbler, Pearson Education.
5. Structural Analysis: M. M. Das, B. M. Das---PHI Learning Pvt Ltd. Delhi.
6. Fundamentals of Structural Analysis: 2nd ed---West---Wiley.
7. Theory of Structures: Vol. I & II by B. C. Punmia, Laxmi Publication.
8. Theory of Structures: Vol. I & II by Perumull & Vaidyanathan, Laxmi Publication.
9. Fundamentals of Structural Analysis: K. M. Leet, Vang, Gilbert—McGraw Hills
10. Matrix Methods for structural engineering.by Gere, Weaver.
11. Introduction to Finite element method, Dr. P.N. Godbole, New Age Publication, Delhi.
12. Finite element Analysis, S.S. Bhavikatti, New Age Publication, Delhi.
13. Basic Structural Analysis: Wilbur and Norris.

Savitribai Phule Pune University
TE Civil (2015 Course) w.e.f. June 2017

301005 Fluid Mechanics-II

Teaching scheme	Examination scheme
Lectures: 4 hours/week	In semester exam: 30 marks---1 hour Paper
Practical: 2 hours/week	End semester exam: 70 marks—2.5 hours Paper
	Oral: 50 Marks

Unit I **(8 hours)**

a) Fluid Flow around Submerged Objects: Practical problems involving fluid flow around submerged objects, Definitions and expressions for drag, lift, drag coefficient, lift coefficient, types of drag. Drag on sphere, cylinder, flat plate and Aerofoil, Karman's vortex street, Effects of free surface and compressibility on drag, Development of lifts, Lift on cylinder and Aerofoil, Magnus effect, Polar diagram.

B)Unsteady Flow: Types of unsteady flow; Flow through openings under varying head, Fluid compressibility, Celerity of elastic pressure wave through fluid medium; Water hammer phenomenon; Rise of pressure due to water hammer, Surge Tanks and their functions.

Unit -II **(08 hours)**

a) Introduction to Open channel flow: Classification of channels, and Channel flows. Basic governing equations of Channel flow viz. continuity equation, energy equation and momentum equation, One dimensional approach, Geometric elements of channel, Velocity distribution in open channel flow, Introduction to notches and weirs ((Rectangular, Triangular, Trapezoidal).

b) Depth-Energy Relationships in Open Channel Flow:

Specific energy, Specific force Specific energy diagram, Specific force diagram, Depth discharge Diagram, Critical depth, Conditions for occurrence of critical flow; Froude's number, flow classification based on it, Important terms pertaining to critical flow viz. section factor, concept of first hydraulic exponent; Critical flow computations; channel transitions

Unit –III **(08 hours)**

a) Uniform flow in open channels : Characteristics and establishment of uniform flow, uniform flow formulae :Chezy's and Manning's formulae; Factors affecting Manning's roughness coefficient; Important terms pertaining to uniform flow, viz. normal depth, conveyance, section factor, concept of second hydraulic exponent, Uniform flow computations. Most efficient channel sections (rectangular, triangular, trapezoidal and circular).

b) Hydraulic Jump-Phenomenon of hydraulic jump; Location and examples of occurrence of hydraulic jump; Assumptions in the theory of hydraulic jump; Application of momentum equation to hydraulic jump in rectangular channel: Conjugate depths and relations between conjugate depths. Energy dissipation in hydraulic jump; Graphical method of determination of energy dissipation, Classification of hydraulic jump; Practical uses of hydraulic jump, venture flume, standing wave flume

Unit -IV **(08 hours)**

a) Impact of Jet: Force and work done due to impact of jet on stationary and moving, flat and curved surfaces using linear momentum principle.

b) **Centrifugal Pumps**: General classification of pumps, Centrifugal pumps- Classification, theory working, Selection of pumps, Centrifugal head, Work done by impeller, Heads and efficiencies, minimum starting speed, Cavitation in centrifugal pumps, multistage pumping, Introduction to submersible pumps and reciprocating pumps,

Unit -V **(08 hours)**

a) Hydropower generation: Elements of hydropower plant; hydraulic turbines- Classification, heads and efficiencies, Design and governing of Pelton Wheel, Francis turbine-parts and working. Cavitation in hydraulic turbines- **Site visit is recommended to learn this topic.**

b) Performance of hydraulic turbines: Prediction of performance in terms of unit quantities and specific quantities, Specific speed, Characteristic curves, Dimensional analysis as applied to hydraulic turbines, selection of turbines

Unit-VI **(08 hours)**

a) Gradually Varied Flow in Open Channels-Definition and types of non-uniform flow; Gradually Varied Flow (GVF) and Rapidly Varied Flow (RVF); Basic Assumptions of GVF; Differential equation of GVF - Alternative forms; Classification of channel bed slopes, Various GVF profiles, their general characteristics and examples of their occurrence; Control section

b) **Gradually varied flow computations:** Methods of GVF computations. Direct Step method, Graphical Integration method, Standard Step method, VenTe Chow method.

Oral

The Oral is based on the term work which consists of a journal giving the detailed report on experiments and assignments performed and visit report.

List of Experiments

Following experiments and assignments shall be performed.

A) Experiments (All compulsory, Fluid Mechanics II)

1. Flow around a Circular Cylinder/Aerofoil
2. Study of Uniform Flow Formulae of Open channel.
3. Velocity Distribution in Open Channel Flow.
4. Calibration of Standing Wave Flume/Venturi flume
5. Study of Hydraulic Jump as Energy Dissipater. 6.
Impact of Jet on flat plate and curved vane
7. Characteristics of a Pelton Wheel
8. Characteristics of a Centrifugal Pump
9. Calibration of Notch

B) Assignments (All compulsory, Fluid Mechanics II):

(a) Graphical determination of energy loss in Hydraulic Jump.
(b) Assignment on GVF computation using Direct Step and VenTe Chow method.

C) Report on Site visit to Hydropower generation plant/Research Institute.

Reference Books

1. Engineering Fluid Mechanics by Garde, Mirajgaonkar, Scitech
2. Hydraulics and Fluid Mechanics by P. N. Modi & S. N. Seth Standard book house
3. Open Channel Flow by K Subranmanya, TMH, Third Ed.
4. Open Channel Hydraulics: Vente Chow - Tata McGraw Hill.
5. Open Channel Flow: K. G. RangaRaju - Tata McGraw Hill.
6. Fluid Mechanics- Fundamental and Applications by Cengel and Cimbala- McGraw Hill
7. Flow through Open Channels—Srivastava-- Oxford University Press
8. A test book of Fluid mechanics and Machinary by Bansal
9. Fluid Mechanics by Streeter, Wylie and Bedford – Tata McGraw Hill
10. Fluid Mechanics by White – Mc-Graw Hill
11. Fluid Mechanics-A.K.Mohanty- PHI Learning PvtLtd.Delhi
12. Open Channel Flow by M. M. Das - PHI Learning PvtLtd.Delhi

Savitribai Phule Pune University

TE Civil (2015 Course) w.e.f. June 2017

301006 Employability Skills Development

Teaching scheme	Examination scheme
Practical: 2 hours/week	Term Work: 50 Marks

How to handle this course? **(02 hours)**

This course has been introduced with the objective of enhancing the employability of the students through development of their skills. Following topics and their contents are expected to be explored through following 10 activities.

1. Expert lectures 2.Group discussions 3.Case study analysis 4.Group presentations 5.Company and corporate visits 6.Mock interviews and exercises 7.Demo presentations 8. Audio-video shows 9. Use of e-resources 10.Games.

The term work will consist of detailed report of any 8 out of above 10 activities. The activities which need to be performed in a group will have a group of not more than 6 students. However, the report for the term work will be prepared at individual level.

Unit I **(02 hours)**

a) What is Employability? What are Employability Skills? Focus on what skills do employers expect from graduates? Career planning with action plan.

Unit –II **(02 hours)**

b) Interpersonal Skills-Critical Thinking, Assertiveness, Decision Making, Problem Solving, Negotiation, Building Confidence, Time Management, Personal Presentation, Assertiveness, Negotiation, Avoiding Stress.

Unit –III **(02 hours)**

c) Presentation Skills-Presentation Skills What is a Presentation? Writing Your Presentation Coping with Nerves

Unit –IV **(02 hours)**

d) Communication Skills-Verbal Communication, Written Communication, Difference between C.V. Bio data and Resume

Unit –V **(02 hours)**

e) Commercial Awareness-Professional etiquettes and manners, Global negotiating and Persuading, Integrity. Global trends and statistics about civil engineering businesses.

Unit-VI **(02 hours)**

f) Personal skills-Leadership, Ability to work in a team, Conceptual ability, Subject Knowledge and competence, Analysing and investigating, Planning, Flexibility, Self, Lifelong Learning, ,Stress Tolerance, Creativity

Reference Reading

1.Cambridge English for Job Hunting—Colm Downes---Cambridge University Press(ISBN-978-0- 521-14470-4)
2.Polyskills--Foundation books-- Cambridge University Press—(ISBN 978-81-7596-916-2)
3.Global Business Foundation Skills-- Foundation books-- Cambridge University Press—(ISBN 978-81-7596-783-0)

E-Resources

www.skillsyouneed.com/general/employability-skills.html-
*www.kent.ac.uk/careers/sk/top-ten-skills.htm*www.skillsyouneed.com/general/employability-
www.fremont.k12.ca.us/cms/lib04/.../Domain/.../employability-skills.pdf

Savitribai Phule Pune University

TE Civil (2015 Course)---w.e.f. June 2017

301007 Advanced Surveying

Teaching scheme	**Examination scheme**
Lectures: 3 hours/week	**In semester exam: 30 marks---1 hour Paper**
Practical: 2 hours/week	**End semester exam: 70 marks—2.5 hours Paper**
	TW: 50 Marks

Unit-I Geodetic Surveying & SBPS (06 hours)

a) Objects, Methods of Geodetic Surveying, Introduction to triangulation, Classification of triangulation systems, Triangulation figures, Concept of well-conditioned triangle, selection of stations, Intervisibility and height of stations.

b) Introduction to SBPS; Positioning with SBPS - Absolute & Differential methods, Use of SBPS in Surveying, SBPS Co-ordinates & heights, Factors governing accuracy in SBPS positioning, Different types of errors in SBPS positioning. Earth ellipsoid, Geodetic datum and Co-ordinate systems, Applications of GPS in civil engineering.

Unit-II Hydrographic Surveying (06 hours)

Objects, Applications, Establishing controls, Shore line survey, Sounding, Sounding equipment, Methods of locating soundings – conventional and using GPS, Reduction of soundings, Plotting of soundings, Nautical sextant and its use, Three point problem and its use, solution of three point problem by all methods, Tides and tide gauges, determination of MSL

Unit-III Remote Sensing and Geographical Information System (06 hours)

a) Remote Sensing introduction, Definition, Necessity, Importance and use; Basic concepts in Remote Sensing , Basic Laws of electromagnetic radiation, Atmospheric effects on radiation, Interaction of EM energy with matter, Resolution in remote sensing, Satellite remote sensing, Problems confronting remote sensing system. Ideal and Real remote sensing systems. Space platforms for remote sensing: Imaging sensors and techniques. Image interpretation:- Visual image processing & Digital image processing. Applications of remote sensing. Introduction to LIDAR & Underground utility survey. Comparison between aerial photograph and satellite image.

b) Geographical Information System -Introduction, Definition, Objectives, Components (people, procedure, hardware, software & data) & functions (input, manipulation, management, querry & analysis and visualization) of GIS. Coordinate systems and projections, Georeferencing, GIS data – spatial (Raster & vector) & aspatial data. Introduction to vector and raster data analysis such as network analysis, overlay analysis etc. for vector, DEM, Management of aspatial data. Applications of GIS such as visibility analysis, Slope analysis, Watershed analysis & Preparation of thematic maps. Limitations of GIS,

Unit -IV Triangulation Adjustment (06 hours)

Kinds of errors, Laws of weights, Determination of most probable values (MPV) of conditioned and independent quantities, Method of least squares, Indirect observations, Probable error and its determination, Distribution of error to the field measurements, Normal equation, Method of correlates. Station and figure adjustment of geodetic quadrilateral without central station.

Spherical triangle, Calculations of spherical excess and sides of spherical triangle.

Unit – V Aerial Photogrammetry (06 hours)

Objects, Classification- qualitative & quantitative photogrammetry, Applications, comparison of Map and aerial photograph, Vertical, Tilted and Oblique photographs, Scale of vertical photograph, Relief displacement in vertical photograph, Flight planning, Stereoscopic parallax & its measurement by parallax bar.

Mirror stereoscope, Differential height from differential parallax, Ground control points (GCPs), Introduction to digital photogrammetry, different stereo viewing techniques in digital photogrammetry, Method of creation of elevation data, Different products of digital photogrammetry.

Unit –VI Trigonometric Levelling and Setting out works (06 hours)

a) Trigonometric Levelling :- Terrestrial refraction, Angular corrections for curvature and refraction, Axis signal correction, Determination of difference in elevation by single observation and reciprocal observations.

b) Setting out of Construction works:- Setting out of a bridge, Determination of the length of the central line and the location of piers. Setting out of a tunnel – Surface setting out and transferring the alignment underground.

Term work

Term work shall consist of the following practicals and project.

Geodetic Surveying and Trigonometrical levelling (any three)

1. Measurement of horizontal and vertical angles with 1” theodolite.
2. Determination of elevation of inaccessible objects by trigonometrical levelling.
3. Practical based on various special functions available in a total station such as remote elevation measurements, remote distance measurements and co-ordinate stakeout .
4. Establishing control station using single or dual frequency GPS receiver

1. Study and use of nautical sextant and measurement of horizontal angles
2. Plotting of river cross-section by hydrographic surveying
3. Solution to three point problem by analytical method

1. Study of aerial photograph and finding out the scale of the photograph.
2. Determination of air base distance using mirror stereoscope.
3. Determination of difference in elevation by parallax bar.

1. Study and applications of different RS data products available with National Remote Sensing Centre (NRSC)
2. Use of RS images and visual interpretation
3. Use of interface and tools in GIS software such as GRAM++ or QGIS or equivalent software.

Project: (Any one)

1. Adjustment of geodetic quadrilateral without central station by method of correlates.
2. Field survey (500 sq.m.) using Differential GPS (Control as well as mapping).

Reference Books

1. Surveying & Levelling, 2/E—Subramanian—Oxford University Press
2. Surveying: Vol. II. and III by Dr. B. C. Punmia : Laxmi Publication - New Delhi.
3. Surveying and Levelling Vol. II by T. P. Kanetkar and S. V. Kulkarni Pune Vidyarthi Publication.
4. GPS Sattelite Surveying—Alfred Leick—Wiley
5. Remote sensing and Geographical Information System, By A. M. Chandra and S. K. Ghosh, Narosa Publishing House.
6. Remote Sensing & GIS,2/E—Bhatta-- Oxford University Press
7. Principles of Geographical Information System—Burrough-- Oxford University Press
8. Surveying—M.D.Saikia—PHI Learning Pvt .Ltd.Delhi
9. Advanced Surveying -Total Station, GIS and Remote Sensing by SatheeshGopi, R.Sathikumar and N. Madhu , Pearson publication
10. Surveying Vol. 2 by S. K. Duggal, McGraw Hill Publication
11. Remote sensing & image interpretation, Lillesand& Kiefer, John wiley Pub.
12. Surveying &levelling by R. Subramanian, Oxford Publication.

Suggested Reading

Bureau Gravimetrique International (BGI)
International GPS Service for Geodynamics (IGS)
International Association of Geodesy (IAG)
International Federation of Surveyors (FIG)
Permanent Service for Mean Sea Level (PSMSL)
Commission X Global and Regional Geodetic Networks
www.nrsa.gov.in
www.iirs-nrsa.gov.in
www.surveyofindia.gov.in

Savitribai Phule Pune University

TE Civil (2015 Course) w.e.f. June 2017

301008 Project Management and Engineering Economics

Teaching scheme	Examination scheme
Lectures: 4 hours/week	In semester exam: 30 marks---1 hour Paper
	End semester exam: 70 marks—2.5 hours Paper

Unit I **(8 hours)**

Introduction to project management

Importance, Objectives & Functions of Management , Principles of Management, Categories of Project, Project Failure, Project--- Life Cycle Concept and Cost Components, Project Management Book of Knowledge {PMBOK} – Different Domain Areas, Project management Institute and Certified Project Management Professionals (PMP). Importance of organizational Structure in Management- Authority / Responsibility Relation, Management by objectives (MBO)

Unit –II **(08 hours)**

Project planning and scheduling

WBS – Work Breakdown Structure, Gantt/Bar chart & its Limitations, Network Planning, Network analysis, C. P. M.- . Activity on Arrow (A.O.A.), Critical path and type of Floats, Precedence network analysis (A.O.N.), Types of precedence relationship, P. E. R.T. Analysis

Unit –III **(08 hours)**

Project Resources and Site Planning

Objectives of Materials Management – Primary and Secondary Material Procurement Procedures - Material requirement - raising of Indents, Receipts, Inspection, Storage, Delivery, Record keeping – Use of Excel Sheets, ERP Software, Inventory Control - ABC analysis, EOQ, Introduction to Equipment Management – Fleet Management, Productivity Studies, Equipment Down Time, Sizing - Matching , Site Layout and Planning, Safety Norms – Measures and Precautions on Site, Implementation of Safety Programs

Unit –IV **(08 hours)**

Project Monitoring and Control

Resource Allocation – Resource Smoothening and Levelling, Network Crashing – Time- Cost – Resource optimization, Project Monitoring - Methods, Updating and Earned Value Analysis, Introduction to use of Project Management Softwares – MS Project / Primavera, Case study on housing project scheduling for a small project with minimum 25 activities.

Unit –V (08 hours) Project Economics

Introduction to Project Economics - Definition, Principles, Importance in Construction Industry, Difference between Cost, Value, Price, Rent, Simple and Compound Interest, Profit, Annuities, Demand, Demand Schedule, Law of Demand, Demand Curve, Elasticity of Demand, Supply, Supply Schedule, Supply Curve, Elasticity of Supply Equilibrium, Equilibrium Price, Equilibrium Amount, Factors affecting Price Determination, Law of Diminishing Marginal Utility, Law of Substitution, Concept of Cost of Capital, Time Value of Money, Sources of Project Finances –

Concepts of Debt Capital and Equity Capital. Types of Capital – Fixed and Working, Equity Shares and Debenture Capital, FDI in Infrastructure

Unit-VI **(08 hours)**

Project appraisal

Types of Appraisals such as Political, Social, Environmental, Techno-Legal, Financial and Economical, Criteria for Project Selection - Benefit - Cost Analysis, NPV, IRR, Pay-Back Period, Break Even Analysis [Fundamental and Application Component], Study of Project Feasibility report and Detailed Project Report (DPR), Role of Project Management Consultants in Pre-tender and Post-tender.

Reference Books

1. Project Management—Khatua—Oxford University
2. Construction Project Management-Planning, Scheduling and Controlling by K. K. Chitkara, Tata McGraw Hill Publishing Company, New Delhi.
3. Construction Management and Planning by B. Sengupta and H. Guha, Tata McGraw Hill Publishing Company, New Delhi.
4. The Essentials of Project Management by Dennis Lock, Gower Publishing Ltd. UK.
5. Essentials for Decision Makers by Asok Mukherjee, Scitech Publication, New Delhi.
6. Total Quality Management - Dr. S.Rajaram and Dr. M. Sivakumar-- Biztantra
7. Total Engineering Quality Management – Sunil Sharma – Macmillan India Ltd.

Savitribai Phule Pune University
TE Civil (2015 Course) w.e.f. June 2017
301009 Foundation Engineering

Teaching scheme	Examination scheme
Lectures: 3 hours/week	In semester exam: 30 marks---1 hour Paper
	End semester exam: 70 marks—2.5 hours Paper

Unit-I

Subsurface Investigations for Foundations (06 hours) Purpose and planning of subsurface exploration. Methods of Investigation: Trial pits, borings, depth & number of exploration holes, core recovery, RQD, Core Log. Geophysical methods– Seismic refraction and Electrical resistivity method. Disturbed and undisturbed sampling, types of samplers, degree of disturbance of a sampler. Field tests- SPT, N value correction and significance, DCPT, SCPT and introduction of advanced testing techniques like Pressure meter test. **Site visit is recommended to learn this topic.**

Unit-II

Bearing capacity and Shallow Foundation (06 hours) Basic definitions, Modes of shear failure, bearing capacity analysis- Terzaghi's, Hanson's, Meyerhof's, Skempton's, Vesics equations and IS code method - Rectangular and Circular footings. Bearing Capacity evaluation: - Plate Load Test and SPT. Housel's perimeter shear concept. Bearing capacity of layered soil. Effect of water table on bearing capacity. Effect of eccentricity. Shallow foundation- Types and Applications. Floating foundation. Presumptive bearing capacity.

Unit-III **(06 hours)**

a) Settlement and Consolidation Settlement: - Introduction, Causes of settlement. Pressure bulb, Contact pressure, Significant Depth of foundation, Allowable settlement, Differential settlement - I.S. criteria, Types - Elastic settlement, Consolidation settlement. Use of Plate Load test and SPT in settlement analysis. Allowable soil pressure.

b) Consolidation - Introduction, spring analogy, Terzaghi's consolidation theory, Laboratory consolidation test, Determination of coefficient of consolidation- Square root of time fitting method and logarithm of time fitting method. Time factor. Rate of settlement and its applications in shallow foundation. Introduction of Normal consolidation, over consolidation and Preconsolidation pressure.

Unit-IV **(06 hours)**

Deep Foundations

Introduction, Pile classification, Pile installation-Cast in-situ, driven and bored pile, Load carrying capacity of pile by static method, Dynamic methods-Engineering news formula and Modified ENR formula. Pile load test and Cyclic Pile load test. Group action- Feld rule. Rigid Blocks method. Negative skin friction. Settlement of pile group in cohesive soil by approximate method. Piers and Caissons- Definition, Types and uses. Well foundation: components, sand Island method.

Unit V **(06 hours)**

Cofferdams and Foundation on Black Cotton Soils

a) Cofferdams: Types and concepts of Steel Sheet Piles and Precast Concrete Piles, Interlocking Circular Piles, RC Diaphragm wall method.

b) Foundation on Black Cotton Soils: Characteristics of black cotton soil, swelling potential and its evaluation methods, Engineering problems, Swelling pressure measurement, Foundations on black cotton soil: design principles, Construction techniques in B.C soils, under reamed piles-Design principles and its construction Techniques. Stone Columns prefabricated vertical Drains, Preloading technique, and vibro flotation technique.

Unit VI **(06 hours)**

Soil Reinforcement and Earthquake Geo-techniques

a) Soil Reinforcement: Basic components and Mechanism of reinforced soil. Geosynthetics: type's, functional properties and requirements. Geosynthetic Applications in Civil Engineering.

b) Earthquake Geo-techniques Introduction, Earthquake Terminology, Sources of earthquake, Seismic zones of India, Magnitude of an earthquake, Intensity of earthquakes, Effect of ground motion on structures, General principles of earthquake resistant design. Liquefaction Phenomenon.

Reference Books

1. Dr. B. J. Kasmalkar, "Foundation Engineering", Pune Vidyarthi Griha Prakashan, Pune
2. Gopal Ranjan and A. S. Rao, "Basic and Applied Soil Mechanics", New Age International Publishers, (2010)
3. Dr. B. C. Punmia, "Soil Mechanics and Foundation Engineering", Laxmi Publications.
4. Soil Mechanics- T.William Lambe--Wiley
5. J. E. Bowels, "Foundation Analysis and Design", McGraw-Hill
6. Foudation Enginnering- P. C. Varghese-- PHI Learning Pvt. Ltd.
7. Soil Mechanics and Foundation Engineering- V. N. S Murthy, Marcel Dekker, Inc. Newyork.
8. Soil Mechanics & Foundation Engineering - Rao --Wiley
9. A. K. Arora, "Soil Mechanics and Foundation Engineering", Standard Publishers, 2009.
10. Engineering in Rocks for Slopes. Foundations and Tunnels - T Ramamurthy - PHI Learning
11. Geotechnical Engineering by Conduto, PHI, New Delhi.
12. Foundation Design Manual: N V Nayak, Dhanpat Rai Publications.
13. International Steven Kramer, "Geotechnical Earthquake Engineering", Prentice Hall Publications.
14. Practical Handbook of Grouting: Soil-Rock and Structures---James Warner-- Wiley
    15. IS 1892, 1893, 2911, 6403, SP36 (PART-II)

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301010 Structural Design –II

Teaching scheme	Examination scheme
Lectures: 4 hours/week	In semester exam: 30 marks---1.5 hours Paper
Practical: 4 hours/week	End semester exam: 70 marks—2.5 hours Paper
	Term Work: 50 Marks, Oral Based on T.W.: 50 Marks

Unit I **(8 hours)**

Introduction to various design philosophies R.C structures: Historical development, Working stress method, Ultimate load method and Limit state method.

a) Working stress method: Moment of resistance of singly reinforced rectangular R.C. sections, Under reinforced, Balanced and Over reinforced sections. Moment of resistance of doubly reinforced rectangular sections.

b) Limit state method: Limit state of collapse, Limit state of serviceability and Limit state of durability. Characteristic strength, Characteristic load, concept of Safety - Probabilistic approach, Semi probabilistic approach. Partial safety factors for material strengths and loads. Study of Structural Properties of Concrete.

Unit II **(8 hours)**

a) Assumptions of Limit State Method, Strain variation diagram, Stress variation diagram, Design parameters for singly reinforced rectangular R.C. section, Moment of resistance of under reinforced and balanced section, M.R. of doubly reinforced rectangular section and flanged section.

b) Design of slab: One way, Simply supported, Cantilever and Continuous slabs by using IS code coefficients.

Unit III **(8 hours)**

a) Design of slab: Two way slabs: Simply supported, Continuous and Restrained.

b) Design of staircase: Dog legged and Open well.

Unit IV **(8 hours)**

Design of flexural members: Simply supported, Continuous, Cantilever beams (singly reinforced, doubly reinforced and flanged) for flexure.

Unit V **(08 hours)**

Design of flexural members:

a) Design of flexural members: For Shear, Bond and Torsion.

b) Design of flexural members: Redistribution of moments in continuous reinforced concrete beam.

Unit VI **(08 hours)**

a) Column: Introduction, Strain and Stress variation diagrams, axially loaded Short Column with minimum eccentricity requirements. Design of Short Column for axial load, Uni-axial, Biaxial bending using interaction curves.

b) Design of Isolated Column footing for axial load and uni-axial bending .

Term work

Design Assignments

a) Design of G + 2 (Residential/Commercial/Public) building covering all types of Slabs, Beams, Columns, Footings and Staircase (first and intermediate flights).

i. Minimum plan area of each floor shall be more than 150 m^2.

ii. Design of all plinth and ground beams.

iii. Design of all slabs, beams of first floor.

iv. Design of three types columns for, (a) axial load, (b)axial load + uniaxial BM, (c)axial load + biaxial BM), from terrace level to footing along with detailed load calculations and footing for columns with (a) axial load (b)axial load + uniaxial BM

v. Design any one element by using spread sheet.

vi. Detailing of reinforcement should be as per SP-34 & IS 13920

vii. Full imperial drawing sheets in four numbers. Out of which only structural plan drawing sheet shall be drawn by using any drafting software.

b) Reports of two site visits. (Building under construction)

Oral Examination shall be based on the above term work.

Note: Maximum number of students for projects not more than Four

Reference Books

1. "Illustrated Reinforced Concrete Design" by Dr. V.L.Shah and Dr. S.R. Karve, 'Structures Publications' , Pune 411009
2. "Illustrated Design of Reinforced Concrete Buildings (G+3)" by Dr. V.L.Shah and Dr. S.R. Karve, 'Structures Publications', Pune 411009.
3. "Design of Reinforced Concrete Structures" by Subramanian, 'Oxford University Press'.
4. "Limit State Analysis and Design" by P. Dayaratnram, 'Wheeler Publishing company', Delhi.
5. "Comprehensive Design of R.C. Structures" by Punmia, Jain and Jain, 'Standard Book House', New Delhi.
6. "RCC Analysis and Design" by Sinha, S, Chand and Co. New Delhi.
7. "Reinforced Concrete Design" by Varghese, PHI, New Delhi.
8. "Reinforced Concrete Design" by Pillai Menon, 'Tata McGraw Hill', New Delhi.
9. "Design of Concrete Structure" by J N Bandyopadhyay, PHI, New Delhi.

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301011 Environmental Engineering-I

Teaching scheme	Examination scheme
Lectures: 4 hours/week	In semester exam: 30 marks--1 hour Paper
Practical: 2 hours/week	End semester exam: 70 marks—2.5 hours Paper
	Practical Exam: 50 Marks

Unit-I **(08 hours)**

A) Noise Pollution: Sound measurements – Sound pressure, Intensity, Sound pressure level, Loudness, Equivalent noise level and Cumulative noise level.

B) Air Pollution: Atmospheric stability, Mixing heights, Meteorological parameters.

Air pollution control mechanism. Equipment for particulate contaminants. Principle and working of Settling chamber, Cyclone, Fabric filter, ESP. Gaseous contaminants control by adsorption and absorption technique.

C) Municipal Solid Waste: Concept of Municipal Solid waste management, Sources, Classifications, Treatment (composting &anaerobic digestion) Disposal (sanitary land fill)

Unit -II **(08 hours)**

A) Introduction to water supply scheme: Data collection for water supply scheme, Components and layout. Design period, Factors affecting design period.

B) Quantity: Rate of water consumption for various purposes like domestic, Industrial, Institutional, Commercial, Fire demand and Water system losses, Factors affecting rate of demand, Population forecasting.

C) Quality: Physical, Chemical, Radioactivity and Bacteriological Characteristics, Heavy metals. Standards as per IS: 10500 (2012)

Unit –III **(08 hours)**

A) Water treatment: Principles of water treatment operations and processes, Water treatment flow sheets.

B) Aeration: Principle and Concept, Necessity, Methods, Removal of taste and odour. Design of aeration fountain.

C) Sedimentation: Plain and chemical assisted - principle, efficiency of an ideal settling basin, Settling velocity, Types of sedimentation tanks, Design of sedimentation tank. Introduction & design of tube settlers.

Unit -IV **(08 hours)**

A) Coagulation and flocculation: Principle of coagulation, Common coagulants alum & ferric salts, Introduction to other coagulant aids like bentonite clay, Lime stone, Silicates and Polyelectrolytes, Introduction of natural coagulants, Mean velocity gradient "G" and Power consumption, Design of Flocculation chamber, Design of Clari-flocculator.

B) Filtration: Theory of filtration, Mechanism of filtration, Filter materials, Types: Rapid, Gravity, Pressure filter, Multimedia and dual media filters, Components, Under drainage system, Working and cleaning of filters, Operational troubles, Design of Rapid sand Gravity filters.

Unit -V **(08 hours)**

A) Disinfection: Mechanism, Factors affecting disinfection, Types of disinfectants, Types and methods of chlorination, Break point chlorination, Bleaching powder estimation.
B) Water softening methods and Demineralization : lime-soda, Ion-Exchange, R.O. and Electrodialysis
C) Fluoridation and defluoridation.

Unit-VI **(08 hours)**

A) Water distribution system: System of water supply- Continuous and intermittent system. Different distribution systems and their components. ESR- Design of ESR capacity. Wastage and leakage of Water- Detection and Prevention.
B) Rainwater harvesting: Introduction, need, methods and components of domestic rainwater harvesting system. Design of roof top rainwater harvesting system.
C) Introduction to Packaged WTP in townships, big commercial plants, necessity (On-site water treatment)

Term Work

Note- Any 8 out of 10 Practicals. (a ,b & c are compulsory.)

a) Practicals.

1. pH and Alkalinity of raw water, soft drinks & tea.
2. Total hardness and components of raw water.
3. Chlorides in water.
4. Chlorine demand and residual chlorine.
5. Sodium or Potassium or Calcium using flame photometer.
6. Turbidity and optimum dose of alum.
7. Fluorides or Iron contents in water.
8. Most Probable Number (MPN)
9. Ambient air quality monitoring for PM10/PM2.5,SO2 & NOx.
10. Measurement of noise levels at various locations using sound level meter, Calculate cumulative noise level at any one location.

b) Site visit to water treatment plant and Detailed Report.

c) Assignment 1. Study of Water intake structures.
2. Complete Design of WTP using appropriate software.

Text / Reference Books

Reference Books:

1. Environmental Engineering: Peavy and Rowe, McGraw Hill Publications.
2. Optimal Design of Water Distribution Networks: P. R. Bhave, Narosa Publishing House.
3. Rain Water Harvesting: Making water every body's business by CSE (Centre for Science and Environment) www.cse.org
4. Harvesting Faith: Linda K. Hubalek. Published by Butterfield books.
5. CPHEEO Manual on Water Supply & Treatment.
6. Standard Methods for the examination of water and waste water, 20th Edition (American Public health Association).

Text Books:

1.Water Supply Engineering: S. K. Garg, Khanna Publishers, New Delhi.
2.Water Supply and Sanitary Engineering: G. S. Birdie and J. S. Birdie, DhanpatRai Publishing Company, New Delhi.
3 Environmental Engineering 1: Water Supply Engineering: B. C. Punmia, Ashok Jain and Arun Jain. Laxmi Publications (P) Ltd.
4 Air Pollution: H. V. N. Rao and M. N. Rao, TMH Publications.
5**.** Theory and practice of water and waste water treatment--Wiley
6. Water Supply and Treatment Manual: Govt. of India Publication.
7. Waste Water Treatment-Concept Design and Approach---C.L.Karia,R.A.Christian--PHI
8. Environmental Remote Sensing from Regional to Global Scales—Ed.Giles Foody—Wiley
9. Water Supply and Sanitary Engineering: G. S. Birdie and J. S. Birdie, Dhanpat Rai Publishing Company, New Delhi.

Suggested Reading:

- Environmental Engineering by N. N. Barak , MGH
- Environmental Engineering by Venugopal Rao, PHI
- Environmental Engineering by Steel,McGhee , MGH
- Water Supply & Engineering by Pande andCarne , Tata McGraw Hill
- Water Supply Engineering by Harold Eaton Babbit & James Joseph Doland , MGH
- Principles of Water Treatment by Keny J. Howe, MWH.
- Water treatment : principles & Design 3rd edition by John C Crittenden R. Rhodes
- Water quality &Treatment : Handbook on Drinking Water 6th Edition by James K. Edzwald.
- Standard Methods, APHA,AWWA.
- Environmental Engineering Laboratory Manual by B. Kotain & Dr. N. Kumarswamy
- NEERJ Laboratory Manual

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301012 Seminar

Teaching scheme	Examination scheme
Practical: 1 hour/week	**Oral Exam: 50 Marks**

Oral examination shall be conducted based on a Seminar report to be prepared by each individual. The seminar report should contain the following.

1. Introduction of the topic, its relevance to the construction industry, need for the study, aims and subjunctives, limitations.
2. Literature review from books, journals, conference proceedings, published reports / articles / documents from minimum 8 references.
3. Theoretical chapter on the topic of study, advantages and limitations.
4. Photographs from web search / experiments done / projects visited / organizations visited for studying documents / procedures/ systems / materials/ equipment/ technologies used.
5. Ongoing research areas, information, about commercial vendors, information on benefit – cost aspects.
6. Concluding remarks with respect to commercial/ practical and social applications.
7. References in standard format.

Note:- In order to arouse the interest of students and engage them in active learning, mini-projects/ complex problems may be given in groups of maximum 4students, covering different aspects involved in Civil engineering so as to also enable the students to submit separate individual reports as required above.

Internal guides may prepare a continuous evaluation sheet of each individual and refer it to the external examiner for consideration.

The oral examination of each individual may then be conducted as per the practice adopted for other subjects.

FACULTY OF ENGINEERING

Savitribai Phule Pune University

Syllabus for the

T.E (Electronics & Telecommunications Engineering)

(2015 Course)

(w.e.f . June 2017)

Savitribai Phule University of Pune, Pune

Third Year E&TC Engineering (2015 Course)

(With effect from Academic Year 2017-18)

Semester I

Course Code	Course	Teaching Scheme Hours / Week			Semester Examination Scheme of Marks						Credits	
		Theory	Tutorials	Practicals	In-Sem	End-Sem	TW	PR	OR	Total	Th+Tut	PR/OR/TW
304181	Digital Communication	3	--	--	30	70	--	--	--	100	3	--
304182	Digital Signal Processing	3	--	--	30	70	--	--	--	100	3	--
304183	Electromagnetics	3	1	--	30	70	--	--	--	100	4	--
304184	Microcontrollers	3	--	--	30	70	--	--	--	100	3	--
304185	Mechatronics	3	--	--	30	70	--	--	--	100	3	--
304191	Signal Processing and Communications Lab (DC/DSP)	--	--	4	--	--	50	50		100	--	2
304192	Microcontrollers and Mechatronics Lab	--	--	4	--	--	50	50		100	-	2
304193	Electronics System Design	2	--	2	--	--	-	--	50	50	2	1
	Audit Course 3	--	--	--	--	--	--	--	--	--	----	
	Total	17	01	10	150	350	100	100	50	750	18	5
										Total Credits	**23**	

Third Year E&TC Engineering (2015 Course)

(With effect from Academic Year 2017-18)

Semester II

Course Code	Course	Teaching Scheme Hours / Week			Semester Examination Scheme of Marks						Credit	
		Theory	Tutorials	Practicals	In-Sem	End-Sem	TW	PR	OR	Total	Th+Tut	PR/OR/TW
304186	Power Electronics	3	--	--	30	70	--	--	--	100	3	--
304187	Information Theory, Coding and Communication Networks	4	--	--	30	70	--	--	--	100	4	--
304188	Business Management	3	--	--	30	70	--	--	--	100	3	--
306189	Advanced Processors	3	--	--	30	70	--	--	--	100	3	--
304190	System Programming and Operating Systems	3	--	--	30	70		--	--	100	3	--
304194	Power and ITCT Lab	--	--	4	--	--	50	50	--	100	--	2
304195	Advanced Processors and System Programming Lab	--	--	4	--	--	50	50	--	100	--	2
304196	Employability Skills and Mini Project	2	--	2	--	--	--	--	50	50	2	1
	Audit Course 4	--	--	--	--	--	--	--	--	--		
	Total	18	---	10	150	350	100	100	50	750	18	5
										Total Credits	23	

304181 Digital Communication

Credits: TH-03

Teaching Scheme:
Lecture : 03 hr/week

Examination Scheme:
In-Sem : 30 Marks
End-Sem: 70 Marks

Course Objectives:

- To understand the building blocks of digital communication system.
- To prepare mathematical background for communication signal analysis.
- To understand and analyze the signal flow in a digital communication system.
- To analyze error performance of a digital communication system in presence of noise and other interferences.
- To understand concept of spread spectrum communication system.

Course Outcomes:
On completion of the course, student will be able to

1) Understand working of waveform coding techniques and analyse their performance.
2) Analyze the performance of a baseband and pass band digital communication system in terms of error rate and spectral efficiency.
3) Perform the time and frequency domain analysis of the signals in a digital communication system.
4) Design of digital communication system.
5) Understand working of spread spectrum communication system and analyze its performance.

Course Contents

Unit I : Digital Transmission of Analog Signal (8 Hrs)

Introduction to Digital Communication System: Block Diagram and transformations, Basic Digital Communication Nomenclature. Digital Versus Analog Performance Criteria, Sampling Process, PCM Generation and Reconstruction, Quantization Noise, Non-uniform Quantization and Companding, PCM with noise: Decoding noise, Error threshold, Delta Modulation, Adaptive Delta Modulation, Delta Sigma Modulation, Differential Pulse Code Modulation, LPC speech synthesis.

Unit II :Baseband Digital Transmission (7Hrs)

Digital Multiplexing: Multiplexers and hierarchies, Data Multiplexers. Data formats and their spectra, synchronization: Bit Synchronization, Scramblers, Frame Synchronization. Inter-symbol interference, Equalization

Unit III : Random Signal & Noise (8Hrs)

Introduction, Mathematical definition of a random process, Stationary processes, Mean, Correlation &Covariance function, Ergodic processes, Transmission of a random process through a LTI filter, Power spectral density, Gaussian process, noise, Narrow band noise, Representation of narrowband noise in terms of in phase & quadrature components.

Unit IV : Baseband Receiver (8Hrs)

Signal space representation : Geometric representation of signal, Conversion of continuous AWGN channel to vector channel, Likelihood functions, Coherent Detection of binary signals in presence of noise, Optimum Filter, Matched Filter, Probability of Error of Matched Filter, Correlation receiver.

Unit V : PassbandDigital Transmission (8Hrs)

Pass band transmission model, Signal space diagram, Generation and detection, Error Probabilityderivationand Power spectra of coherent BPSK, BFSK and QPSK.

Geometric representation, Generation and detection of - M-ary PSK, M-ary QAM and their error probability, Non-coherent BFSK, DPSK.

Unit VI : Spread Spectrum Modulation (7Hrs)

Introduction, Pseudo noise sequences, A notion of spread spectrum, Direct sequence spread spectrum with coherent BPSK, Signal space dimensionality & processing gain, Probability of error, Concept of jamming, Frequency hop spread spectrum.

Text Books:

1. A.B Carlson, P B Crully, J C Rutledge, “Communication Systems”, Fourth Edition, McGraw Hill Publication.

2. Simon Haykin, “Digital Communication Systems”, John Wiley & Sons, Fourth Edition.

Reference Books:

1. P Ramkrishna Rao, Digital Communication, McGraw Hill Publication
2. Ha Nguyen, Ed Shwedyk, “A First Course in Digital Communication”, Cambridge University Press.
3. B P Lathi, Zhi Ding “Modern Analog and Digital Communication System”, Oxford University Press, Fourth Edition.
4. Bernard Sklar, Prabitra Kumar Ray, “Digital Communications Fundamentals and Applications” Second Edition, Pearson Education
5. Taub, Schilling, “Principles of Communication System”, Fourth Edition, McGraw Hill.

304182 Digital Signal Processing

Credits: TH-03

Teaching Scheme:	**Examination Scheme:**
Lecture : 03 hr/week	**In-Sem : 30 Marks**
	End-Sem : 70 Marks

Course Objectives:

- To introduce students with transforms for analysis of Discrete time signals and systems.
- To understand the digital signal processing, sampling and aliasing
- To use and understand implementation of digital filters.

Course Outcomes:

On completion of the course, student will be able to

1) Analyze the discrete time signals and system using different transform domain techniques.
2) Design and implement LTI filters for filtering different real world signals.
3) Develop different signal processing applications using DSP processor.

Course Contents

Unit I :DSP Preliminaries and Applications (6 Hrs)

Sampling, DT signals, sampling theorem in time domain, sampling of analog signals, recovery of analog signals, and analytical treatment with examples, mapping between analog frequencies to digital frequency, representation of signals as vectors, concept of Basis function and orthogonality, Eigen value and eigen vector, Basic elements of DSP and its requirements, advantages of Digital over Analog signal processing.

Unit II :Discrete Fourier Transform (8 Hrs)

DTFT, Definition, Frequency domain sampling , DFT, Properties of DFT, circular convolution, linear convolution, Computation of linear convolution using circular convolution, FFT, decimation in time and decimation in frequency using Radix-2 FFT algorithm, Linear filtering using overlap add and overlap save method, Amplitude spectrum and power spectrum, Introduction to Discrete Cosine Transform.

Unit III : Z transform (6 Hrs)

Need for transform, relation between Laplace transform and Z transform, relation between Fourier transform and Z transform, Properties of ROC, properties of Z transform, Relation between pole locations and time domain behavior, causality and stability considerations for LTI systems, Inverse Z transform, Power series method, partial fraction expansion method, Solution of difference equations using Z transform.

Unit IV : IIR Filter Design (8 Hrs)

Concept of analog filter design, IIR filter design by approximation of derivatives, IIR filter design by impulse invariance method, Bilinear transformation method, warping effect. Butterworth filter design, Characteristics of Butterworth filters, Chebyshev filters and elliptic filters, IIR filter realization using direct form, cascade form and parallel form, Finite word length effect in IIR filter design

Unit V : FIR Filter Design (6 Hrs)

Ideal filter requirements, Gibbs phenomenon, windowing techniques, characteristics and comparison of different window functions, Design of linear phase FIR filter using windows and frequency sampling method. Magnitude and Phase response of Digital filters, Frequency response of Linear phase FIR filters, FIR filters realization using direct form, cascade form , Finite word length effect in FIR filter design.

Unit VI : DSP Applications (6Hrs)

Overview of DSP in real world applications such as Digital crossover audio systems, Interference cancellation in ECG, Speech coding and compression, Compact disc recording system, Vibration signature analysis for defective gear teeth, Speech noise reduction, two band digital crossover.

Text Books:

1. John G. Proakis, Dimitris G. Manolakis, “ Digital Signal Processing: Principles, algorithms and applications” Fourth edition, Pearson Prentice Hall.

2. S. Salivahanan, C. Gnanpriya, “ Digital Signal processing”, McGraw Hill

Reference Books:

1. Ifaeachor E.C,Jervis B. W., “ Digital Signal processing : Practical approach”, Pearson publication
2. Li Tan, Jean Jiang, “ Digital Signal Processing : Fundamentals and applications“ Academic press
3. Dr. Shaila Apte, “Digital Signal Processing” Wiley India Publication, second edition
4. K.A. Navas, R. Jayadevan, “ Lab Primer through MATLAB”, PHI

304183 Electromagnetics

Credits: TH-03+Tut- 01

Teaching Scheme:

Lecture : 03 hr/week

Tut : 01 hr/week

Examination Scheme:

In-Sem : 30 Marks

End-Sem : 70 Marks

Course Objectives:

- To introduce the basic mathematical concepts related to electromagnetic vector fields.
- To impart knowledge on the concepts of electrostatics, electric potential, energy density and their applications.
- To impart knowledge on the concepts of magnetostatics, magnetic flux density, scalar and vector potential and its applications.
- To impart knowledge on the concepts of Faraday's law, induced emf and Maxwell's equations
- To impart knowledge on the concepts of Concepts of electromagnetic waves and Transmission lines.

Course Outcomes:

On completion of the course, student will be able to

1) Understand the basic mathematical concepts related to electromagnetic vector fields.

2) Apply the principles of electrostatics to the solutions of problems relating to electric field and electric potential, boundary conditions and electric energy density.

3) Apply the principles of magnetostatics to the solutions of problems relating to magnetic field and magnetic potential, boundary conditions and magnetic energy density.

4) Understand the concepts related to Faraday's law, induced emf and Maxwell's equations.

5) Apply Maxwell's equations to solutions of problems relating to transmission lines and uniform plane wave propagation.

Course Contents

Unit I :Electrostatics – I (8 Hrs)

Sources and effects of electromagnetic fields – Coordinate Systems – Vector fields Gradient, Divergence, Curl – theorems and applications – Coulomb's Law – Electric field intensity – Field due to discrete and continuous charges – Gauss's law and applications. Electric potential –Concept of Uniform and Non-Uniform field, Utilization factor.

Unit II :Electrostatics – II (8 Hrs)

Electric field in free space, conductors, dielectrics – Dielectric polarization – Dielectric strength – Electric field in multiple dielectrics – Boundary conditions (dielectric-dielectric, conductor – dielectric), significance of Poisson's and Laplace's equations, Capacitance, Energy density, Applications.

Unit III : Magnetostatics (9 Hrs)

Lorentz force, magnetic field intensity (H) – Biot–Savart's Law – Ampere's Circuit Law – H due to straight conductors, circular loop, infinite sheet of current, Magnetic flux density (B) – B in free space, conductor, magnetic materials, Boundary conditions, scalar and vector potential, Poisson's Equation, Magnetic force, Torque, Inductance, Energy density, Applications.

Unit IV : Electrodynamic Fields (8 Hrs)

Faraday's law, Translational and motional emf, Displacement current, Time varying Maxwell's equations - point form, integral form, Power and Poynting theorem, concept of Retarded magnetic vector potential, Applications.

Unit V : Transmission Lines(8 Hrs)

Line parameters, skin effect, general solution, physical significance of the equations, wavelength, velocity of propagation, the distortion less line, Reflection on a line not terminated in Z0, reflection coefficient, open and short circuited lines, reflection factor and reflection loss, standing waves; nodes; standing wave ratio, Input impedance of dissipation less line, Input impedance of open- and short-circuited lines, Power and impedance measurement on lines, Reflection losses on the unmatched Load, Problems solving using Smith chart.

Unit VI : Uniform Plane Waves (8Hrs)

Maxwell's equation using phasor notations, Electromagnetic wave equations (Helmholtz equation), Relation between **E** and **H**, depth of penetration, concept of polarization, Reflection by perfect conductor-normal incidence, reflection by perfect dielectric- normal incidence, snell's law.

Text Books:

1. Mathew N. O. Sadiku, 'Principles of Electromagnetics', 4th Edition ,Oxford University Press Inc, 2009.
2. William H. Hayt and John A. Buck, 'Engineering Electromagnetics', Tata McGraw Hill, 8th Revised edition, 2011.

Reference Books:

1. Kraus and Fleish, 'Electromagnetics with Applications', McGraw Hill International Editions, 5th edition, 2010.
2. Jordan and Balmain, "Electromagnetic Waves and Radiating Systems", PHI, 1964.

304184 Microcontrollers

Credits: TH-03

Teaching Scheme:	**Examination Scheme:**
Lecture : 03 hr/week	**In-Sem : 30 Marks**
	End-Sem : 70 Marks

Course Objectives:

- To understand architecture and features of typical Microcontroller.
- To understand need of microcontrollers in real life applications.
- To learn interfacing of real world peripheral devices
- To study various hardware and software tools for developing applications.

Course Outcomes:

On completion of the course, student will be able to

1) Learn importance of microcontroller in designing embedded application.
2) Learn use of hardware and software tools.
3) Develop interfacing to real world devices.

Course Contents

Unit I :Introduction to Microcontroller Architecture (6 Hrs)

Overview of MCS-51 architecture, Block diagram and explanation of 8051, Port structure , memory organization, Interrupt structure, timers and its modes, serial communication modes. Overview of Instruction set, Sample programs (assembly): Delay using Timer and interrupt, Programming Timer 0&1, Data transmission and reception using Serial port

Unit II :IO Port Interfacing-I (6 Hrs)

Interfacing of: LEDS, Keypad, 7-segment multiplexed display, LCD, ADC 0809(All programs in assembly).

Programming environment: Study of software development tool chain (IDE), hardware debugging tools (timing analysis using logic analyser)

Unit III : Parallel Port Interfacing-II (6 Hrs)

Interfacing of: DAC, Temperature sensors, Stepper motor, Motion detectors, Relay, Buzzer, Optoisolaters, Design of DAS and Frequency counter: All programs in assembly

Unit IV : PIC Microcontroller Architecture (6 Hrs)

Features, comparison & selection of PIC series as per application. PIC18FXX architecture- MCU, Program and Data memory organization, Pin out diagram, Reset operations, Oscillator options (CONFIG), BOD, power down modes & configuration bit settings, timer and its programming, Brief summary of Peripheral support, Overview of instruction set.

Unit V : Real World Interfacing Part I (6 Hrs)

Port structure with programming, Interrupt Structure (Legacy and priority mode) of PIC18FWith SFRS. Interfacing of LED, LCD (4&8 bits), and Key board, use of timers with interrupts, CCP modes: Capture, Compare and PWM generation, DC Motor speed control with CCP: All programs in embedded C

Unit VI : Real World Interfacing Part II (6Hrs)

Basics of Serial Communication Protocol: Study of RS232, RS 485, I2C,SPI, MSSP structure (&I2C),UART, Sensor interfacing using ADC, RTC(DS1306) with I2C and EEPROM with SPI. Desig PIC test Board, Home protection System: All programs in embedded C.

Text Books:

1. Mahumad Ali Mazadi, “The 8051 microcontroller & embedded systems” 2nd Edition ,PHI
2. Mahumad Ali Mazadi,“PIC Microcontroller & Embedded System” 3rd Edition ,Pearson

304185 Mechatronics

Credits: TH-03

Teaching Scheme: **Examination Scheme:**

Lecture : 03 hr/week **In-Sem : 30 Marks**

End-Sem : 70 Marks

Course Objectives:

- To understand the concept and key elements of Mechatronics system, representation into block diagram
- To understand principles of sensors their characteristics
- To Understand of various data presentation and data logging systems
- To Understand concept of actuator
- To Understand various case studies of Mechatronics systems

Course Outcomes:

On completion of the course, student will be able to

1 Identification of key elements of mechatronics system and its representation in terms of block diagram

2 Understanding basic principal of Sensors and Transducer.

3. Able to prepare case study of the system given.

Course Contents

Unit I :Introduction to Mechatronics (6 Hrs)

Basics of Mechatronics Systems : Definition of Mechatronics, Key elements of Mechatronics Systems, Levels of mechatronics systems,Measurement Characteristics,Examples of Mechatronics systems in daily life as ,WashingMachines, Digital Cameras,CD Players, camcorders, Mechatronics design process,phases of mechatronics design process, integrated design approach. **Mechanical Components and Servo mechanism :**Mechanical System and Motion, Mass Inertia and Dashpot, Gears, types of Gears, Servomechanism(Concepts and Theory, Problems).Case study Mechatronics Design of Coin Counter/Coin Separator

Unit II :Overview of Sensors, Transducers and their Characteristics Specifications (8Hrs)

Specifications related to selection criterion for force, pressure, temperature and motion (Rotary and

Linear).

Classification and selection of transducers:

Force: Load Cell, Cantilever Beam (Design aspect example)

Pressure: Strain Gauge, Piezoelectric

Motion: Rotary and Linear motions, Proximity sensors Inductive, Capacitive and Magnetic, sources detectors in optical proximity sensors.Comparison of Various proximity sensors

Temperature: Optical Fibre and its use in temperature measurement**,** Fibre Optic Temperature sensors,Ultrasonic Transducersfor applications as position, level, flow measurement.

Gas sensors, Wind sensors:Gyroscope, Accelerometer, Magnetometer (As used in smart phones)

Smart Sensors: Concept, Radiation Sensors - Smart Sensors - Film sensor, IR- temperature sensors

Introduction to MEMS& Nano Sensors . Rotary Optical Encoder

Unit III : Hydraulic Systems (6 Hrs)

Introduction to Hydraulic Actuators

Fluid Power systems:Concept of Actuators, Classification of Actuators: Pneumatic, Hydraulic and Electrical Actuators, Fluid Power systems

Hydraulic Systems: Physical Components of a Hydraulic systems, Hydraulic Pumps (e.g. Gear Pumps, Vane Pumps, Piston Pumps and Axial Piston Pumps) , Filters and Pressure Regulation, Relief Valve, Accumulator.

Unit IV : Pneumatic Systems (6 hrs)

Introduction to Pneumatic a Actuators

Physical Components of a Pneumatic Systems, Pneumatic Cylinders, Pneumatic Actuators (e.g. Spring Actuator and Spring Actuator with positioner), Air compressor ,Air Receiver, Air Dryer

Air Service Treatment: Air Filter, air regulator and Gauge, Air Lubricator and Pressure regulation Intake and Air Filter.Case study of Robotic Pick and Place robot

Unit V : Electrical Actuators, Electron-Mechanical Actuators (6 Hrs)

Electrical-Actuation system: Selection criteria and specifications of stepper motors, solenoid valves,relays (Solid State relays and Electromechanical relays).

Selection Criterionofcontrol valve, Single acting and Double acting Cylinders.

Electro-Pneumatic: Pneumatic Motors, Valves: Electro Hydraulic: 3/2 Valves, 4/2 Valves, 5/3 Valves

Cables: Power cable and Signal cables

Unit VI :Mechatronics Systems in Automobile (6Hrs)

(Treatment with Block Diagram Approach)

Boat Autopilot,High Speed tilting trains, Automatic car parking systems, Engine Management systems, Antilock Brake systems (ABS) ,CNC Machines(Only Black Diagram and explaination)

Text Books:

1) W. Boltan "Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering" 6th Edition, Pearson Education, 2016

2)David Alciatore and MaichaelB Histand, "Introduction to Mechatronics and Measurement Systems",4th Edition, Tata McGraw Hill 2013.

3) K.P.Ramachandran, G.K.Vijayaraghavan and M.S. Balasundaram, "Mechatronics-Integrated Mechanical Electronic Systems", Willey Publication 2008

Reference Books:

1) Nitaigour P. Mahalik ," Mechatronics-Principles, Concepts and Applications", Tata McGraw Hill, Eleventh reprint 2011.

2) DevdasShetty and Richard A.Kolk, "Mechatronics System Design", Thomson India Edition 2007.

3) HMT Limited, " Mechatronics", Tata McGraw-Hill Publishing Hous

304191 Signal Processing and Communications Lab

Credits: PR-02

Teaching Scheme:	**Examination Scheme:**	
Practical : 04 hr/week	**Practical :**	**50 Marks**
	Termwork :	**50 Marks**

Digital Communication

Note : Perform any 6 experiments from Group A and any 3 from Group B

Group A

1 Study of PCM and Companded PCM.

2 Study of DM and ADM.

3 Study of Pulse shaping, ISI and eye diagram

4 Study of Generation &detection of BPSK and QPSK.

5 Study of Generation &detection of BFSK.

6 Study of line codes (NRZ, RZ, POLAR RZ, BIPOLAR (AMI), MANCHESTER) & their spectral analysis.

7 Study of Detection of digital base band signal in presence of noise.

8 Study of Generation of PN Sequence and its spectrum.

9 Study of Generation &detection of DS-SS coherent BPSK&its spectrum.

Group B

1 Program for implementation to simulate PCM/ DM/ADM system.

2 Simulation program to study effect of ISI and noise in baseband communication system.

3 Simulation Program to study Random Processes.

4 Simulation program for calculation and plotting the error probability of BPSK, QPSK, QAM. Comparison of theoretical and practical BERs.

5 Simulation of any digital communication system using Simulink or similar software.

6 Simulation program for Constellation diagram of any pass band modulated signal in presence of noise.

Digital Signal processing

- Minimum eight experiments to be performed.
- Experiments can be performed using any appropriate software's such as C/MATLAB/SCILAB etc.

1. Write a program to verify the sampling theorem and aliasing effects with various sampling frequencies.
2. Write a programs to study and verify DFT properties (Minimum two properties).
3. Write a program to find 4 point circular convolution and compare the result with 8 point circular convolution to study aliasing effect in time domain.
    (a) To find Z and inverse Z transform and pole zero plot of Z-transfer function.
    (b) To solve the difference equation and find the system response using Z transform.
4. To plot the poles and zeros of a transfer function when the coefficients of the transfer
    (a) function are given, study stability of different transfer functions.
5. To study the effect of different windows on FIR filter response. Pass the filter coefficient designed in experiment 6 via different windows and see the effect on the filter response.
6. Design Butterworth filter using Bilnear transformation method for LPF and write a
    (a) program to draw the frequency response of the filter.
7. To plot the mapping function used in bilinear transformation method of IIR filter design.(assignment may be given)
8. Effect of coefficient quantization on the impulse response of the filter using direct form I
    (a) and II realization and cascade realization.(theory assignment)
9. Design and implement two stage sampling rate converter.
10. Computation of DCT and IDCT of a discrete time signal and comment on energy compaction density
11. Write a program for speech signal enhancement using pre-emphasis filter and speech filtering using bandpass filter. Any biomedical signal e.g. ECG can also be used for signal enhancement

304192 Microcontrollers and Mechatronics Lab

Credits: PR-02

Teaching Scheme: **Examination Scheme:**

Practical : 04 hr/week **Practical : 50 Marks**

Termwork : 50 Marks

Microcontrollers

List of Practical's: Minimum 10 experiments

(Experiment number 2,3, 5,6, 7, 9,10, 12 are compulsory; Any one from 1and4 , 8, 11 and 13)

1. Simple programmes on Memory transfer.
2. Parallel port interacting of LEDS—Different programs(flashing, Counter, BCD, HEX, Display of Characteristic)
3. Waveform Generation using DAC
4. Interfacing of Multiplexed 7-segment display (counting application)
5. Interfacing of LCD to 8051 (4 and 8 bit modes)
6. Interfacing of Stepper motor to 8051- software delay using Timer
7. Write a program for interfacing button, LED, relay & buzzer as follows

   A. On pressing button1 relay and buzzer is turned ON and LED's start chasing from left to right

   B. On pressing button2 relay and buzzer is turned OFF and LED start chasing from right to left .
8. Interfacing 4X4 keypad and displaying key pressed on LCD.
9. Generate square wave using timer with interrupt
10. Interfacing serial port with PC both side communication.
11. Interfacing EEPROM 24C128 using SPI to store and retrieve data
12. Interface analog voltage 0-5V to internal ADC and display value on LCD
13. Generation of PWM signal for DC Motor control.

Mechatronics

List of Practical's

1. Servomotor position control using photo electric pickup
2. Position and velocity measurement using encoders
3. Study of liquid flow measurement.

4. Study on the application of data acquisition systems for industrial purposes.
5. Interfacing of any 2- sensors with data acquisition systems.
6. Study of Hydraulic Trainer.
7. Study of Pneumatic Trainer.
8. Study of Electro-Pneumatic Trainer.
9. Study of Electro-Hydraulic Trainer.
10. Demonstration of any one case study.

304193 Electronic System Design

Credits: TH-02 PR-01

Teaching Scheme: **Examination Scheme:**

Lecture : 02 hr/week **Oral : 50 Marks**

Practical : 02 hr/week

Course Objectives:

- Design working, reliable and electronic system to meet specifications.
- Inculcate circuit designing skills and ability and to use modern design tools.
- Enhance employability based on knowledge and understandings of electronic system design.
- To learn basics of database systems used in design / simulation software.
- To create an interest in the field of electronic design as a prospective career option.

Course Outcomes:

On completion of the course, student will be able to

1. Apply the fundamental concepts and working principles of electronics devices to design electronics systems.
2. Shall be able to interpret datasheets and thus select appropriate components and devices
3. Select appropriate transducer and signal conditioning circuit to design prototype of Data Acquisition system.
4. Design an electronic system/sub-system and validate its performance by simulating the same.
5. Shall be able to use an EDA tool for circuit schematic and simulation.
6. Create, manage the database and query handling using suitable tools.

Course Contents

Unit I : Design of SMPS **(3 Hrs)**

General block diagram of SMPS, Advantages of SMPS, Comparison between SMPS and Linear Power Supply, Basic concept of switching regulator, Basic topologies, Step down converter, Step up converter, Fly back Converter, Forward converter.Performance parameters of SMPS. Selection Criteria of Switching element,Switching diode, Filter capacitor and inductor, PWM circuit, High frequency transformer design (steps only), Protection Circuits for SMPS.

Unit II : Design of Data Acquisition Systems (DAS) **(3 Hrs)**

Need of DAQ, Block diagram of DAQ, Application Areas of DAQ, Performance parameters of DAQ, Selection of Sensor, Transducers, and Actuator, Interfacing of sensor, Need of signal conditioners, Design of signal conditioning circuits, Selection criteria for ADC and DAC, Selection Criteria of Microcontrollers, PC Interfacing using serial communication like RS-232, USB, Overview of storage interface (like SD-Card, Serial EEPROM), Display interfaces (like 7-segment and LCD), GUI Development.

Unit III :Introduction to DBMS and SQL (4 Hrs)

RDBMS: Need and Overview, hierarchy, classification, creating a data base table and basics of normalization. Data integrity. Current trends (Intro to Non-SQL databases). Basics of SQL.Insert, Update and Deleteoperations,Retrieving Data based on query.Sorting and Filtering Data, Advanced Filtering, Summarizing Data, Grouping Data, Using Sub-queries, Nested queries, Joining Tables, Managing Tables. Using viewsand generating reports.

Unit IV : Design of Communication System(3Hrs)

Gathering requirements for designing a basic block diagram and detailing of **any one section out of following (One only)**

1. Modulator – Demodulator Design(AM / FM / FSK)
2. Design of Mixer
3. Audio / Power Amplifier
4. HF Oscillator, Cascode Amplifier

Unit V :PCB Design (2 Hrs)

Types of PCB, PCB artwork components (pads, vias, tracks, footprints) and their metrics, Netlists, Power planes, High frequency considerations, Power considerations, Design Artwork (double sided PTH), Carry out signal integrity analysis.

Text Books:

1. “Switching Power Supply Design,”3E, Abraham I. Pressman et. al, The McGraw-Hill Companies, 2009
2. “Measurement, Instrumentation, and Sensors Handbook”, John G. Webster, CRC Press, 1999
3. Reference Manual for MySQL / SQL Server / Oracle for Relational Databases
4. Roger L. Freeman,” Fundamentals of Telecommunications”, John Wiley & Sons

Reference Books:

1. Practical design of power supplies” , Ron Lenk, John Wiley & Sons, 2005
2. The Circuit Designer’s Companion”, Peter Wilson, Elsevier Ltd, 2012
3. Printed Circuits Handbook, 7th Edition, Clyde Coombs, Happy Holden, McGraw-Hill ,2016
4. Printed Circuit Boards: Design, Fabrication, and Assembly”, R. Khandpur, McGraw-Hill ,05
5. Mazidi, PIC microcontroller & embedded system, 3rd Edition ,Pearson
6. Henry Korth, "Data base system Concepts", 6th Edition, Mc-Graw Hill Education

7. http://www.ti.com/lit/an/slua143/slua143.pdf
8. https://www.onsemi.com/pub/Collateral/SMPSRM-D.PDF

http://download.ni.com/evaluation/daq/Measurement_System_Build_Guide.pdf

Guidelines:

a) Students are expected to Design and simulate all assignments during the semester in a group.Group shall consist of **maximum of three** students.
b) Institutions are requested to provide components required for implementation and required software.
c) **For hardware based assignments:** Paper design should be functionally verified with an appropriate EDA tool (NI Multisim/Orcad/Pspice / Altium Designer suite etc.) and prepare the document which consist of :
   1. Problem statement (Different for each group)
   2. Specifications 3.Block Diagram
   4. Component Selection 5. Design Calculations
   6. Simulation results 7. Bill of Material (generated from SQL)
   8. Conclusion **9.** Datasheets
   10. Detailed circuit diagram (separate sheet: Imperial /Half Imperial size)
d) **For software based assignments (Assignment 3):** Implement the database using MySQL software and prepare the user manual for the implemented system.

List of Practicals:

Assignment 1: Design and Implementation of SMPS

a) Design and simulate buck converter using ICslike LM3842 / LM 3524 and measure performance parameters like load regulation, line regulation, ripple rejection, output impedance, dropout voltage.
b) Design and Implement buck converter using ICs like LM3842 / LM 3524 and measure performance parameters like load regulation, line regulation, ripple rejection, output impedance and dropout voltage.

Assignment 2: Design, simulate and implement multi-channel data acquisition system

a) Minimum two sensors must be interfaced to microcontroller and design signal conditioning circuit for the same.

b) Interface display device such as LED, 7-segment and LCD
c) Interface the actuators such as Relay, DC Motor, Solenoid
d) Serial interface such as RS-232, USB to transmit the data to PC
e) Optional: GUI development using Lab-View, MATLAB, C#, .net, python etc.

Assignment 3: Create Database tables to store the relevant information of various electronic components. Define Keys for the tables and join those using relational keys.

a) Database for Electronic components shall be created with specification details.
b) Manipulate data using DML commands.
c) Use SQL queries for following
    I. Add and delete particular component.
    II. Display all the components with given criteria.
    III. Retrieve particular component as per the specification. This shall involve join of minimum two tables.
    IV. To sort / filter component according their values / tolerances
d) Generate Report s like consumption, inventory, Purchases during specified period.
e) Generate Bill of Materials for SMPS or DAQ design by entering all related components to database and using queries and report tool.

Assignment 4: Design of Building block in communication System

a) Design of block level system used for communication (Choose any one system for design)
b) Design any one building block in detail with selection of components, specifications and calculations. Specifications related to frequency and Power must be mentioned. Termination matching with preceding and next block.

Audit Course 3

Japanese Language Audit Course

With changing times, the competitiveness has gotten into the nerves and 'Being the Best' at all times is only the proof of it. Nonetheless, 'being the best' differs significantly from 'Communicating the best'! The best can merely be communicated whilst using the best… suited Language!!

Japanese is the new trend of 21^{st} century. Not only youngsters but even the professionals seek value in it. It is the engineer's companion in current times with an assertion of a thriving future. Pune has indisputably grown to become a major center of Japanese Education in India while increasing the precedence for Japanese connoisseurs.

Japanese certainly serves a great platform to unlock a notoriously tough market & find a booming career. While the companies prefer candidates having the knowledge of the language, it can additionally help connect better with the native people thus prospering in their professional journey. Learning Japanese gives an extra edge to the 'resume' since the recruiters consciously make note of the fact it requires real perseverance and self-discipline to tackle one of the most complex languages.

It would be easy for all time to quit the impossible; however it takes immense courage to reiterate the desired outcomes, recognize that improvement is an ongoing process and ultimately soldier on it.

The need of an hour is to introduce Japanese language with utmost professionalism to create awareness about the bright prospects and to enhance the proficiency and commitment. It will then prove to be the ultimate path to the quest for professional excellence!

Course Objectives:

- To meet the needs of ever growing industry with respect to language support.
- To get introduced to Japanese society and culture through language.

Course Outcomes:

On completion of the course

- One will have ability of basic communication.
- One will have the knowledge of Japanese script.
- One will get introduced to reading , writing and listening skills
- One will develop interest to pursue professional Japanese Language course.

Course Duration: 4 semesters (3 units / semester)

TE-Semester 1

Unit 1 : Introduction to Kanji Script,

Describing one's daily routine. To ask what someone does.

Expressions of Giving & Receiving.

Unit 2 : Adjectives (Types of adjectives)

Asking impression or an opinion about a thing / person / place that the listener

Has experienced, visited, or met

Describing things / person / places with the help of the adjectives.

Unit 3 : Expressions of Like & Dislikes. Expressing one's ability, hobby

Comparison between objects, persons & cities

Audit Course 3

Cyber and Information Security

Basic Concepts of Technology and Law

Basics of Information Technology, Basics of Indian Legal System, Information Technology Act 2000 (Amended), Relevant Amendments in all other laws. E-Contract The essence of digital contracts, Law of Contract, Construction of E-contracts, Issues of security, Employment contracts, Consultant Agreements and Digital signature

Intelligent Property Issues in Cyber space: Doman names and related issues, Copyright in digital media, Patents in cyber world. Rights of Neitzens and E- Governance: Privacy and freedom issues in cyber world, E-Governance, Cyber crimes and Cyber laws.

Information Security Fundamentals: Background, Importance, Statistics, National and International Scenario, Goals of security, Confidentiality, Privacy, Integrity, Non-repudiation, Availability.
Essentials of computer security - Sources of security threats – Intruders, Viruses, Worms and related threats - Threat identification - Threat analysis -Vulnerability identification and Assessment.

Security Investigation: Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues Access Control, Intrusion Detection and Server Management, Firewalls: Overview of Identification and Authorization, Overview of IDS, Intrusion, Detection Systems and Intrusion

Prevention Systems, User Management, Overview of Firewalls, Types of Firewalls, DMZ and firewall features

Security Policies and Management: Security Policy Design, Designing Security Procedures, Risk Management and Assessment Techniques, Security stan

dards, Security Models. Security Management Practices, Security Laws, Information Classification Process, Risk Management, Security Procedures and Guidelines, Business Continuity and Disaster Recovery, Ethics and Best Practices, Security Assurance

SEMESTER II

304186 Power Electronics

Credits: TH-03

Teaching Scheme:

Lecture : 03 hr/week

Examination Scheme:

In-Sem : 30 Marks

End-Sem : 70 Marks

Course Objectives:

- To introduce students to different power devices to study their construction, characteristics and turning on circuits.
- To give an exposure to students of working & analysis of controlled rectifiers for different loads, inverters, DC choppers, AC voltage controllers and resonant converters.
- To study the different motor drives, various power electronics applications like UPS, SMPS, etc. and some protection circuits.

Course Outcomes:

On completion of the course, student will be able to

1) Design & implement a triggering / gate drive circuit for a power device
2) Understand, perform & analyze different controlled converters.
3) Evaluate battery backup time & design a battery charger.
4) Design & implement over voltage / over current protection circuit.

Course Contents

Unit I : Power Devices (8 Hrs)

Construction, Steady state characteristics & Switching characteristics of SCR, Construction, Steady state characteristics of Power MOSFET & IGBT. SCR ratings: IL, IH, VBO, VBR, dv/dt, di/dt, surge current & rated current. Gate characteristics, Gate drive requirements, Gate drive circuits for Power MOSFET & IGBT,opto isolator driving circuits for SCR. Series and parallel operations of SCR's. Applications of above power devices as a switch .

Unit II :AC-DC Power Converters (8 Hrs)

Concept of line & forced commutation, Single phase Semi & Full converters for R, R-L loads, Performance parameters, Effect of freewheeling diode, Three phase Semi & Full converters for R load, effect of source inductance, Power factor improvement techniques, Diode based boost converter. Single Phase dual converter with inductive load.

Unit III : DC-AC Converters **(8 Hrs)**

Single phase bridge inverter for R and R -L load using MOSFET / IGBT, performance Parameters, single phase PWM inverters. Three Phase voltage source inverter for balanced star R load with 120° and 180 mode of operation, Device utilization factor, Harmonics Elimination/Modulation Techniques.

Unit IV : DC-DC converters & AC Voltage Controller **(8 Hrs)**

Working Principle of step down chopper for R-L load (highly inductive), control strategies. Performance parameters, Step up chopper, 2-quadrant & 4-quadrant choppers, SMPS: Fly back/ Half Bridge/ LM3524 based or equivalent Circuit. Single-Phase full wave AC voltage controller by using IGBT with R load.

Unit V : Resonant Converters & Protection of Power Devices & Circuits **(8 Hrs)**

Need for Resonant converters, Concept of Zero current switching (ZCS) and Zero voltage switching (ZVS) resonant converters. Cooling & heat sinks, over voltage conditions, over voltage protection circuits, metal oxide varistors, over current fault conditions, Over current protection. Electromagnetic interference, sources, minimizing techniques, shielding techniques for EMI.

Unit VI : Power Electronics Applications **(8 Hrs)**

ON-line and OFF line UPS with battery AH, back up time, battery charger rating. Electronic Ballast, LED Lamp with Driver Circuit, fan Regulator. Single phase separately excited DC motor drive, stepper motor drive, BLDC motor drive. Variable voltage & variable frequency three phase induction motor drive.

Text Books:

1) M. H. Rashid, “Power Electronics circuits devices and applications”, PHI 3rd edition, 2004 edition, New Delhi.

2) M. S. Jamil Asghar, "Power Electronics", PHI, 2004, New Delhi

Reference Books:

1) Ned Mohan, T. Undeland & W. Robbins, “Power Electronics Converters Applications and Design” 2nd edition, John Willey & sons, Singapore, Oxford University Press, New Delhi, 2005

2) P.C. Sen, “Modern Power Electronics”, S Chand & Co New Delhi

3) "GE SCR MANUAL" 6th edition, General Electric, New York, USA

4) Dr. P. S. Bimbhra, “Power Electronics”, Khanna Publishers, Delhi.

5) M D Singh, K B Khanchandani “Power Electronics” TMH

304187 Information Theory Coding Techniques and Communication Networks

Credits: TH-04

Teaching Scheme:	**Examination Scheme:**
Lecture : 04 hr/week	**In-Sem : 30 Marks**
	End-Sem : 70 Marks

Course Objectives:

- To understand information theoretic behavior of a communication system.
- To understand various source coding techniques for data compression
- To understand various channel coding techniques and their capability.
- To Build and understanding of fundamental concepts of data communication and networking.

Course Outcomes:

On completion of the course, student will be able to

1) Perform information theoretic analysis of communication system.
2) Design a data compression scheme using suitable source coding technique.
3) Design a channel coding scheme for a communication system.
4) Understand and apply fundamental principles of data communication and networking.
5) Apply flow and error control techniques in communication networks.

Course Contents

Unit I :Information Theory & Source Coding (6 Hrs)

Introduction to information theory, Entropy and its properties, Source coding theorem, Huffman coding, Shannon-Fano coding, The Lempel Ziv algorithm, Run Length Encoding, Discrete memory less channel, Mutual information, Examples of Source coding-Audio and Video Compression.

Unit II :Information Capacity & Channel Coding (6 Hrs)

Channel capacity, Channel coding theorem, Differential entropy and mutual Information for continuous ensembles, Information Capacity theorem, Linear Block Codes: Syndrome and error detection, Error detection and correction capability, Standard array and syndrome decoding, Encoding and decoding circuit, Single parity check codes, Repetition codes and dual codes, Hamming code, Golay Code, Interleaved code.

Unit III : Cyclic Codes (6 Hrs)

Galois field, Primitive element & Primitive polynomial, Minimal polynomial and generator polynomial, Description of Cyclic Codes, Generator matrix for systematic cyclic code, Encoding for cyclic code, Syndrome decoding of cyclic codes, Circuit implementation of cyclic code.

Unit IV : BCH and Convolutional Codes (6Hrs)

Binary BCH code, Generator polynomial for BCH code, Decoding of BCH code, RS codes, generator polynomial for RS code, Decoding of RS codes, Cyclic Hamming code and Golay code. Introduction of convolution code, State diagram, Tree diagram, Trellis diagram, Sequential decoding and Viterbi decoding

Unit V : Data Communication & Physical Layer(6 Hrs)

Data Communications – Networks - Network models – OSI model – Layers in OSI model – TCP / IP protocol suite – Addressing – Guided and Unguided Transmission media.

Unit VI : Data Link Layer (4Hrs)

Data link control: Framing – Flow and error control –Protocols for Noiseless and Noisy Channels – HDLC.

Text Books:

1) Bernad Sklar, "Digital Communication Fundamentals & applications", Pearson Education. Second Edition.

2) Behrouz A. Foruzan, "Data communication and Networking", Tata McGraw-Hill

Reference Books:

1) Ranjan Bose, "Information Theory coding and Cryptography", McGraw-Hill, 2^{nd} Ed

2) Murlidhar Kulkarni, K.S.Shivaprakasha, "Information Theory & Coding", Wiley Publications

3) Simon Haykin, "Communication Systems", John Wiley & Sons, Fourth Edition.

4) Shu lin and Daniel j, Cistello jr., "Error control Coding" Pearson, 2^{nd} Edition.

5) Todd Moon, "Error Correction Coding : Mathematical Methods and Algorithms", Wiley Publication

6) Khalid Sayood, "Introduction to Data compression", Morgan Kaufmann Publishers

304188 Business Management

Credits: TH-03

Teaching Scheme:	**Examination Scheme:**	
Lecture : 03 hr/week	**In-Sem**	**: 30 Marks**
Tutorial:	**End-Sem**	**: 70 Marks**
	Term Work	**:**

Course Objectives:

- To get awareness about various domains in Business Management.
- To understand concept of Quality Management, Financial Management and Project Management.
- To learn Human Resource Management, marketing management are the major tasks in Business
- To promote Entrepreneurship.

Course Outcomes:

On completion of the course, student will be able to

1) Get overview of Management Science aspects useful in business.
2) Get motivation for Entrepreneurship
3) Get Quality Aspects for Systematically Running the Business
4) To Develop Project Management aspect and Entrepreneurship Skills.

Course Contents

Unit I :Basics of Business Management (8 Hrs)

Introduction, Definition of management, characteristics of management, functions of management - Planning, Organizing, Staffing, Directing, Co-ordination, Controlling, Motivating, Communication, Decision Making, Principles of management – F.W.Taylor, Henry Fayol, Elton Mayo, Administration and management, Nature of management, levels of management, scientific management, managerial roles, Forms of Organization- Line , Line –staff,committee etc, Dist Business sectors & forms of business organizations- private sector,Cooperative sectors, public sector, joint sector, Services sector, Various forms of business organizations – Sole Proprietorship, Partnership firms, Joint stock companies -their features, relative merits, demerits & suitability. Concept of globalization

Unit II :Quality Management (6 Hrs)

Definition of quality, goalpost view of quality, continuous improvement definition of quality, types of quality – quality of design, conformance and performance, phases of quality management, Juran's and Demings view of quality, Quality Management Assistance Tools: Ishikawa diagram – Pareto Analysis – Pokka Yoke (Mi stake Proofing).quality circles, TQM, Kaizen, Five S (5S), Six sigma Quality Management Standards Application of six sigma a CASE study - The ISO 9001:2015 Quality Management System Standard. Software quality management with respect to CMM level and ISO standard.

Unit III : Financial Management and Project Management (6 Hrs)

Capital Structure, Fixed & working capital, Cash flow, Financial accounting concepts and application, Scope of business, Macro analysis, micro analysis, Demand and supply analysis. Function of money market and capital Market, sources of finance. Introduction to capital budgeting, Techniques of capital budgeting. Break even analysis - assumptions, importance, Cost-Benefit analysis,. Introduction to Project Management process (Project Life cycle Management),Project selection criteria, project scope, Project planning, scheduling , Resources and constrains. Project estimates and costing .Project qualitative and quantitative Risk analysis and Mitigation, project quality planning and deliverables. Case study of a project Mnagement.

Unit IV : Human Resource Development (6 Hrs)

Strategic importance HRM; objectives of HRM; challenges to HR professionals; role, Responsibilities and competencies of HR professionals; HR department operations; Human Resource Planning - objectives and process; human resource information system.. Talent acquisition; recruitment and selection strategies, career planning and management, training and development, investment in training program; executive development, Case study on Recent trends in Human Resource Development. Case study of a HR of an organization.

Unit V : Entrepreneurship Development (6 Hrs)

Concept of entrepreneurship, Identification of business opportunities, Generation of business idea, Business plan, Preparation of business proposal, Sources of finance – government and nongovernment agencies, , Policies and incentives for small business development, Government policies and incentives, Woman entrepreneurship, Industrial relations, Case study on Small scale industries in India.

Unit VI : Marketing (6 Hrs)

Introduction to marketing, marketing environment, segmentation. Consumer behavior and Marketing management. Marketing research, pricing, advertising, branding and packaging. Personal selling and sales force Management .Modern marketing system (digital Mastering□marketing) Email Marketing, Social Media Marketing, Web Marketing, Google (Google Analytics, Advertising and

Applications), Facebook, LinkedIn, Twitter, Guides & Directories, Online Publications etc for sales, customer services, staff recruitment etc, Blogging and Micro Blogging Event Management, Online Payments, Disability Web Access, Surveys & Forms, Affiliate & Voucher Marketing, Crowd sourcing, Mobile Social Media (Geotagging etc) and Mobile Marketing, Mobile Applications (Apps and Mobile Web), Audio , Video podcasting.

Introduction to supply chain management and customer relationship management

Text Books:

1) O. P. Khanna, "Industrial Engineering and Management", Dhanpatrai publications Ltd, NewDelhi.

2) L.C.Jhamb , Savitri Jhamb , Industrial Management – I , Everest Publishing House .

3) Jenniffer Greene, Andrew Stellman,Head First PMP 3rd Edition OREILLY Publication

4) Marketing Management-Phillip Kotlar, The Millennium Edition, PHI EEE Edition

Reference Books:

1) G. S. Batra , "Development of entrepreneurship " , deep and deep publications, new delhi

2) Ashwathappa, "human resource management", mc-gra w-hill education (india) pvt. Ltd.

3) M.Y. Khan and P. K. Jain, "financial management" , mc-graw-hill education (india) pvt. Ltd.

4) Ravi M. Kishore, "project management", mc-graw-h ill education (india) pvt.

5) Pravin kumar, " fundamentals of engineering economics", wiley india

6) Monga..i.r..Financial Accounting:conceptsand Applications,maytirpaperbacks

7) Business organization and management by dr. C. B. Gupta, publisher sultan chand & co. Delhi

8) Fundamentals of accounting & financial analysis: by Anil Chowdhry (Pearson education)

9) Textbook of economic theory - Stonier and Hague; LongmanGreen and co., london.

10) managerial economics - theory and application - D. M. Mithani

304189 Advanced Processors

Credits: TH-03

Teaching Scheme: **Examination Scheme:**

Lecture : 03 hr/week **In-Sem : 30 Marks**

End-Sem : 70 Marks

Course Objectives:

- To understand need and application of ARM Microprocessors in embedded system.
- To study the architecture of ARM series microprocessor
- To understand architecture and features of typical ARM7& DSP Processors.
- To learn interfacing of real world input and output devices
- To learn embedded communication systems.

Course Outcomes:

On completion of the course, student will be able to

1) Describe the ARM microprocessor architectures and its feature.

2) Interface the advanced peripherals to ARM based microcontroller

3) Design embedded system with available resources.

4) Use of DSP Processors and resources for signal processing applications.

Course Contents

Unit I :ARM7, ARM9, ARM11 Processors (6 Hrs)

Introduction to ARM processors and its versions, ARM7, ARM9 & ARM11 features, advantages & suitability in embedded application, registers, CPSR, SPSR, ARM and RISC design philosophy, ARM7 data flow model, programmers model, modes of operations. Introduction to Tiva TM4C123G Series Overview, Programming model, Tivaware Library

Unit II :ARM7 Based Microcontroller (6 Hrs)

ARM7 Based Microcontroller LPC2148: Features, Architecture (Block Diagram and Its Description), System Control Block (PLL and VPB divider) , Memory Map, GPIO, Pin Connect Block, timer, Instruction set, programming in assembly language.

Unit III : Real World Interfacing with ARM7 Based Microcontroller -1 (6 Hrs)

Interrupt structure of LPC2148, Interfacing with LED, LCD, GLCD, KEYPAD, simple LPC2148 GPIO Programming examples Using timers of LPC2148 to generate delay, serial communication programming for transmission and reception from computer, programming for UART.

Unit IV : Real World Interfacing with ARM7 Based Microcontroller -2 (6 Hrs)

GSM and GPS module interfacing, on-chip ADC using interrupt (VIC) and without using interrupt (VIC), EEPROM using I2C, SDCARD using SPI, on-chip DAC for waveform generation.

Unit V : Digital signal Processors –I (6 Hrs)

Introduction, Computer Architectures for signal processing, General purpose Digital signal Processors, selecting digital signal processors, Special purpose DSP Hardware, Architecture of TMS320C67X, Features of C67X processors, CPU, General purpose register files, Functional units and operation, Data paths, Control register file.

Unit VI : Digital signal Processors-II (6Hrs)

TMS320C67X Functional units,Internal memory, External memory, on chip peripherals, Interrupts, Instruction set and addressing modes, Fixed point instructions, Floating point instructions, Conditional operations, Parallel operations, Pipeline operations, Code Composer studio, Application programs in C67X.

Text Books:

1) Andrew Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide – Designing and Optimizing System Software", ELSEVIER

2) Digital Signal Processors: Architecture, Programming and Applications By B. Venkatramani, M Bhaskar McGraw Hill Second Edition

Reference Books:

i. LPC 214x User manual (UM10139) :- www.nxp.com

ii. ARM architecture reference manual : - www.arm.com

iii. Trevor Martin,"An Engineer's Introduction to the LPC2100 series", Hitex (UK)

iv. TMS320C67XX User manual: www.ti.com

v. Digital Signal Processing A Practical Approach by Emmanuel Ifeachor, Barrie W. Jervis Pearson Second edition

vi. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M", Newness, ELSEVIER.

304190 System Programming and Operating System

Credits: TH-03

Teaching Scheme:

Lecture : 03 hr/week

Examination Scheme:

In-Sem : 30 Marks

End-Sem : 70 Marks

Course Objectives:

- To understand system software concepts, like the use and implementation of assembler, macros, linker, loaders and compiler.
- To get acquainted with software tools for program development.
- To explore memory allocation methods, input output devices and file system w. r. t. various operating system.
- To study and implement various processes scheduling techniques and dead lock avoidance schemes in operating system.

Course Outcomes:

On completion of the course, student will be able to

1) Demonstrate the knowledge of Systems Programming and Operating Systems
2) Formulate the Problem and develop the solution for same.
3) Compare and analyse the different implementation approach of system programming operating system abstractions.
4) Interpret various OS functions used in Linux / Ubuntu

Course Contents

Unit I: Introduction to Systems Programming (8 Hrs)

Introduction:
Components of System Software, Language Processing Activities, Fundamentals of Language Processing.
Assemblers:
Elements of Assembly language programming. Simple assembler scheme, Structure of an assembler, Design of single and two pass assembler.
Macro Processors:
Macro Definition and call, Macro expansion, Nested Macro Calls, Advanced Macro Facilities, Design of a two-pass macro-processor.

Unit II : Compiler, Loaders and Linkers(8Hrs)

Compilers:
Basic compilers function, Phases of compilation, memory allocation, compilation of expression, Compilation of expressions, compilation of control structures, Code of optimization.

Loaders:

Loader Schemes: Compile and go, General Loader Scheme, Absolute loaders, subroutine linkages, relocating loaders, direct linking loaders, Design of an absolute loader.

Linkers:

Relocation and linking concepts, Design of linker, self relocating programs, Static and dynamic linker.

Unit III : Introduction to OS and Process management(6 Hrs)

Introduction to OS :
Architecture, Goals & Structures of O.S, Basic functions, Interaction of O. S. & hardware architecture, System calls, Batch, multiprogramming. Multitasking, time sharing, parallel, distributed & real -time O.S.

Process Management:
Process Concept, Process states, Process control, Threads, Scheduling: Types of scheduling: Preemptive, Non preemptive, Scheduling algorithms: FCFS, SJF, RR.

Unit IV : Concurrency control(6Hrs)

Concurrency:
Interprocess communication, Mutual Exclusion, Semaphores, Classical Problems of Synchronization: Readers-Writers, Producer Consumer, and Dining Philosopher problem.

Deadlock:
Principles of deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection.

Unit V : Memory Management (8 Hrs)

Basics of memory management, Swapping, Memory Allocation, Paging, Segmentation ,Virtual memory, Demand Paging, Page replacement, Page replacement algorithms – Optimal FIFO, LRU, LRU approximation, Allocation of frames

Unit VI : Input and Output, File System (8Hrs)

I/O management & Disk scheduling:
I/O Devices, Organization of I/O functions, Operating System Design issues, I/O Buffering, Disk Scheduling (FCFS), RAID, Disk Cache.

File Management:
Concepts, File Organization, File Directories, File Sharing, Record Blocking, Allocation methods, Free Space management

Text Books:

1. 1 Dhamdhere D., "Systems Programming and Operating Systems", 2nd Edition, 'TMH
2. Siberschatz A; Galvin P.B; Gagne G, “Operating System Concepts”, John Wiley.
3. J. J. Donovan, “Systems Programming”, McGraw Hill

Reference Books:

1. Stalling William, "Operating Systems" , Pearson Education, fifth edition.
2. Adam Hoover, “System Programming with C and UNIX”, Pearson Education
3. Leland L. Beck, “System Software,” Pearson Editions.
4. Andrew S. Tanenbaum, “Modern Operating Systems”, Second Edition, PHI.
5. A. V. Aho, R. Sethi, J. D. Ullman. Compilers: Principles, Techniques, and Tools. Addison-Wesley

304194 Power Electronics and Information Theory Laboratory

Credits: PR-02

Teaching Scheme:

Practical : 04 hr/week

Examination Scheme:

Practical : 50 Marks

Term work : 50 Marks

Power Electronics

List of Experiments (Any 8)

1) Characteristics of SCR
   i) Plot V-I characteristics , ii) Observe the effect of gate current
   iii) Measure I_H & I_L
2) V-I Characteristics of MOSFET / IGBT
   i) Plot output characteristics ii) Plot transfer characteristics
3) Single phase Semi / Full Converter with R & R-L load
   i) Observe load voltage waveform,
   ii) Measurement of firing angle, average o/p voltage across loads,
   iii) Verification of theoretical values with practically measured values.
4) Single-Phase PWM bridge inverter for R load
   i) Observe output rms voltage waveforms,
5) Step down dc chopper using power MOSFET / IGBT
   i) Measure duty cycle and observer effect on average load voltage for DC chopper
6) Find load & line regulation of given SMPS
7) Single phase AC voltage controller using SCRs for R load
   i) Observe output rms voltage waveforms,
   ii) Measurement of firing angle, o/p voltage across load,
   iii) Verification of theoretical values with practically measured values.
8) Speed control of DC motor / Stepper motor / AC motor
   i) Speed control of DC motor using armature voltage control / field control method.
   Measure RPM and plot graph of speed versus armature voltage and field current OR
   ii) Study drive circuit for stepper motor- phase sequencing and micro stepping. OR
   iii) Plot speed-torque characteristic of three phase induction motor.
9) To study over voltage / over current protection circuit.
10) i) Study of Power Factor improvement techniques. OR

ii) Simulation of circuits by using Powers software

Information Theory, Coding Techniques and Communication Networks

Note: Perform any 8 practical Assignments (1-6 and 11 are compulsory)

1 Write a program for determination of various entropies and mutual information of a given channel. Test various types of channel such as

a) Noise free channel. b) Error free channel

c) Binary symmetric channel d) Noisy channel

Compare channel capacity of above channels.

2 Write a program for generation and evaluation of variable length source coding using (C/MATLAB or any relevant software) (Any 2)

a) Shannon – Fano coding and decoding

b) Huffman Coding and decoding

c) Lempel Ziv Coding and decoding

3 Write a Program for coding & decoding of Linear block codes.

4 Write a Program for coding & decoding of Cyclic codes.

5 Write a program for coding and decoding of convolutional codes

6 Write a program for coding and decoding of BCH and RS codes.

7 Write a program to study performance of a coded and uncoded communication system (Calculate coding gain, error probability, Bit energy Vs error performance)

8 Write a simulation program to implement source coding and channel coding for transmitting a text file.

9 Implementation of any compression algorithm by using various toolboxes in MATLAB or any other platform for either audio, image or video data.

10 Study of Networking Components and LAN.

11 Write a simulation program to implement ARQ techniques

304195 Advanced Microprocessors and System Programming Lab

Credits: PR-02

Teaching Scheme:

Practical : 04 hr/week

Examination Scheme:

Practical : 50 Marks

Term work : 50 Marks

Advanced Microprocessors

List of Practical's

Group A: LPC2148 Based Experiments (Any 6)

1 Interfacing LPC2148 with GLCD to display image on it
OR
GPIO configuration and control with simple LED example on TIVA TM4C123G Platform
2. Using UART of LPC2148 for serial reception and transmission from/to computer
3. Interfacing GSM with LPC2148 for sending and receiving message and voice call
4. Interfacing GPS with LPC2148 for finding current location latitude and longitude values
5. Using built-in ADC of LPC2148 for displaying its values (Programming built-in ADC with interrupt and without interrupt) OR
Programming of on chip ADC and displaying converted digital values on HyperTerminal on TIVA Platform
6. Interfacing SD card to LPC2148 using SPI
7. Interfacing EEPROM to LPC2148 using I2C protocol
8. Introduction to Programming environment with CCS and Tiva library

Group B: DSP Based Experiments (Any 2)

The programs may be written in assembly language, C language and combination of both

1. Convolution
2. Discrete Fourier Transform Using FFT Algorithm
3. Discrete Fourier Transform Using DFT FFT Radix 2 Algorithm
4. FIR filter
5. Real time audio signal capture

TMS320C6748 DSP Development kit(LCDK) with XDS100 V2 JTAG Emulator may found useful.

System Programming and Operating Systems Lab

List of Practical's:

List of Assignments:

1. a. Study of Basic Linux Commands
   b. Write an shell scripting on LINUX OS
2. Write C Program to implement Lexical Analyzer for simple arithmetic operation which creates output tables (Uniform Symbol Table or a. Identifier Table b. Literal Table c. Symbol Table)
3. Design of PASS I of two pass assembler for pseudo machine code.
4. Design of a MACRO PASS-I
5. Implement Job scheduling algorithms: FCFS, SJF
6. Implement Bankers Algorithm for deadlock detection and avoidance
7. Implementation of page replacement algorithm: FIFO / LRU
8. Case Study
   a. Android mobile operating system
   b. Study of System calls to list files, directories
   c. Study of System calls to handles process

304196 Employability Skills and Mini Project

Credits: TH-02 PR-01

Teaching Scheme: **Examination Scheme:**

Lecture : 02 hr/week **Oral : 50 Marks**

Practical : 02 hr/week

Course Objectives:

- To understand the "Product Development Process" including budgeting through Mini Project.
- To plan for various activities of the project and distribute the work amongst team members.
- To inculcate electronic hardware implementation skills by -
- Learning PCB artwork design using an appropriate EDA tool.
- Imbibing good soldering and effective trouble-shooting practices.
- Following correct grounding and shielding practices.
- To develop student's abilities to transmit technical information clearly and test the same by delivery of Seminar based on the Mini Project.
- To understand the importance of document design by compiling Technical Report on the Mini Project work carried out.

Course Outcomes:

On completion of the course, student will be able to

1. Understand, plan and execute a Mini Project with team.
2. Implement electronic hardware by learning PCB artwork design, soldering techniques, testing and troubleshooting etc.
3. Prepare a technical report based on the Mini project.
4. Deliver technical seminar based on the Mini Project work carried out.

Course Contents

Execution of Mini Project

- Project group shall consist of **not more than 3** students per group.
- Mini Project Work should be carried out in the Design / Projects Laboratory.
- Project designs ideas can be necessarily adapted from recent issues of electronic design magazines Application notes from well known device manufacturers may also be referred.

- Use of Hardware devices/components is mandatory.
- Layout versus schematic verification is mandatory.
- Bare board test report shall be generated.
- Assembly of components and enclosure design is mandatory.

B: Selection: Domains for projects may be from the following, but not limited to:

- Instrumentation and Control Systems
- Electronic Communication Systems
- Biomedical Electronics
- Power Electronics
- Audio , Video Systems
- Embedded Systems
- Mechatronic Systems

- Microcontroller based projects should preferably use Microchip PIC controllers/ATmega controller/AVR microcontrollers.

C. Monitoring: (for students and teachers both)

Suggested Plan for various activities to be monitored by the teacher.

Week 1 & 2: Formation of groups, Finalization of Mini project & Distribution of work.

Week 3 & 4: PCB artwork design using an appropriate EDA tool, Simulation.

Week 5 to8:PCB manufacturing through vendor/at lab, Hardware assembly, programming (if required) Testing, Enclosure Design, Fabrication etc

Week 9 & 10: Testing of final product, Preparation, Checking & Correcting of the Draft Copy of Report

Week 11 & 12: Demonstration and Group presentations.

Log book for all these activities shall be maintained and shall be produced at the time of examination.

D. Report writing

- A project report with following contents shall be prepared:
    - Title
    - Specifications
    - Block diagram
    - Circuit diagram
    - Selection of components, calculations

- Simulation results
- PCB artwork
- Layout versus schematic verification report
- Testing procedures
- Enclosure design
- Test results
  Conclusion
- References

Text Books:

1. Thomas C Hayes, Paul Horowitz,, "The Art of Electronics",Newens Publication

2. Analog Circuit Design: Art, Science and Personalities, by Jim Williams (Editor) , EDN series for Design Engineers,

3. M Ashraf Rizvi," Effective Technical Communication", Tata McGraw Hill Education Pvt. Ltd.

Reference Books:

1. . Robert Boylested, " Essentials of Circuit Analysis", PHI Puublications
2. Meenakshi Raman, Sangeeta Sharma," Technical Communication, Principles and Practice", Oxford University Press
3. A.E. Ward, Angus, " Electronic Product Design", Stanley thornes Publishers, UK.
4. C Muralikrishna, Sunita Mishra," Communication Skills for Engineers", Pearson

Audit Course 4

Japanese Language Audit Course

With changing times, the competitiveness has gotten into the nerves and ‘Being the Best’ at all times is only the proof of it. Nonetheless, ‘being the best’ differs significantly from ‘Communicating the best’! The best can merely be communicated whilst using the best… suited Language!!

Japanese is the new trend of 21^{st} century. Not only youngsters but even the professionals seek value in it. It is the engineer’s companion in current times with an assertion of a thriving future. Pune has indisputably grown to become a major center of Japanese Education in India while increasing the precedence for Japanese connoisseurs.

Japanese certainly serves a great platform to unlock a notoriously tough market & find a booming career. While the companies prefer candidates having the knowledge of the language, it can additionally help connect better with the native people thus prospering in their professional journey. Learning Japanese gives an extra edge to the ‘resume’ since the recruiters consciously make note of the fact it requires real perseverance and self-discipline to tackle one of the most complex languages.

It would be easy for all time to quit the impossible; however it takes immense courage to reiterate the desired outcomes, recognize that improvement is an ongoing process and ultimately soldier on it.

The need of an hour is to introduce Japanese language with utmost professionalism to create awareness about the bright prospects and to enhance the proficiency and commitment. It will then prove to be the ultimate path to the quest for professional excellence!

Course Objectives:

- To meet the needs of ever growing industry with respect to language support.
- To get introduced to Japanese society and culture through language.

Course Outcomes:

On completion of the course

- One will have ability of basic communication.
- One will have the knowledge of Japanese script.
- One will get introduced to reading , writing and listening skills

- One will develop interest to pursue professional Japanese Language course.

Course Duration: 4 semesters (3 units / semester)

Course Content for TE-Semester 2

Unit 1 : Stating existence or a presence of thing (s), person (s)
Relative positions, Counters

Unit 2 : Expressing one's Desire & wants
Verb groups,
Asking, Instructing a person to do something

Unit 3 : Indicating an action or motion is in progress. Describing habitual action
Describing a certain continuing state which resulted from a certain action in the past. Express permission & prohibition.

Audit Course 4

Embedded System Design using MSP430

Embedded applications like automation and control, consumer electronics, test and measurement equipment's, HVAC and building control, remote monitoring and other embedded applications require Low power CPU's with more GPIO's, in-build ADC and dedicated Embedded protocols. MCU workshop is based upon Low power 16-bit MSP430 series platforms. Participants will be exposed to complete application-building concept using 16-bit MSP430 series MCUs. The workshop will be designed to give hands-on experience so that every participant will get expertise in using MSP430 platform. From Standalone applications to Embedded Networking applications (Embedded Wi-Fi) will be covered with exposure to real world interfacing techniques.

Learning outcomes:

At the end of the workshop participant will be able to learn/understand

- Embedded C programming techniques for 16-bit platform
- Embedded protocols and its interfacing techniques
- Embedded Wireless networking concepts and its implementation with application oriented projects and case studies.

Prerequisite:

Must have exposure to building embedded applications for 8-bit platforms
Basic knowledge of C language programming

Digital Electronics fundamentals

Introduction to Embedded Curriculum: framework, concept map and role of faculty mentors.

Embedded Systems and role of TI platforms

Introduction to MSP430 series platforms: scope, application and tools in Embedded ecosystem

Programming MSP430 using CCS

MSP430's Internal Architecture and Programmer's model

Various Configuration registers of in-build modules and their programming (GPIO, PWM, ADC)

Clock tree structure and its role

Interfacing Analog sensors

Enabling Low power modes and understanding Interrupt based programming techniques

Various Serial Communication Interfaces : UART / I2C / SPI

UART programming and data logging applications

Programming SPI Interface, Programming I2C Interface

Embedded Wi-Fi and Internet of things

Real-time data gathering (humidity, temperature, pressure etc.) and remote monitoring for Wireless Sensor Network applications and related use cases.

SAVITRIBAI PHULE PUNE UNIVERSITY

FACULTY OF ENGINEERING

SYLLABUS FOR T. E. (ELECTRICAL ENGINEERING)

(2015 course)

WITH EFFECT FROM YEAR 2017-2018

Savitribai Phule Pune University

FACULTY OF ENGINEERING

T.E. Electrical Engineering (2015 Course)

(w.e.f. 2017-2018)

SEMESTER-I

Sr. No	Subject Code	Subject Title	Teaching Scheme			Examination Scheme					Total Marks	Credit	
			Th.	Pr.	Tu.	PP In Sem	PP End Sem	TW	PR	OR		TH/ TU	PR+OR
1	311121	Industrial and Technology Management	03	--	--	30	70	--	--	--	100	03	--
2	303141	Advance Microcontroller and its Applications	04	02	--	30	70	--	--	50	150	04	01
3	303142	Electrical Machines II	04	02	--	30	70	--	50	--	150	04	01
4	303143	Power Electronics	04	02	--	30	70	--	50	--	150	04	01
5	303144	Electrical Installation, Maintenance and Testing	03	02	--	30	70	50	--	--	150	03	01
6	303145	Seminar and Technical Communication	--	02	--	--	--	50	--	--	50	--	01
	303152	Audit Course III											
TOTAL			18	10	--	150	350	100	100	50	750	18	05

SEMESTER-II

Sr. No.	Subject Code	Subject Title	Teaching Scheme			Examination Scheme					Total Marks	Credit	
			Th.	Pr.	Tu	PP In Sem	PP End Sem	TW	PR	OR		TH/ TU	PR+OR
1.	303146	Power System II	04	02	--	30	70	--	50	--	150	04	01
2.	303147	Control System I	04	02	--	30	70	-	--	50	150	04	01
3.	303148	Utilization of Electrical Energy	03	--	--	30	70	--	--	--	100	03	--
4.	303149	Design of Electrical Machines	04	02	--	30	70	25	--	50	175	04	01
5.	303150	Energy Audit and Management	03	02	--	30	70	25	--	--	125	03	01
6.	303151	Electrical Workshop	--	02	--	--	--	50	--	--	50	--	01
	303153	Audit Course IV											
Total			18	10	--	150	350	100	50	100	750	18	05

Th: Theory lectures hours/week

Pr: Practical hours/week

Tu: Tutorial hours/week

TW: Term work

PR: Theory

OR: Oral

PP: Paper- In semester and End Semester

Audit Course

- Audit Course: Optional for 1st and 2nd term of TE Electrical Engineering

- 'Audit Courses' means a Course in which the student shall be awarded Pass or Fail only. It is left to the discretion of the respective affiliated institute to offer such courses to the students. Evaluation of audit course will be done at institute level itself.

- Teaching-learning process for these subjects is decided by concern faculty/industry experts appointed by the affiliated Engineering College.

- Marks obtained by student for audit course will not be taken into consideration of SGPA or CGPA.

Audit Course III	**(A) Wind Energy Systems**
	(B) Microcontroller MSP 430 and Applications
Audit Course IV	**(A) Bioenergy Systems**
	(B) Applications of Power Electronics

311121: Industrial And Technology Management

Teaching Scheme	Credits	Examination Scheme [Marks]
Theory: 03 Hrs./Week	03	In Sem. : 30 Marks End Sem.:70 Marks

Course Objective:

The course aims to

- Possess knowledge of types of business organizations; explore the fundamentals of economics and Management.
- Understand the basic concepts of Technology management and Quality management.
- Analyse and differentiate between marketing management and financial management.
- Recognize the importance of Motivation, Group dynamics, Team work, leadership skill and entrepreneurship.
- Explain the fundamentals of Human Resource management.
- Identify the importance of Intellectual property rights and understand the concept of patents, copy rights and trademarks.

Course Outcome:

Upon successful completion of this course, the students will be able to

- Differentiate between different types of business organization and discuss the fundamentals of economics and management.
- Explain the importance of technology management and quality management.
- Describe the characteristics of marketing and its types.
- Discuss the qualities of a good leader.

Unit 01: Introduction to managerial and economical demand (06Hrs)

Managerial Economics: Definition of economics, Demand and Supply concept, Law of demand and supply, Elasticity of demand and supply, Demand forecasting: Meaning and methods.

Management: Meaning, scope, function, and importance of management. Difference between administration and management. Types of business ownership: Sole proprietorship, Partnership (Act 1934), LLP (Limited Liability Partnership), (Act2008). Business Organizations: Line organization, Line and Staff organization and Functional Organization. Joint Stock Company: Public Limited and Private Limited, Public Sector Undertaking (PSU)

Unit 2: Technology and Industrial Management (06Hrs)

Introduction to industrial management: Concept, development, application and its scope.

Introduction of Technology Management : Definition of technology, Management and its relation with society, classification of technology, Management of technology at various levels- its importance on National Economy, Ethics in technology management, Critical Factors in technology management.

Unit 3: Quality Management **(06Hrs)**

Definition of Quality Management: Definition of quality, continuous improvement, Types of quality. Quality of design, Assistance Tools: Ishikawa diagram – Pareto Analysis. Pokka Yoke (Mistake Proofing) quality circles, Kaizen. TQM, 5S (Case study of Toyota, descriptive treatment). Six-Sigma, Quality Management Standards (Introductory aspects only) The ISO 9001:2000 Quality Management System Standard- The ISO 14001:2004. Environmental Management System Standard.

Unit 4: Marketing and Financial Management **(06Hrs)**

Marketing Management: Market, meaning, characteristics and its types: Perfect Competition, Monopoly, Monopolistic completion and Oligopoly. Marketing and selling, marketing planning. Market survey and market research, online Marketing.

Financial Management: Definition of financial management, cost. Types of costs, and methods of costing, price, capital. Debit, credit, books of accounts and final accounts.

Unit 5: Human Resource Management **(06Hrs)**

Motivation: Introduction to Motivation, theories of work motivation: Maslow Hierarchy of need's theory, Theory X, Theory Y and F. Herzberg's two factor theory. Group dynamics: Types and interactions of groups, stages of group dynamics: Norming, Storming, Forming, Performing and Adjourning. Leadership- Laissez-faire, importance, qualities of good leadership. Human Resource Management- Introduction, importance, scope. HR planning. Recruitment, selection, training and development, Performance management.

Unit 6: Entrepreneurship **(06Hrs)**

Entrepreneurship- Definition, concept, traits, qualities of entrepreneur. Importance and limitations of rational decision making, Decision making under certainty, uncertainty and risk. Incentives for small business development, Government policies and incentives, Case study on Small scale industries in India. Introduction to Intellectual Property Rights (IPR), Meaning of IPR, Different forms of IPR, Patents, Criteria for securing Patents. Patent format and structure, Copy and trademark (Descriptive treatment only).

Text Books:

[T1] O.P. Khanna, industrial engineering and management, Dhanpat Rai and sons, New Delhi.

[T2] E. H. McGrah, S. J. Basic managerial skill for all.

[T3] Tarek Khalil, Management of Technology Tata Mc Graw Hill Publication Pvt. Ltd.

[T4] Prabuddha Ganguli Intellectual Property rights TATA McGraw-Hill Publishing Company

[T5] Management Accounting and financial management by "M. Y. Khan and P. K. Jain", Mcgraw Hill-Tata-ISBN.

Reference Books:

- **[R1]** C. B. Mamoria and V.S.P.Rao- Personnel Management, Himalaya Publishing House, 30th Edition 2014
- **[R2]** Harold Koonlz and O D'onnel – Management.McGrawHill Publication 1980
- **[R3]** Philip Kotler- Marketing Management. Pearson Edition 2008
- **[R4]** Robert Heller, Managing Teams, Dorling Kindersley, London.
- **[R5]** Kelly John M, Total Quality Management, InfoTech Standard, Delhi.
- **[R6]** Joseph M. Juran Juran's Quality Handbook TATA McGraw-Hill.
- **[R7]** Dale H. Besterfield and CarolBesterfield Total Quality Management Prentice Hall of India Pvt. Ltd.
- **[R8]** Shiv Sahai Singh[Editor] The Law of Intellectual Property rights.
- **[R9]** N. R. Subbaram, What Everyone Should Know About Patents, Pharma Book Syndicate, Hyderabad.
- **[R10]** Principles and Practices of Management –Dr. P.C. Shejwalkar, Dr. Anjali Ghanekar, Prof. Deepak Bhivpathki.
- **[R11]** Financial Management by "I M Pandey", Vikas Publishing House Pvt. Ltd., Delhi Philip Kotler- Marketing Management

Unit	Text Books	Reference Books
1	T1	R2,R10
2	T1, T2,T3	R5
3	-	R3,R5,R6
4	T5	R3, R11
5	T1	R1,R2
6	T4	R8

303141: Advance Microcontroller and its Applications

Teaching Scheme		Credit	Examination Scheme[Marks]	
Theory :	04 Hrs./week	04	In Sem. :	30 Marks
Practical :	02 Hrs./week	01	End Sem.:	70 Marks
			Oral :	50 Marks

Prerequisite:

- Knowledge of Number system
- Knowledge of basic logic components.
- Programming skills in C Language,
- Microprocessor and Microcontroller Architecture.

Objectives:

The objectives of this course are

- To provide understanding of architecture of PIC 18F458 microcontroller
- To develop ability to Write and Interpret Assembly and C language programs for PIC 18F458
- To interface various devices with PIC18F458

Course outcomes:

On successful completion of the course the student will be able to

- Explain architecture of PIC18F458 microcontroller, its instructions and the addressing modes.
- Develop and debug program in assembly language or C language for specific applications
- Use of an IDE for simulating the functionalities of PIC microcontroller and its use for software and hardware development.
- Interface a microcontroller to various devices.
- Effectively utilize advance features of microcontroller peripherals.

Unit 01 : PIC Architecture (08 Hrs.)

Comparison of CISC and RISC, RAM and Program memory organization, Program counters, Stack pointer, Bank Select Register, Status register, Data transfer instructions, Arithmetic and logical instructions. Assembly language programs.

Unit 02 : Assembly language programming (08 Hrs.)

Addressing Modes for PIC 18 microcontroller, Branch instruction, CALL, RETURN, Bit addressable instruction. Assembly language programs I/O ports, SFR related to PORTs, I/O port programming.

Unit 03 : Programming of PIC microcontroller in C (08 Hrs.)

Embedded C concepts, Header and source files and pre-processor directives, Data types, data structures, Control loops, functions, bit operations. I/O port programming in C, Delay programming.PIC 18 Timer 0 Programing in C

Unit 04 : Special Hardware features and Programming (08 Hrs.)

Timers required for CCP Applications, CCP module in PIC 18 microcontroller, Applications of CCP mode Generation of waveform using Compare mode of CCP module. Period measurement of a unknown signal using Capture mode in CCP module, Speed control of DC motor using PWM mode of CCP module

Unit 05 : Interrupt programming (08 Hrs.)

Interrupt Programming, Programming of Timer interrupts, Programming of External interrupts, Serial port programming. Interfacing of PIC18F458 8 bit model LCD(16x2)

Unit 06 : Interfacing of PIC Microcontroller (08 Hrs.)

PIC ADC, Programming of ADC using interrupts, Measurement of temperature and voltage Using PIC microcontroller. Interfacing DAC with PIC18F458, Interfacing of Electromechanical Relays and Opto-isolators.

Guidelines for Instructor's Manual

- Commands to be followed in order to operate the PIC18 micro controller kit.
- Detailed connection diagram / Circuit Diagram of the KIT.
- Pin Diagram and PIN layout of PIC 18F458, all supporting ICs.
- Manuals for interfacing kits such as DC motor, DAC.
- User manuals of all the interfacing kits such as stepper motor, DC motor, DAC etc.

Guidelines for Student's Lab Journal

- Title of the program.
- The program has to be written in the following format. Address- Instruction-Comment
- Input data has to be specified.
- Result of the program.
  Flow Chart for each program has to be drawn on separate page.

Guidelines for Laboratory Conduction

- Each student within the group has to enter and execute the program turn wise.
  Staff member has to check the result of all the groups after the execution of the program.
- Each subgroup of students in the laboratory should consist of maximum three numbers.

List of Experiments:

Any six experiments from section (A) and any three experiments from section (B)

Section A.

1. i) Introduction to MPLAB. ii) Programs on Addition, Subtraction and Multiplication
2. Data transfer to ports
3. Timer, Counter, Delay programming
4. Interfacing 18F458 to Switch and LED
5. Interfacing of LCD [16 X 2] with PIC 18F458
6. Generation of square, positive ramp, negative ramp, triangular waveforms using DAC interface
7. Generating PWM waveform using PWM mode of 18F458 timer
8. Driving relay from 18F458 using software and hardware interrupts

Section B.

1. Interfacing DC motor with PIC 18F458
2. Interfacing Stepper motor with PIC 18F458
3. Interfacing LM35 with PIC 18F458 and display temperature on it.
4. Measurement of speed using optical encoder.
5. Measurement of level using sensors and PIC 18F458.

Text Books:

[T1] PIC Microcontroller and Embedded Systems Using Assembly and C for PIC18 by Muhammad Ali Mazidi, Rolind D. McKinley, Danny Causey, Pearson Education.

[T2] Fundamentals of Microcontrollers and Applications in Embedded Systems with PIC by Ramesh Gaonkar, Thomson and Delmar learning, First Edition.

[T3] Programming And Customizing the PIC Microcontroller by MykePredko, TATA McGraw-Hill.

[T4] PIC microcontroller: An introduction to software and Hardware interfacing by Han-Way-Huang Thomson Delmar Learning.

[T5] Microcontroller Theory and Applications with PIC18F, M.Rafiquzzaman, John Wiley and Sons

Reference Books:

[R1] PIC18F458 datasheet

[R2] MPLAB IDE user guides

[R3] MICROCHIP Technical Reference Manual of 18F4520 Embedded Design with PIC 18F452 Microcontroller by John B. Peatman, Prentice Hall

Unit	Text Books	Reference Books
1	T1,T2,T3,T4	R1
2	T1, T2,T3,T4,T5	R1,R2
3	T1,T4,T5	R1
4	T1,T2,T3,T4	R1
5	T1,T2,T3,T4	R1
6	T1,T2,T3,T4	R1,R3

303142: Electrical Machines II

Teaching Scheme			Credits	Examination Scheme [Marks]		
Theory	:	4 Hrs./Week	04	In Sem.	:	30 Marks
Practical	:	2 Hrs./Week	01	End Sem.	:	70 Marks
				Practical	:	50 Marks

Prerequisites:

- Working principle and concepts of electrical machines
- Construction of DC series motor
- Phasor diagram and equivalent circuit of single phase transformer
- Construction and working of three phase induction motor.

Course Objectives:

- Learn construction & working principle of three phase synchronous machines.
- Define regulation of alternator & calculate it by direct and indirect methods.
- Study the methods of starting 3- phase synchronous motor, & its operation under Different conditions.
- Learn Speed control methods of three phase induction motor.
- Develop phasor diagram & circle diagram of a c series motor.
- Develop equivalent circuit of single phase induction motor.

Course Outcomes:

Students will be able to

- Explain construction & working principle of three phase synchronous machines
- Estimate regulation of alternator by direct and indirect methods.
- Demonstrate operation of synchronous motor at constant load and variable excitation (v curves & ^ curves) & constant excitation and variable load.
- Explain Speed control methods of three phase induction motor.
- Plot circle diagram of ac series motor
- Obtain equivalent circuit of single phase induction motor by performing no load & blocked rotor test.

Unit 01: Three phase Synchronous machines. (08Hrs.)

Three phase Synchronous machines: Construction, rotating-field type and rotating-armature type, salient-pole type and non-salient-pole type and their comparison. Excitation Methods.

Three phase Synchronous generator (cylindrical rotor type): Principle of operation. Emf equation and winding factors, rating of generator. Generator on no-load and on balanced load. Armature reaction and its effect under different load power factors. Voltage drop due to armature resistance, leakage flux and synchronous reactance. Per phase equivalent circuit and Phasor diagram. Power - power angle relation.

Three phase Synchronous generator (salient pole type): Armature reaction as per Blondel's two reaction theory for salient-pole machines, Direct-axis and quadrature-axis synchronous reactance's and their determination by slip test. Phasor diagram of Salient-pole generator and calculation of voltage regulation.

Unit 02: Voltage regulation of Three phase Synchronous generator: (08 Hrs.)
Performance of open circuit and short circuit test on synchronous generator, determination of voltage regulation by emf, mmf, and Potier triangle methods. Determination of voltage regulation by direct loading. Short circuit ratio.

Parallel operation of 3-phase alternators: Necessity, conditions, Load sharing between two alternators in parallel. Parallel-Generator theorem. Process of synchronizing alternator with infinite bus-bar by lamp methods and by use of synchroscope. Synchronizing current, power and torque.

Unit 03: Three phase synchronous motor: (08 Hrs.)
Principle of operation. Methods of starting. Equivalent circuit, significance of torque angle, Losses, efficiency and Power flow chart. Operation of 3-phase Synchronous motor with constant excitation and variable load, Operation with constant load and variable excitation ('V' Curves and 'inverted V' curves). Phenomenon of hunting and its remedies. Applications of 3-phase synchronous motors. Introduction to synchronous – induction motor. Comparison of 3 phase synchronous motor with 3-phase induction motor.

Unit 04: 3-ph induction motor, Induction generator and special purpose motors: (08 Hrs.)
Speed control of three phase induction motor by various methods (Stator side and rotor side controls). Action of 3-phase induction motor as induction generator, applications of induction generator. Introduction to Energy Efficient three phase Induction Motor and Super conducting Generator.

Special Purpose Motors (Descriptive Treatment Only): Construction, principle of working, characteristics ratings and applications of Brushless D.C. motors, Stepper motors (permanent magnet and variable reluctance type only), Permanent Magnet motor (A.C. & D.C.) and linear induction motors.

Unit 05: A.C. series motor (08 Hrs.)
Operation of D.C. series motor on a.c. supply, nature of torque developed, problems associated with AC. operation and remedies.

Plain Series motor: direct and quadrature axis fluxes. Transformer and rotational emfs in the field winding and the armature winding. Approximate Phasor diagram (Ignoring leakage fluxes, magnetizing current and currents in the short-circuited armature coils). Circle diagram, performance characteristics from circle diagram. Drawbacks of plain series motor.

Compensated series motor: Compensating winding, conductively and inductively compensated motor. Use of compoles for improving commutation. Ratings and applications of Compensated Series motors.

Universal motors: ratings, performance and applications, comparison of their performance on A.C. and D.C. supply.

Unit 06: Single phase induction motor **(08 Hrs.)**

Construction of single phase induction motor, double field revolving theory. Equivalent circuit and torque-slip characteristics on the basis of double revolving field theory. Tests to determine the parameters of equivalent circuit and calculation of performance characteristics of motor. Methods of self-starting. Types of single phase induction motors: Split-phase motors (Resistor split-phase motor, Capacitor-start motor, Capacitor start and capacitor run motor and permanent capacitor motor). Shaded pole induction motor: their construction, operation, torque-slip characteristics and applications. Comparison of 1-phase induction motor with 3-phase induction motor.

Guidelines for Instructor's Manual

Prepare 3/4 sets of standard experiments. It must contain title of the experiment. Also, Aim, Apparatus including name of machines with their specifications, rheostats, ammeter, voltmeter, wattmeter if used along with their ratings / ranges etc.

- **Theory:** Brief theory explaining the experiment
- **Circuit / connection diagram** or construction diagram must be drawn either manually using geometrical instruments or using software on A-4 size quality graph paper / plain white paper.
- **Procedure:** Write down step by step procedure to perform the experiment.
- **Observation table:**
- **Sample calculation:** For obs. number ---
- **Result table:**
- **Nature of graph:**
- **Conclusion:**
- **Questions / Answers**: Write minimum 4 /5, questions / answers based on each experiment.

Theory part must be typed on A-4 good quality paper on single side. Put these pages of experiments / circuit diagram in plastic folder and provide it to a group of 4/5 students.

Guidelines for Student's Lab Journal

1. Students should write the journal in his own hand writing.
2. Circuit / Connection diagram or construction diagram must be drawn either manually using or using software. [Do not use Xerox copy of standard journal]
3. Hand writing must be neat and clean.
4. Journal must contain certificate indicating name of the institute, student, department, subject, class/ year, number of experiments completed, signature of staff, Head of the department and the Principal.
5. Index must contain sr. number, title of the experiment, page number, and the signature of staff along with date.
6. Put one blank page in between two experiments. Prepare the parallelogram at the center of page and write experiment number, date and title of the experiment in separate line.

   (Use black or blue ink pen for writing.)

Guidelines for Laboratory Conduction

1. Check whether the MCB / main switch is off.
2. Make connections as per circuit diagram. Use flexible wire for connection of voltmeter and pressure coil connection of wattmeter. For rest of the connections, use thick wire. Do not keep loose connection. Get it checked from teacher / Lab Assistant.
3. Perform the experiment only in presence of teacher or Lab Assistant.
4. Do the calculations and get it checked from the teacher.
5. After completion of experiment, switch off the MCB / main switch.

Write the experiment in the journal and get it checked within week

List of Experiments: To perform any eight experiments from the following list

A) Compulsory experiments:

1. Determination of regulation of cylindrical rotor alternator by following methods
   a) EMF method b) MMF method.
2. Determination of regulation of cylindrical rotor alternator by Potier method.
3. Determination of regulation of salient pole alternator by slip test.
4. V and inverted V curve of synchronous motor at constant load.
5. Speed control of three phase induction motor by V/F method

B) Optional experiments (any Three)

1. Determination of Regulation of alternator by direct loading.
2. Load test on three phase synchronous motor.
3. Load test on Single -phase induction motor.
4. Load test on Single-phase series motor.
5. No load and blocked-rotor test on a single phase Capacitor-start induction motor and Determination of its equivalent circuit parameters.
6. Performance characteristics of single phase series motor using circle diagram.
7. Synchronization of three phase alternator by Lamp and Synchroscope methods.
8. Simulation of three phase induction motor on MATLAB to obtain its performance.
9. Speed control of three phase induction motor by rotor resistance control method.

Text Books:

[T1] Nagrath and Kothari, Electrical Machines, 2nd Ed., Tata McGraw Hill.

[T2] S. K. Bhattacharya, Electrical Machines, Tata McGraw Hill.

[T3] A.S. Langsdorf, Theory of Alternating Current Machinery, Tata McGraw Hill

[T4] P. S. Bimbhra, Electric Machinery, Khanna Publications.

[T5] B.R. Gupta and Vandana Singhal -Fundamentals of Electric Machines, New Age International (P) Ltd.

[T6] E. Openshaw Taylor, Performance and design of a.c. commutator motors, Wheeler Publishing.

[T7] V. K. Mehta and Rohit Mehta, Principles of Electrical Machines, S Chand Publications

[T8] Krishna Reddy –Electrical Machines vol.II and III, SCITECH publications.

[T9] Ashfaq Husain, Electrical Machines, Dhanpat Rai and Co.

[T10] M V Deshpande, Electrical Machines, Prentice Hall of India

Reference Books:

[R1] M.G. Say, Performance and Design of A.C. Machines (3rd Ed.), ELBS

[R2] J B Gupta - Theory and performance of Electrical Machines, S K Kataria Publications

[R3] Samarjit Ghosh, Electrical Machines, Pearson Publication.

[R4] Bhag S Guru and Huseyin R Hiziroglu, Electrical Machinary and Transformer, 3rd Edition, Oxford University Press.

[R5] E G Janardanan, Special Electrical Machines, Prentice Hall of India.

[R6] Suvarnsingh Kalsi Application of high Temperature super conductors to electric power equipments (Rotating Machines) Wiley publication.

Unit	Text Books	Reference Books
1	T1,T2,T7,T9	R3
2	T4,T7,T9	R2
3	T1,T4,T7	R2,R4
4	T4,T7,T9	R5,R6
5	T4,T6,T3	R1,R2
6	T2,T3,T7,T9	R2,R3

303143: Power Electronics

Teaching Scheme	Credits	Examination Scheme[Marks]	
Lectures : 4hrs/ week	04	In sem	30
Practical 2hrs/week	01	End sem	70
		Practical	50

Prerequisite:

- Knowledge of semiconductor material, basic electronics, diode, BJT,UJT,FET and its characteristics
- Working of Diode based rectifier, concept of rms and average value
- Use square notebooks for notes and plotting of waveforms

Course Objectives:

To enable students to gain knowledge and understanding in the following aspects:

- Fundamentals of power electronic devices and characteristics.
- The concepts and operating principles of power electronics circuits.
- Design procedures and techniques of power electronics systems.

Course Outcomes :

The students will be able to:

- Develop characteristics of different power electronic switching devices
- Reproduce working principle of power electronic converters for different types of loads
- Analyse the performance of power electronic converters

Unit 01: Silicon Controlled Rectifier (08 hrs)

Construction, Static and dynamic Characteristics, specifications/rating of SCR ,Triggering Circuits (R, R-C, UJT), Commutation Circuits (class C&D), Protection (over voltage, over current, and Thermal), Gate Turn Off(GTO) Thyristor (Construction, Working and Application).

Unit 02: Transistor based Devices and DC-DC converter (08 hrs)

Transistor based Devices: MOSFET, IGBT, Construction, working, Static and Dynamic Characteristics, specifications, safe operating area, Latching of IGBT.

DC-DC converter: Principle of operation of chopper, classification on the basis of Operating quadrants (A,B,C,D,E), Control techniques: CLC, TRC, PWM and FM Techniques. Analysis of Step up Chopper and Numerical with RLE load. Necessity of input filter, Areas of application, Buck Boost Chopper (Descriptive Treatment).

Unit 03: Single Phase AC-DC Converter (08 hrs)

Single phase Converter: Fully controlled converter (rectification and inversion mode), Half controlled converter (Semi- converter), Operation of all converters with R, RL load , derivation of Average and RMS output voltage, power factor, THD, TUF. Numerical based on output voltage and current calculations, Effect of source inductance on operation of converter, Concept of overlap angle and voltage drop calculation. Single phase dual converter (Descriptive treatment only).

Unit 04: Three Phase Converter and AC Voltage Regulator

(08 hrs)

Three phase converter: Fully controlled converter, rectification and inversion mode, Half controlled converter (Semi-converter), Operation of all converters with R, RL load, derivation of Average and RMS output voltage, power factor, THD, TUF. Numerical based on output voltage and current calculations

AC voltage regulator: DIAC, TRIAC- four mode operation, triggering of TRIAC using DIAC; Single phase AC Voltage regulator principle with R and RL Load, derivation of Average and RMS output voltage, Concept of two stage AC voltage regulator (With R and R-L load).

Unit 05: Single phase DC-AC Converter (Transistor based) (08 hrs)

Full bridge VSC, derivation of output voltage and current, Numericals, current source converter with ideal switches. **PWM techniques:** Single pulse, multiple pulse and sinusoidal pulse modulation with Fourier analysis.

Unit 06: Three phase DC-AC Converter (Transistor based) (08 hrs)

Three phase VSC using 120^0 and 180^0 mode and their comparison, PWM based VSC, voltage control and harmonic elimination techniques (Single Pulse Modulation, Transformer Connection, Multilevel Control, Stepped Wave),Multilevel Converter concept its classification(Neutral Point Clamped Converter, Flying Capacitor Converter, cascaded multilevel converter) comparison between multilevel converters, balancing of dc voltage across capacitor

Guidelines for Instructor's Manual

- Title and circuit diagram of power electronic switching device and converter circuit.
- Working operation and output characteristics / output waveforms of power electronic switching device /converter circuit.
- Procedure to carry out the experiment.

Guidelines for Student's Lab Journal

- Title, aim, circuit diagram, procedure and theory of power electronic switching device or converter circuit.
- Equipments along with the specifications needed to carry out the experiment.
- Circuit diagram, observation table, calculations must be written on left side of the journal and aim, theory related to experiment and procedure must be written on right side.
- Analyse and interpret the experimental results and write the conclusions appropriately.

Guidelines for Laboratory Conduction

- Each group in the lab should have not more than three students.
- All the students in the group must do the connections and perform the practical under the the guidance of the staff member.
- Staff member has to check the result of all the groups.

List of Experiments:

Group A : Hardware Experiments (Any Six)

1. Static VI characteristic of SCR /GTO
2.Static VI characteristic of TRIAC
3. Single phase Half controlled converter with R and RL load
4. Single phase fully controlled converter with R load.
5. Single Phase fully controlled converter with and without Free Wheeling diode with RL load
6. Single phase A.C. voltage regulator with R load
7.Study of DC step down chopper
8. Output and Transfer Characteristic of MOSFET and IGBT (Both)
9. Three phase voltage source converter using 120^0 and 180^0 mode

Group B: Perform any THREE experiments based on Software

1. Three phase AC-DC fully controlled bridge converter R and RL load
2. Three phase voltage source inverter using 120^0 and 180^0 mode
3. Study of DC step down chopper
4. Single phase A.C. voltage regulator R and RL load
5. Study and Design of single phase VSC
6. Design of snubber circuit and verification using simulation

Text Books:

1. M. H. Rashid - Power Electronics 2nd Edition, Pearson publication
2. Ned Mohan, T.M. Undeland, W.P. Robbins - Power Electronics, 3rd Edition, John Wiley and Sons
3. B.W. Williams: Power Electronics 2nd edition, John Wiley and sons
4. Ashfaq Ahmed- Power Electronics for Technology, LPE Pearson Edition.
5. Dr. P.S. Bimbhra, Power Electronics, Third Edition, Khanna Publication.
6. K. Hari Babu, Power Electronics , Scitech Publication.

Reference Books:

1. Vedam Subramanyam - Power Electronics , New Age International , New Delhi
2. Dubey, Donalda, Joshi,Sinha, Thyristorised Power controllers, Wiely Eastern New Delhi.
3. M. D. Singh and K. B. Khandchandani, Power Electronics, Tata McGraw Hill
4. Jai P. Agrawal, Power Electronics systems theory and design LPE, Pearson Education, Asia.
5. L. Umanand, Power Electronics – Essentials and Applications Wiley Publication.
6. J. Michael Jacob – Power Electronics Principal and Applications.
7. M.H.Rashid - Power Electronics Handbook, Butterworth-Heinemann publication, 3 edition
8. M.S. Jamil Asghar, Power Electronics, PHI.
9. V.R. Moorthi, Power Electronics Devices, circuits, and Industrial applications,
   Oxford University Press.
10. NPTEL Web course and video course on Power Electronics by Dr.B.G.Fernandis,IIT,Mumbai.

Unit	Text Books	Reference Books
1	T5,T6	R3,R8,R10
2	T4,T5,T6	R3,R5,R6,R9,R10
3	T1,T5	R3,R10
4	T5,T6	R1,R7,R10
5	T1,T2,T3	R3,R10
6	T1,T2,T3	R3,R10

303144: Electrical Installation, Maintenance and Testing

Teaching Scheme			Credits	Examination Scheme [Marks]		
Theory	:	03 Hrs./Week	03	In Sem	:	30 Marks
Practical	:	02 Hrs./Week	01	End Sem	:	70 Marks
				Term work	:	50 Marks

Prerequisites:

- Introduction of Electrical supply system, Typical AC power supply scheme, Classification of Supply systems.
- Single line Diagram of electrical supply system.

Course Objective:

The course aims :-

- To understand the basic concepts, design and estimation of distribution systems & substation
- To enable candidate to design earthing system for residential and industrial premises
- To understand practical aspects of condition monitoring and maintenance of various electrical equipment.
- To learn testing methods of various electrical equipment.

Course Outcome:

Upon successful completion of this course, the students will be able to :-

- Classify distribution systems, its types and substations
- Design of different earthing systems for residential and industrial premises
- Select methods of condition monitoring and testing of various Electrical Equipments
- Estimate and Costing of residential and industrial premises

Unit 01: Distribution Systems: (06 Hrs.)

Classification of supply systems (State Only)

(i)DC, 2-wire system, (ii) Single phase two wire ac system, (iii) Three phase three wire ac supply system, iv) Three phase four wire ac supply system. Comparison between overhead and underground systems (For above mentioned systems) on the basis of volume requirement for conductor. AC Distribution System: Types of primary and secondary distribution systems, calculation of voltage drops in ac distributors (Uniform and Non Uniform Loading) (Numerical) Economics of power transmission: Economic choice of conductor (Kelvin's law) (Derivation and Numerical) Distribution Feeders: Design considerations of distribution feeders; radial and ring types of primary feeder's voltage levels, energy losses in feeders.

Unit 02: Substation and Earthing: (06 Hrs.)

Substation: Classification of substations, Various equipments used in substation with their specifications, Bus bar arrangements in the substation: Simple arrangements like single bus bar, sectionalized single bus bar, main and transfer bus bar system with relevant diagrams.

Earthing: Necessity of Earthing, Types of earthing system (Equipment and Neutral), and Maintenance Free Earthing system. Methods of testing earth resistance, Different electrode configurations (Plate and Pipe electrode), Tolerable step and touch voltages, Steps involved in design of substation earthing grid as per IEEE standard 80 – 2000.

Unit 03: Maintenance and Condition Monitoring: (06 Hrs.)

Importance and necessity of maintenance, different maintenance strategies like breakdown maintenance, planned/preventive maintenance and condition based maintenance. Planned and preventive maintenance of transformer, Induction motor and Alternators. Insulation stressing factors, Insulation deterioration, polarization index, dielectric absorption ratio. Concept of condition monitoring of electrical equipments. Advance tools and techniques of condition monitoring, Thermography.

Unit 04: Condition Monitoring and Testing of Electrical Equipment: (06 Hrs.)

Failure modes of transformer, Condition monitoring of oil as per the IS/IEC standards, Filtration/reconditioning of insulating oil, Condition monitoring of transformer bushings, On load tap changer, dissolved gas analysis, degree of polymerization. Induction motor fault diagnostic methods – Vibration Signature Analysis, Motor Current Signature Analysis.

Testing of Power cables – Causes of cable failure, fault location methods and Remedial actions. Testing of Transformer - Type tests and Routine tests.

Unit 05: Estimation and Costing: (06 Hrs.)

Introduction, HT, LT overhead lines and underground cables, cable sizing, price catalogue, labour rates, schedule of rates and estimating data (only theory), Estimation and conductor size calculations of internal wiring for Residential and Commercial (Numericals) installations and estimate for underground LT service lines.

Unit 06: Electrical Safety: (06 Hrs.)

Causes of Accidents, Prevention of Accidents & precautions to be taken. Dangers arising as a result of faulty equipments and tools, chemicals, water, poor joints and insulation strains and moving machines. Contents of first aid box, treatment for cuts, burns and electrical shock. Procedures for first aid (e.g. removing casualty from contact with live wire and administering artificial respiration). Various statutory regulations (Electricity supply regulations, factory acts and Indian electricity rules of Central Electricity Authority (CEA), Classification of hazardous area.

Industrial Visit:

Visit to repair workshop (Any One).

i) Three phase induction motor ii) Transformer iii) Power Cable.

List of Experiments :

Compulsory experiments:

(Drawing sheets for 1 and 2 using AutoCAD or other CAD software)

1. Single Line diagram of 132 or 220 or 400 kV substation (based on actual field visit) Symbols, Plate or Pipe earthing.
2. Estimation for 11 kV feeders and substation.
3. Assignment on design of earthing grid for 132/220 kV substation.

Any **five experiments** are to be performed out of following :

1. Measurement of Dielectric Absorption Ratio and Polarization Index of insulation.
2. Study of troubleshooting of electrical equipment based on actual visit to repair workshop (Any One).i) Three phase induction motor ii) Transformer iii) Power Cable
3. Study of thermograph images and analysis based on these images.
4. Assignment – Construction, working and troubleshooting of any two household Electrical equipments (Fan, Mixer, Electric Iron, Washing Machines, Electric Oven, Microwave - Limited to electrical faults)
5. Study the various types of earthing for electrical appliances/systems, Practice of earthing and Measurement of Earth resistance of Campus premises.
6. Design, Estimation and costing of earthing pit and earthing connection for computer lab, Electrical Machines Lab, HT Substation.
7. Project design and estimation of power circuit of labs/industry.
8. Measurement of insulation resistance of motors and cables

Guidelines for Instructor's Manual Practical Sessions –

The Instructor’s Manual should contain following related to every experiment –

- Brief theory related to the experiment.
- Apparatus with their detail specification as per IS code.
- Basic AUTOCAD instructions for drawing the sheet.
- Design / Solving of given problem using data book as a reference.
- Students should be encouraged to visit workshops or small industries of transformer/ induction motor / cables also for repairing of household equipment.
- Students should write the troubleshooting charts and visit report based on visit as mentioned above.
- Few short questions related to design.

Guidelines for Student's Manual Practical Sessions –

The student's Manual should contain following related to every experiment –

- Brief theory related to the experiment.
- Apparatus with their detail specification as per IS code.
- Design/Solve a given problem.
- Students should visit workshops or small industries of transformer/ induction motor / cables also for repairing of household equipment.
- Students should write the troubleshooting charts and visit report based on visit as mentioned above.
- Few short questions related to experiment.

Guidelines for Lab /TW Assessment

- There should be continuous assessment for the TW.
- Assessment must be based on understanding of theory, attentiveness during practical.
- Session, how efficiently the student is able to do connections and get the results.
- Timely submission of journal.

Text Books:

[T1] B. R. Gupta- Power System Analysis and Design, 3rd edition, Wheelers publication.

[T2] S. Rao, Testing Commissioning Operation and Maintenance of Electrical Equipment, Khanna publishers.

[T3] S. L. Uppal - Electrical Power - Khanna Publishers Delhi.

[T4] Hand book of condition monitoring by B. K. N. Rao, Elsevier Advance Tech., Oxford (UK).

[T5] S. K. Shastri – Preventive Maintenance of Electrical Apparatus – Katson Publication House.

[T6] B. V. S. Rao – Operation and Maintenance of Electrical Equipment – Asia Publication.

[T7] Hand book on Electrical Safety.

Reference Books:

[R1] P.S. Pabla –Electric Power Distribution, 5th edition, Tata McGraw Hill.

[R2] S. L. Uppal, Electrical Wiring and Costing Estimation, Khanna Publishers, New Delhi.

[R3] Surjit Singh, Electrical wiring, Estimation and Costing, Dhanpat Rai and company, New Delhi.

[R4] Raina K.B. and Bhattacharya S.K., Electrical Design, Estimating and Costing, Tata McGraw Hill, New Delhi

[R5] B.D. Arora-Electrical Wiring, Estimation and Costing,- New Heights, New Delhi.

[R6] M.V. Deshpande, Elements of Power Station design and practice, Wheelers Publication.

[R7] S. Sivanagaraju and S. Satyanarayana, Electric Power Transmission and Distribution, Pearson Publication .

IS/IEEE Standards:

1. IS : 1180 – Distribution Transformer.
2. IS : 2026 – Power Transformer.
3. IS: 4029 – Testing of 3 Phase Induction Motor.
4. IS : 694:1986 – PVC insulated cables for working voltages up to and including 1100 V.
5. IS : 900:1992 – Code of practice for installation and maintenance of Induction Motors.
6. IEEE 80:2000 – IEEE Guide for Safety in AC Substation Grounding.
7. IEEE 142 Guide for Earthing.
8. Indian Electricity Rules.

Unit	**Text Books**	**Reference Books**
1	T1	R2, R7
2	T2	R7
3	T3,T4	R6,R1
4	T5,T6	R6,R1
5	-	R3, R4,R5
6	T7	-

303145: Seminar and Technical Communication

Teaching Scheme		Credits	Examination Scheme	
Practical	: 02 Hr/Week	01	Term work :	50 Marks

Course Objectives:

- Gaining of actual knowledge (terminology, classification, methods and advanced trends)
- Learning fundamental principles, generalization or theories
- Discussion and critical thinking about topics of current intellectual importance
- Developing specific skills, competencies, and points of view needed by professionals in the field most closely related to the course.

Course Outcomes:

At the end of this student will able to

- Relate with the current technologies and innovations in Electrical engineering.
- Improve presentation and documentation skill.
- Apply theoretical knowledge to actual industrial applications and research activity.
- Communicate effectively.

Seminar should be based on a detailed study of any topic related to the advance areas/applications of Electrical Engineering. Topic should be related to Electrical Engineering. However it must not include contents of syllabus of Electrical Engineering.

It is expected that the student should collect the information from journals, internet and reference books in consultation with his/her teacher/mentor, have rounds of discussion with him/her. The report submitted should reveal the students assimilation of the collected information. Mere compilation of information from the internet and any other resources is discouraged.

Format of the Seminar report should be as follows:

1. The report should be neatly typed on white paper. The typing shall be with normal spacing, Times New Roman (12 pt) font and on one side of the paper. (A-4 size).
2. Illustrations downloaded from internet are not acceptable.
3. The report should be submitted with front and back cover of card paper neatly cut and bound together with the text.
4. Front cover: This shall have the following details with Block Capitals
   a. Title of the topic.
   b. The name of the candidate with roll no. and Exam. Seat No. at the middle.
   c. Name of the guide with designation below the candidate's details.
   d. The name of the institute and year of submission on separate lines at the bottom.
5. Certificate from institute as per specimen, Acknowledgement and Contents.
6. The format of the text of the seminar report should be as follows
   I. The introduction should be followed by literature survey.

II. The report of analytical or experimental work done, if any.
III. The discussion and conclusions shall form the last part of the text.
IV. They should be followed by nomenclature and symbols used.
V. The Reference Books are to be given at the end.

7. The total number of typed pages, excluding cover shall from 20 to 25 only.
8. All the pages should be numbered.
9. Two spiral bound copies of the seminar report shall be submitted to the college.
10. Candidate shall present the seminar before the examiners.
11. The total duration of presentation and after-discussion should be about 30 minutes.

The assessment for the subject shall be based on:

1. Report submitted. 2. Presentation 3. Discussion.

Audit Course III

303152 (A): Wind Energy Systems

Course Name: Wind Energy Systems

Prerequisite: Completion of FE or equivalent

Teaching Scheme:
Lectures 2 h per week
Field Visit: 1 day

Examination Schemes: Audit (P/F)
Written / MCQ /
Term paper

Description:

The following topics may be broadly covered in the classroom. The course will introduce the basics of: wind energy, availability, introduction to wind machines, generators, basics of design of wind electric generators, small and large wind machines, various designs and types of wind machines, grid interaction, advantages and limitations of the technology, environmental impact, introduction to manufacturing of the systems, characterization, quality assurance, standards, certification and economics. The site visit will be organized to understand the basic operation and system elements.

Details:

- Energy in wind, Basic wind energy conversion
- Introduction to wind turbines, Types of wind energy systems
- Typical construction of various wind energy systems
- Wind electricity generation systems
- Environmental impact of wind electricity generators
- Economics and sustainability of wind electricity
- Introduction go Wind Electricity Generation (WEG) systems
- Wind turbine basics and design
- Generator designs for WEG
- Small and large WEG systems, Site requirements for WEG
- Controllers for WEG systems
- Grid integration of WEG
- Economics of WEG
- Financial modeling of WEG
- Software tools for simulation, validation and economics of WEG
- Operation and maintenance of WEG
- Environmental impact assessment
- Standards and certification for WEG
- Basics of WEG systems, Elements of WEG systems for small and large scale
- Procurement versus production
- Bought-outs, assemblies, sub-assemblies
- Manufacturing and assembly, Manufacturing standards
- Quality assurance and standards, Certification
- Special purpose machines and Automation in manufacturing
- Site assembly and fabrication
- Typical shop layouts
- Inventory management
- Economics of manufacturing

Site Visit:

- Large-scale wind power plant
- If possible any nearby manufacturing facility for wind machines

Audit Course III

303152(B): Microcontroller MSP 430 and Applications

Teaching Scheme: **Examination Scheme**

Lecture and Practicals: Total 24 Hours
Written/Assignment

- 16 bit MSP430 microcontroller architecture, Pin diagram, Memory organization of MSP430, special function registers, GPIO control.
- Interrupts and interrupt programming, Watchdog timer. System clocks.
- Programming MSP430 in embedded C, Timers and RTC using MSP430, timer modes and its programming.
- Analog interfacing and data acquisition: ADC and Comparator in MSP430.
- Case study: MSP430 based embedded system applications using ADC & PWM etc.

Text Books:

1. Getting Started with the MSP430 Launchpad by Adrian Fernandez, Dung Dang, Newness publication ISBN-13: 978-0124115880
2. MSP430 microcontroller basics 1st Edition by John H. Davies (Author), Newnes Publication ISBN- 13: 978-0750682763
3. Ajay V. Deshmukh, "Microcontrollers, Theory and applications", Tata McGraw-Hill Companies – 2005

Other References:

1. http://processors.wiki.ti.com/index.php/MSP430_LaunchPad_Low_Power_Mode
2. http://processors.wiki.ti.com/index.php/MSP430_16-Bit_Ultra-Low_Power_MCU_Training
3. RF430CL330H :
   Datasheet: http://www.ti.com/lit/ds/symlink/rf430cl330h.pdf
4. RF430CL331H:
   Datasheet: http://www.ti.com/lit/ds/symlink/rf430cl331h.pdf
5. Datasheet: RF430FRL15xH:
   Datasheet: http://www.ti.com/lit/ds/symlink/rf430frl152h.pdf
   User Guide: http://www.ti.com/lit/ug/slau506/slau506.pdf
6. CC2538:
   Datasheet: http://www.ti.com/lit/ds/symlink/cc2538.pdf
7. CC256x:
   Datasheet: http://www.ti.com/lit/ds/symlink/cc2560.pdf
8. CC2640:
   Datasheet: http://www.ti.com/lit/ds/symlink/cc2640.pdf
   User Guide: http://www.ti.com/lit/ug/swcu117f/swcu117f.pdf
9. CC3100 and CC3200: http://www.ti.com/lit/ug/swru368a/swru368a.pdf

List of Experiments:

1. Learn and understand how to configure MSP-EXP430G2 Launchpad digital I/O pins. Write a C program for configuration of GPIO ports for MSP430 (blinking LEDs, push buttons interface).

   Exercises:

   a. Modify the delay with which the LED blinks.
   b. Modify the code to make the green LED blink.
   c. Modify the code to make the green and red LEDs blink:
      i. Together
      ii. Alternately
   d. Alter the code to turn the LED ON when the button is pressed and OFF when it is released.
   e. Alter the code to make the green LED stay ON for around 1 second every time the button is pressed.
   f. Alter the code to turn the red LED ON when the button is pressed and the green LED ON when the button is released.

2. Learn and understand GPIO based Interrupt programming. Write a C program and associated GPIO ISR using interrupt programming technique.

   Exercises:

   a) Write the code to enable a Timer interrupt for the pin P1.1.
   b) Write the code to turn on interrupts globally

3. Implement Pulse Width Modulation to control the brightness of the on-board, green LED. This experiment will help you to learn and understand the configuration of PWM and Timer peripherals of the MSP430G2553.

   Exercises:

   a) Observe the PWM waveform on a particular pin using CRO.
   b) What is the maximum resolution of PWM circuitry in MSP430G2 Launchpad?
   c) Change the above code to create a PWM signal of 75% duty cycle on particular PWM pin.

4. The main objective of this experiment is to control the on-board, red LED by the analog input from a potentiometer. This experiment will help you to learn and understand how to configure an ADC to interface with a potentiometer.

   Exercises:

   a) Alter the threshold to 75% of Vcc for the LED to turn on.
   b) Modify the code to change the Reference Voltage from Vcc to 2.5V.

Lab Manual:

1) www.ti.com/lab-maunals
<u>Embedded System Design using MSP430 Launchpad Development Kit - Lab Manual</u>

303146 : Power System II

Teaching Scheme	Credits	Examination Scheme [Marks]
Theory : 04 Hrs./Week	04	In Sem. : 30 Marks
Practical : 02 Hrs./Week	01	End Sem. : 70 Marks
		PR : 50 Marks

Prerequisite:

- Constants, circuit representation and generalized constants of short and medium transmission lines.
- Inductance and capacitance for symmetrical and unsymmetrical configuration of transmission lines, Efficiency and line regulation of transmission line.

Course Objective:

The course aims to:-

- Develop analytical ability for Power system.
- Introduce concept of EHVAC and HVDC System.
- Demonstrate different computational methods for solving problems of load flow.
- Analyse the power system under symmetrical and Unsymmetrical fault conditions.

Course Outcome:

Upon successful completion of this course, the students will be able to

- Solve problems involving modelling, design and performance evaluation of HVDC and EHVAC power transmission lines.
- Evaluate power flow in power transmission networks and apply power flow results to solve simple planning problems.
- Calculate currents and voltages in a faulted power system under both symmetrical and asymmetrical faults, and relate fault currents to circuit breaker ratings.

Unit 01: Performance of Transmission Lines (08 Hrs.)

Evaluation of ABCD constants and equivalent circuit parameters of Long transmission line. Concept of complex power, power flow using generalized constants, receiving end power circle diagram for transmission line (assuming ABCD constants are already given), surge impedance loading, Line efficiency, Regulation and compensation, basic concepts. Numerical based on: ABCD constants of Long transmission line, Power flow, circle diagram.

Unit 02: EHV-AC transmission: (08 Hrs.)

Role of EHV-AC transmission, standard transmission voltages, average values of line parameters, power handling capacity and line losses, phenomenon of corona, disruptive critical voltages, visual critical voltages, corona loss, factors and conditions affecting corona loss, radio and television interference, reduction of interference, Numerical Based on Corona, Corona loss and power handling capacity.

Unit 03: Per unit system and Load Flow Analysis (08 Hrs.)

Per unit system: Single line diagram, Impedance and reactance diagrams and their uses, per unit quantities, relationships, selection of base, change of base, reduction to common base, advantages and application of per unit system. Numerical based on network reduction by using per unit system.

Load Flow Analysis: Network topology, driving point and transfer admittance, concept of Z-bus and formulation of Y-bus matrix using Direct method, singular transformation method, Introduction to load flow analysis, power- flow equations generalization to n bus systems, classification of buses, Newton- Raphson method (using polar coordinates - Descriptive treatment only) Numerical based on Y bus Matrix.

Unit 04: Symmetrical Fault Analysis (08 Hrs.)

3-phase short-circuit analysis of unloaded alternator, sub-transient, transient and steady state current and impedances, D.C. Offset, and effect of the instant of short-circuit on the waveforms, estimation of fault current without pre-fault current for simple power systems, selection of circuit-breakers and current limiting reactors and their location in power system (Descriptive treatment Only) Numerical Based on symmetrical fault analysis

Unit 05: Unsymmetrical Fault Analysis: (08 Hrs.)

Symmetrical components, transformation matrices, sequence components, power in terms of symmetrical components, sequence impedances of transmission line and zero sequence networks of transformer, solution of unbalances by symmetrical components, L-L, L-G, and L-L-G fault analysis of unloaded alternator and simple power systems with and without fault impedance. Numerical based on symmetrical components and unsymmetrical fault calculation.

Unit 06: HVDC Transmission (Descriptive treatment only) **(08 Hrs.)**

Classification and components of HVDC system, advantages and limitations of HVDC transmission, comparison with HVAC system, introduction to HVDC control methods - constant current, constant ignition angle and constant extinction angle control, HVDC systems in India, recent trends in HVDC system.

Industrial Visit: Compulsory visit to EHV-AC substation/ HVDC substation

List of Experiments (Compulsory experiments):

1. Measurement of ABCD parameters of a medium transmission line with magnitude and angle.
2. Measurement of ABCD parameters of a long transmission line with magnitude and angle.
3. Performance study of the effect of VAR compensation using capacitor bank on the transmission line.
4. Formulation and calculation of Y- bus matrix of a given system using software.
5. Static measurement of sub-transient reactance of a salient-pole alternator.
6. Measurement of sequence reactance of a synchronous machine (Negative and zero).

Any **three experiments** are to be performed out of following:

1. Plotting of receiving end circle diagram to evaluate the performance of medium transmission line.
2. Performance study of the effect of VAR compensation on transmission line using synchronous Condenser.
3. Solution of a load flow problem using Newton-Raphson method using software.
4. Simulation of Symmetrical fault of single machine connected to infinite bus.
5. Simulation of Unsymmetrical fault of single machine connected to infinite bus.
6. Simulation of HVDC system.

Guidelines for Instructor's Manual Practical Sessions –

The Instructor’s Manual should contain following related to every experiment –

- Brief theory related to the experiment.
- Apparatus with their detailed specifications.
- Connection diagram /circuit diagram.
- Observation table/ simulation waveforms.
- Sample calculations for one/two reading.
- Result table.
- Graph and Conclusions.
- Few questions related to the experiment.

Guidelines for Student's Lab Journal

The Student's Lab Journal should contain following related to every experiment –

- Theory related to the experiment.
- Apparatus with their detailed specifications.
- Connection diagram /circuit diagram.
- Observation table/ simulation waveforms.
- Sample calculations for one/two reading.
- Result table.
- Graph and Conclusions.
- Few short questions related to the experiment.

Guidelines for Lab /TW Assessment

- There should be continuous assessment for the TW.
- Assessment must be based on understanding of theory, attentiveness during practical.
- Session, how efficiently the student is able to do connections and get the results.
- Timely submission of journal.

Text Books:

[T1] I.J. Nagrath and D.P. Kothari – Modern Power System Analysis – Tata McGraw Hill, New Delhi.

[T2] B R Gupta , "Power System Analysis and Design", S.Chand.

[T3] Ashfaq Hussain, "Electrical Power Systems", CBS Publication 5th Edition.

[T4] J.B.Gupta. "A course in power systems" S.K. Kataria Publications.

[T5] P.S.R. Murthy, "Power System Analysis", B.S. Publications

Reference Books :

[R1] H. Hadi Sadat: Power System Analysis, Tata McGraw-Hill New Delhi.

[R2] G. W. Stagg and El- Abiad – Computer Methods in Power System Analysis – Tata McGraw Hill, New Delhi.

[R3] M.E.El-Hawary, Electric Power Systems: Design and Analysis, IEEE Press, New York.

[R4] Rakash Das Begamudre, "Extra High voltage A.C. Transmission Engineering", New age publication.

[R5] M.A.Pai, Computer Techniques in Power System Analysis, Tata McGraw Hill Publication.

[R6] Stevenson W.D. Elements of Power System Analysis (4th Ed.) Tata McGraw Hill, New Delhi.

[R7] K.R.Padiyar: HVDC Transmission Systems, New Age International Publishers Ltd, New Delhi.

[R8] Olle I. Elgard – Electric Energy Systems Theory – Tata McGraw Hill, New Delhi.

[R9] V. K. Chandra, Power Systems, Cyber tech Publications.

[R10] NPTEL Web course and video course on power system analysis.

Unit	Text Books	Reference Books
1	T1, T4	R1, R2, R3, R10
2	T2	R3, R4
3	T1, T3, T4	R1, R2, R3, R5, R8, R10
4	T3, T4	R1, R2, R3, R6, R8, R9, R10
5	T3,	R1, R2, R3, R6, R8, R9, R10
6	T2, T3, T4	R3, R7

303147 : Control System-I

Teaching Scheme			Credits	Examination Scheme [Marks]		
Theory	:	04 Hrs./Week	04	In Sem	:	30 Marks
Practical	:	02 Hrs./Week	01	End Sem	:	70 Marks
				Oral	:	50 Marks

Prerequisite: Laplace Transform, Ordinary differential equations.

Course Objective: The course aims to:-

- To understand basic concepts of the classical control theory.
- To model physical systems mathematically.
- To analyze behavior of system in time and frequency domain.
- To design controller to meet desired specifications.

Course Outcome: Upon successful completion of this course, the students will be able to :-

- Model physical system,
- Determine time response of linear system,
- Analyse stability of LTI system,
- Design PID controller for LTI system

Unit 01 : General (10 Hrs)

Basic concepts of control system, classification of control systems. Types of control system: Feedback, tracking, regulator system, feed forward system. Transfer function, Pole and zero concept. Modeling and representation of control system-Basic concept. Mechanical, Electrical and equivalent system, Electromechanical. Block diagram Algebra, signal flow graph, Mason's gain formula.

Unit 02 : Time domain analysis (08 Hrs)

Standard test signal –step, ramp, parabolic and impulse signal, type and order of control system, time response of first and second order systems to unit impulse, unit step input. steady state errors – static error coefficients. Time domain specifications of second order systems. Importance of dominant closed loop poles of higher order systems Derivation of time domain specifications for second-order under-damped system for unit step input.

Unit 03 : Stability analysis and Root Locus (08 Hrs)

Concept of stability- Absolute, Asymptotic, relative and marginal. Nature of system response for various locations of roots in S-plane of characteristics equation. Routh's-Hurwithz criterion. Root Locus: Basic properties of root locus. Construction of root locus. Angle and magnitude condition for stable system.

Unit 04 : Frequency domain analysis-I (08 Hrs)

Introduction, relation between time and frequency response for second order system. Frequency domain specifications, Polar Plot, Nyquist plot, stability analysis using Nyquist plot.

Unit 05 : Frequency domain analysis-II (08Hrs)

Introduction to Bode plot, Asymptotic approximation: Sketching of Bode plot, stability, stability analysis using Bode plot.

Unit 06 : PID controllers (06Hrs)

Basic concept of P, PI, PID controller, Design specifications in time domain and frequency domain. Design of PID controller by Root-Locus. Tuning of PID controllers. Ziegler-Nichol Method.

Control System Components: Working principle and transfer function of Lag network, lead network, potentiometer, AC and DC servo motors. Working principle of synchros.

Guidelines for Instructor's Manual

Instructor's Manual should contain following related to every experiment –

- Theory related to the experiment
- Apparatus with their detailed specifications.
- Connection diagram /circuit diagram
- Basic MATLAB instructions for control system/ Simulink basics
- Observation table/ Expected simulation results
- Sample calculations for one/two reading
- Result table

Guidelines for Student's Lab Journal

The Student's Lab Journal should contain following related to every experiment –

- Theory related to the experiment
- Apparatus with their detailed specifications.
- Connection diagram /circuit diagram/Simulink diagram/MATLAB program
- Observation table/ simulation results
- Sample calculations for one/two reading
- Result table, Conclusion
- Few short questions related to the experiment.

Guidelines for Laboratory Conduction

- Assessment must be based on understanding of theory, attentiveness during practical session.
- Assessment should be done how efficiently student is able to perform experiment/simulation and get the results. Understanding fundamentals and objective of experiment, timely submission of journal

List of Experiments:

A) Minimum five experiments should be conducted.

1. Experimental determination of DC servo motor parameters for mathematical modeling, transfer function and characteristics.
2. Experimental study of time response characteristics of R-L-C second order system: Validation using simulation.
3. Experimental frequency response of Lag and Lead compensator.
4. PID control of level/Pressure/Temperature control system.
5. Transfer function of any physical systems (AC Servomotor/ Two Tank System/ Temperature control/ Level control)
6. Study of Synchro transmitter receiver.
7. Experimental analysis of D.C. Motor Position control System.

B) Minimum three experiments should be conducted.

1. Stability analysis using a) Bode plot b) Root locus c) Nyquist plot using software.
2. Time response of second order system effect of P,PI, PID on it.
3. Analysis of closed loop DC position control system using PID controller.
4. Effect of addition of pole-zero on root locus of second order system.

Text Books:

[T1] I.J. Nagrath, M. Gopal, "Control System Engineering", New Age International Publishers, 5th edition, 2007.

[T2] Katsuhiko Ogata, "Modern control system engineering", Prentice Hall, 2010.

[T3] Nise N. S. "Control Systems Engineering", John Wiley & Sons, Incorporated, 2011

Reference Books:

[R1] B. C. Kuo, "Automatic Control System", Wiley India, 8th Edition, 2003.

[R2] Richard C Dorf and Robert H Bishop, "Modern control system", Pearson Education, 12th edition, 2011.

[R3] D. Roy Choudhary, "Modern Control Engineering", PHI Learning Pvt. Ltd., 2005.

Unit	Text Books	Reference Books
1	T1, T2, T3	R1,R2
2	T1, T2, T3	R1, R3
3	T1, T2, T3	R2, R3
4	T1, T2, T3	R1, R3
5	T1, T2, T3	R1
6	T3	

303148 : Utilization of Electrical Energy

Teaching Scheme	Credits	Examination Scheme [Marks]
Theory : 03 Hrs./Week	03	In Sem : 30 Marks
		End Sem : 70 Marks

Prerequisite:

- Basics of Electrical Engineering, Effects of electric current
- Chemical reactions in electrolyte
- Control circuit design basics, awareness about artificial lighting, refrigeration, air conditioning
- Characteristics and application of different electric motors, awareness about traction

Course Objective:

The course aims to:-

- Ensure that the knowledge acquired can be applied in various fields such as electric heating, illumination, chemical processes, and electric traction.
- Make the students aware about the importance of maximizing the energy efficiency by optimum utilization of electrical energy.
- Develop ability amongst the students to design -heating element for resistance furnaces and design- illumination schemes. To develop ability amongst the students to analyze the performance of arc furnaces, electric traction, different sources of light, illumination schemes
- Provide know how about Refrigeration, Air Conditioning
- Provide know about electrochemical processes and applications of these in practical world, modern welding techniques.
- Develop self and lifelong learning skills, introduce professionalism for successful career.

Course Outcome:

Upon successful completion of this course, the students will revise :-

- Get knowledge of principle of electric heating, welding and its applications.
- Design simple resistance furnaces and residential illumination schemes.
- Calculate tractive effort, power, acceleration and velocity of traction.
- Get knowledge of electric braking methods, control of traction motors, train lighting and signaling system.
- Understand collection of technical information and delivery of this technical information through presentations.

Unit 01: Electric Heating (06 Hrs.)

Modes of heat transfer, mathematical expressions

Electric heating: Introduction to electric heating, Advantages of electrical heating

Heating methods: - Resistance heating – Direct resistance heating, indirect resistance heating, electric ovens, different types of heating element materials, temperature control of resistance furnaces, and design of heating element (Numerical).

Applications of resistance heating

Induction heating : Principle, core type and coreless induction furnaces, Ajax Wyatt furnace, Numerical on melting furnaces Applications of induction heating

Electric arc heating – Direct and indirect arc heating, types of arc furnaces, equivalent circuit of arc furnace, condition for maximum output, power factor at maximum output (Numerical), Heat control in arc furnace, Applications of arc heating

Dielectric heating –Principle, choice of voltage and frequency for dielectric heating (Numerical), Applications of dielectric heating

Electric Welding -**Welding m e t h o d s –Electric arc welding and resistance welding, Equivalent circuit of arc furnace (Numerical) Modern welding techniques like ultrasonic welding and laser welding**

Unit 02: Electrochemical Process (04 Hrs.)

Need of electro-deposition. Applications of Faraday's laws in electro-deposition. Factors governing electro-deposition. Objectives of electroplating. Equipments and accessories for electroplating plant, Electroplating on non-conducting materials, Principle of anodizing and its applications

Electrical Circuits Used in Refrigeration, Air Conditioning

Brief description of vapour compression refrigeration cycle. Description of electrical circuits used in Refrigerator, Air Conditioner

Unit 03: Illumination (04 Hrs.)

Definitions of luminous flux, solid angle, luminous intensity, illumination, luminous efficacy, depreciation factor, coefficient of utilization, space to height ratio, reflection factor; Laws of illumination.

Design of illumination schemes-Factors to be considered for design of illumination scheme, Calculation of illumination at different points, considerations involved in simple design problems for indoor installation, illumination schemes, standard illumination level. Natural day light illumination (brief information)

Different sources of light: Incandescent lamp, fluorescent lamp, comparison between them. Incandescent and discharge lamps – their construction and characteristics; mercury vapour lamp, sodium lamp, halogen lamp, compact fluorescent lamp, metal halide lamp, neon lamps Electroluminescent lamp-LEDs, types, LASERs Comparison of all above luminaries.

Unit 04: Electric Traction (06 Hrs.)

History of Indian railways.

Traction systems - Steam engine drive, electric drive, diesel electric drive, types of diesel locomotives, Advantages of electric traction, Brief treatment to - Indian railway engine coding terminology, WDM,WDP,WDG series and their capacity . Introduction to metro system, mono rail system.

Systems of track electrification: D.C. system, single phase low frequency A.C. system, 3 phase low frequency A.C. systems, composite systems – kando systems, single phase A.C. to D.C. system **Different accessories for track electrification** -overhead wires, conductor rail system, current collector-pentograph, catenary

Electric locomotive- Block diagram with description of various equipment and accessories.

Supply system constituents-Layout and description of -Traction substation, feeding post(25kV), feeding and sectioning arrangement, sectioning and paralleling post, neutral section.

Details of major equipment in traction substation-transformer, circuit breaker, interrupter

Unit 05: Traction Mechanics (08 Hrs.)

Types of services- Urban, Sub-urban, Main line Speed time curves, trapezoidal and quadrilateral speed-time curves, average and schedule speed (Numerical), Tractive effort. Specific energy consumption. Factors affecting specific energy consumption (Numerical), Mechanics of train movement, coefficient of adhesion (Numerical).

Unit 06: Traction Motors, Control of Traction Motors, Train Lighting (08 Hrs.)

Desirable characteristic of traction motors. Suitability of D.C. series motor, A.C. series motor, 3 phase induction motor and linear induction motor for traction. Control of traction motors -Series-parallel control, Shunt and bridge transition (Numerical), Electrical breaking, Regenerative breaking in traction, Suitability of different motors for braking. Train lighting system.

Railway signalling: - History, necessity, block system route relay interlock and necessity. Metro signalling, Electromechanical system for route relay interlock. Introduction to train tracking system, types. Anti-collision system-brief treatment only.

Industrial Visit: Visit to any one location from the following-

- Railway station (Control room)
- Loco shed
- Traction substation

Text Books:

[T1] E. O. Taylor 'Utilization of Electrical Energy' – Revised in S.I. Units by V.V.L. Rao, Orient Longman

[T2] J.B. Gupta, 'Utilization of Electric Power and Electric Traction', S.K. Kataria and sons, Delhi

[T3] C. L. Wadhwa, 'Generation, Distribution and Utilization of Electrical Energy', Eastern Wiley Ltd.

[T4] A. Chakraborti, M. L. Soni, P. V. Gupta, U.S. Bhatnagar, 'A text book on Power System Engineering', Dhanpat Rai and Co.(P) Ltd – Delhi

[T5] Clifford F. Bonntt 'Practical Railway Engineering', (Imperial college press)

Reference Books:

[R1] 'Art and science of Utilization of Electrical Energy' by H. Partab, Dhanpat Rai and Co.(P) Ltd –Delhi

[R2] 'Modern Electric Traction' by H. Partb, Dhanpat Rai and Co. (P) Ltd – Delhi

[R3] 'Lamps and lighting' by M. A. Cayless, J.R. Coaton and A. M. Marsden

[R4] 'BIS, IEC standards for Lamps, Lighting Fixtures and Lighting' By Manak Bhavan, New Delhi

[R5] 'Illumination Engineering from Edison's Lamp to the Laser' Joseph B. Murdoch

[R6] 'Two centuries of Railway signalling' by Geoffrey, Kichenside and Alan Willims (Oxford Publishing Co-op)

[R7] 'Generation and Utilization of Electrical Energy' S. Sivanagaraju, M. Balsubba Reddy, D. Srilatha (Pearson)

[R8] 'Electrical Powers' S. L. Uppal, Khanna Publication

NOTE

Assignments can be given on following topics

- Types of Electric Welding- Electric arc welding and resistance welding (accessories involved and working of the system, characteristics of arc welding)
- Modern welding techniques like ultrasonic welding and laser welding
- Study of different types of lamps-Incandescent lamp, fluorescent lamp, their construction and characteristics; mercury vapour lamp, sodium lamp, halogen lamp, compact fluorescent lamp, metal halide lamp, neon lamps Electroluminescent lamp-LEDs, types, LASERs
- Comparison of all above luminaries.
- WDM, WDP, WDG series and their capacity. Introduction to metro system, mono rail system.

Unit	Text Books	Reference Books
1	T1,T3,T4	R1,R7, R8
2	T1,T3, T4	R1, R7
3	T1,T3, T4	R1, R3,R4,R5,R7, R8
4	T1,T2,T5, T4	R1, R2,R7, R8
5	T1,T2,T5, T4	R1, R2,R5, R8
6	T1, T2,T5, T4	R1, R2,R6, R8

303149: Design of Electrical Machines

Teaching Scheme	Credits	Examination Scheme [Marks]
Theory : 04 Hrs./Week	04	In Sem : 30 Marks
Practical: 02 Hrs./Week	01	End Sem : 70 Marks
		OR : 50 Marks
		Term work : 25 Marks

Prerequisite:

- Knowledge of various materials used in electrical machines.
- Knowledge of types, construction and working of transformer.
- Knowledge of types, construction and working of three phase induction motor.

Course Objective: The course aims :-

- To design transformer.
- To understand determination of parameters of transformer.
- To understand specifications of transformer.
- To design Induction motor.
- To understand determination of parameters of Induction motor.
- To understand specifications of Induction motor.

Course Outcome:

Upon successful completion of this course, the students will be able to :-

- Calculate main dimensions and Design of single phase and three phase transformer.
- Calculate main dimensions of three phase Induction motor.
- Determine the parameters of transformer.
- Determine parameters of three phase Induction motor.

Unit 01: Transformer (7 Hrs.)

Modes of heat dissipation. Heating and cooling curves. Calculations of heating and cooling time constants. Types and constructional features of core and windings used in transformer. Transformer auxiliaries such as tap changer, pressure release valve, breather and conservator. Specifications of three phase transformers as per IS 2026(Part I).

Unit 02: Transformer Design (8 Hrs.)

Output equation with usual notations, optimum design of transformer for minimum cost and loss. Design of main dimensions, core, yoke and windings of transformer. Methods of cooling and tank design. Estimation of resistance and leakage reactance of transformer.

Unit 03: Performance parameters of Transformer (8 Hrs.)

Estimation of no-load current, losses, efficiency and regulation of transformer. Calculation of mechanical forces developed under short circuit conditions, measures to overcome this effect. Introduction to Computer aided design of transformer, generalized flow chart for design of transformer.

Unit 04: Three phase Induction Motor Design : Part I (9 Hrs.)

Specification and Constructional features. Design of ac windings. Output equation with usual notations, specific electrical and magnetic loadings, ranges of specific loadings, turns per phase, number of stator slots.

Unit 05: Three phase Induction Motor Design : Part II (8 Hrs.)

Suitable combinations of stator and rotor slots .Calculations for main dimensions and stator design parameters. Selection of length of air gap, factors affecting length of air gap, unbalanced magnetic pull. Design of rotor slots, size of bars, end rings for cage rotor and rotor slots, turns and area of cross section of conductor for wound rotor.

Unit 06: Performance parameters of Three Phase Induction motor (8 Hrs.)

Leakage flux and leakage reactance: Slot leakage, tooth top leakage, zig-zag leakage, overhang leakage, leakage reactance calculation for three phase machines. MMF Calculation for air gap, stator teeth, stator core, rotor teeth and rotor core, effect of saturation, effects of ducts on calculations of magnetizing current, calculations of no-load current. Calculations of losses and efficiency. Calculation of short time and continuous rating of electrical machine.

Industrial Visit: Industrial visit to a manufacturing unit of transformer or Induction motor.

Term Work: The term work shall consist of:

1. Details and assembly of three phase transformer with design report.(Sheet in CAD)
2. Details and layout of AC winding with design report.(Sheet in CAD)
3. Assembly of 3- phase induction motor.(Sheet optional CAD or Drawing)
4. Use of Finite Element Analysis(FEA) software for analysis of electrical machines, the report should include:
   a. Schematic diagram (Diagram/FEA model/Layout)
   b. Current/Flux/Force distribution.
   c. Analysis by variation of design parameters.
5. Report based on Industrial visit to a manufacturing unit. (Transformer or Induction motor).

Text Books:

[T1] M.G. Say – Theory and Performance and Design of A.C. Machines, 3rd Edition, ELBS London.

[T2] A.K.Sawhney – A Course in Electrical Machine Design, 10th Edition, - Dhanpat Rai and sons New Delhi.

[T3] K. G. Upadhyay- Design of Electrical Machines, New age publication

[T4] R. K. Agarwal – Principles of Electrical Machine Design, S. K.Katariya and sons.

[T5] Indrajit Dasgupta – Design of Transformers – TMH

Reference Books:

[R1] K.L. Narang , A Text Book of Electrical Engineering Drawings, Reprint Edition : 1993 / 94 – Satya Prakashan, New Delhi.

[R2] A Shanmugasundaram, G. Gangadharan, R. Palani, - Electrical Machine Design Data Book, 3rd Edition, 3rd Reprint 1988 - Wiely Eastern Ltd., - New Delhi

[R3] Vishnu Murti, "Computer Aided Design for Electrical Machines", B.S. Publications.

[R4] Bharat Heavy Electricals Limited, Transformers - TMH.

Guidelines for Instructor's Manual Practical Sessions-

The instructor's manual should contain following related to every drawing sheet-

1. Brief theory related to the concerned sheet.
2. Apparatus with their detail specification as per IS code.
3. Design as per problem statement.
4. Reference tables used for design purpose.
5. Design parameters details in tabular form.
6. Few short questions related to design.

Guidelines for Student's Lab Journal-

The Student's Lab Journal should contain following related to every drawing sheet-

1. Brief theory related to the concerned sheet.
2. Apparatus with their detail specification as per IS code.
3. Design as per problem statement.
4. Reference tables used for design purpose.
5. Design parameters details in tabular form.
6. Few short questions related to design.

Guidelines for Lab/TW Assessment

1. There should be continuous assessment for the Lab/TW
2. Assessment must be based on understanding of theory, attentiveness during practical session, how efficiently the student is able to design as per the problem statement.
3. Timely submission of design report and sheet.

Unit	Text Books	Reference Books
1	T1, T2,T4,T5	R1,R2,R4
2	T1,T2, T4,T5	R1,R4
3	T2,T5	R3,R4
4	T1,T2,T3,T4	R1,R2,R3
5	T2	R3
6	T2	R3

303150 : Energy Audit and Management

Teaching Scheme	Credits	Examination Scheme [Marks]
Theory : 03 Hrs./Week	03	In Sem. : 30 Marks
Practical : 02 Hrs./Week	01	End Sem. : 70 Marks
		Term Work : 25 Marks

Prerequisite:

- Concept of power and energy in three phase and single phase
- Various electrical equipments and specifications

Course Objective:

The course aims to:-

- Understand importance of energy Conservation and energy security.
- Understand impact of use energy resources on environment and emission standards.
- Follow format of energy management, energy policy.
- Learn various tools of energy audit and management
- Calculate energy consumption and saving options with economic feasibility.

Course Outcome:

Upon successful completion of this course, the students will be able to:-

- To get knowledge of BEE Energy policies, Electricity Acts.
- Use various energy measurement and audit instruments.
- Carry out preliminary energy audit of various sectors
- Enlist energy conservation and demand side measures for electrical, thermal and utility Systems.
- Solve simple problems on cost benefit analysis.

Unit 01: Energy Scenario (6 Hrs.)

Classification of Energy resources, Commercial and noncommercial sources, primary and secondary sources, commercial energy production, final energy consumption. Energy needs of growing economy, short terms and long terms policies, energy sector reforms, energy security, importance of energy conservation, energy and environmental impacts, emission check standard, salient features of Energy Conservation Act 2001 and Electricity Act 2003. Indian and Global energy scenario. Introduction to IE Rules. Study of Energy Conservation Building Code (ECBC).

Unit 02: Energy Management (6 Hrs.)

Definition and Objective of Energy Management, Principles of Energy management, Energy Management Strategy, Energy Manager Skills, key elements in energy management, force field analysis, energy policy, format and statement of energy policy, Organization setup and energy management. Responsibilities and duties of energy manager under act 2001. Energy Efficiency Programs. Energy monitoring systems.

Unit 03: Demand Management (6 Hrs.)

Supply side management (SSM), Generation system up gradation, constraints on SSM. Demand side management (DSM), advantages and barriers, implementation of DSM. Use of demand side management in agricultural, domestic and commercial consumers. Demand management through tariffs (TOD). Power factor penalties and incentives in tariff for demand control. Apparent energy tariffs. Role of renewable energy sources in energy management, direct use (solar thermal, solar air conditioning, biomass) and indirect use (solar, wind etc.) Introduction to Net Metering.

Unit 04: Energy Audit (6 Hrs.)

Definition, need of energy audits, types of audit, procedures to follow, data and information analysis, energy audit instrumentation, energy consumption – production relationship, pie charts. Sankey diagram, Cusum technique, least square method and numerical based on it. Outcome of energy audit and energy saving potential, action plans for implementation of energy conservation options. Bench- marking energy performance of an industry. Report formats

Unit 05: Energy Conservation in Applications (6 Hrs.)

a) Motive power (motor and drive system). b) Illumination c) Heating systems (boiler and steam systems) d) Ventilation(Fan, Blower and Compressors) and Air Conditioning systems e) Pumping System f) Cogeneration and waste heat recovery systems g) Utility industries (T and D Sector)

Unit 06: Financial analysis (6 Hrs.)

Financial appraisals; criteria, simple payback period, return on investment, net present value method, time value of money, break even analysis, sensitivity analysis and numerical based on it, cost optimization, cost of energy, cost of generation.

Practicals:

Minimum 8 practicals/tutorials to be conducted from following groups:

Group A (Any Two of the following)

1. Study of Clean Development mechanism
2. Study of building codes (green building)
3. Study of energy management tool
4. Study of force field analysis from energy management point of views

Group B (Any three of following)

5. Analysis and interpretation of Electricity Bills
   Students should calculate electricity charges for
   a) Residential consumer
   b) Commercial Consumer (College campus)
6. Assessment and calculations of energy generated by Solar PV or other renewable sources / Diesel generator available in college campus.

7. Use of Power Analyser for measurement of electrical parameters useful for energy audit or power quality audit.
8. Adequacy assessment of Illumination systems by using Lux Meter
9. Use of temperature measuring devices for analysis of heating systems.
10. Use of other transducers (any one)
    a) Assessment of performance of fans and blowers by using Annemo Meter.
    b) Use of Flow Meters for Pumping system analysis.
    c) Use of pressure measuring equipments useful in audit study.
    d) Smart meters and advanced energy meters
11. Execute Preliminary Energy Audit for (Any One)
    (Preferably this activity should be carried out with student group not exceeding 5)
    a) Laboratory
    b) Educational Institute
    c) Commercial Establishment
    d) Small scale industry
    e) Residential Building
    f) Agricultural Equipments
    g) Municipal Corporations
12. Calculation of energy savings for following (Minimum one)
    a) Illumination
    b) Air conditioning System
    c) Pumping Systems
    d) DG Sets
    e) UPS and Inverter Systems
    f) Lifts and elevators
13. Study of energy audit success stories (any one)
    a) Paper and Pulp Industry
    b) Sugar Industry
    c) Steel Industry
    d) Commercial Establishment
    e) Electrical Generation Plant
14. Study of combined heat power system (cogeneration)
15. Study of Ethical Practices in energy audit.

Guidelines for Instructor's Manual

Instructor's Manual shall have

a. Brief relevant theory.
b. Equipment with specifications.
c. Connection diagram/ methodology.
d. Format of observation table and sample results.

Guidelines for Tutorial Reports (Instruction Manual and Journal Guide lines)

1. Report on Tutorial can be written separately for different batches.
2. Report shall be based on actual case studies presented, audit conducted, and conservation
3. Studies executed.
4. Report shall include following points

   a) Objective b) Procedure c) Equipment d) Details of Name/Place/Location

   e) Type and nature of activity f) Result and Calculations if any

   g) Questions for assessment of Tutorial h) Outcome of activity

Guidelines for Practical Assessment

1. There should be continuous assessment for TW.
2. Assessment must be based on understanding level, presentation skills, efficiency and quality of report.
3. Timely submission of act.

Text Books:

[T1] Guide books for National Certification Examination for Energy Managers/Energy Auditors Book , 1-General Aspects (available on line)

[T2] Guide books for National Certification Examination for Energy Managers/Energy Auditors Book 2 – Thermal Utilities (available on line)

[T3] Guide books for National Certification Examination for Energy Managers/Energy Auditors Book 3- Electrical Utilities (available on line)

[T4] Guide books for National Certification Examination for Energy Managers/Energy Auditors Book 4 (available on line)

Reference Books:

[R1] Success stories of Energy Conservation by BEE (www. Bee-india.org)

[R2] Utilization of electrical energy by S.C. Tripathi, Tata McGraw Hill.

[R3] Energy Management by W.R. Murphy and Mackay, B.S. Publication.

[R4] Generation and utilization of Electrical Energy by B.R. Gupta, S. Chand Publication.

[R5] Energy Auditing made simple by Balasubramanian, Bala Consultancy Services.

Websites:

[W1] www.energymanagertraining.com

[W2] www.em-ea.org

[W3] www.bee-india.org

Unit	Text Books	Reference Books/websites
1	T1	W1,W2
2	T1	W1,W2
3		R4
4	T1	R4, R5 W1,W2
5	T1, T2, T3	W1,W2
6	T1, T4	W1,W2

303151: Electrical Workshop

Teaching Scheme		credits	Examination Scheme[Marks]	
Lectures	----		In sem	Nil
Practical	**2 hrs/week**	01	End sem	Nil
			Term Work	50

Objectives:

- To develop hardware skills such as soldering, winding etc.
- To develop debugging skills.
- To increase ability for analysis and testing of circuits.
- To give an exposure to market survey for available components
- To develop an ability for proper documentation of experimentation.
- To enhance employability of a student.
- To prepare students for working on different hardware projects.

Course Outcomes:

After successful completion of the course, student will be able to

- Integrate electrical/electronic circuits for useful applications
- Acquire hardware skills to fabricate circuits designed.
- Read data manuals/data sheets of different items involved in the circuits.
- Test and debug circuits.
- Produce the results of the testing in the form of report.

Instructions:

- The exercises must be carried out in a group of maximum 3 students.
- Minimum 5 exercises must be carried out.
- Students will present the design, procedure observations and conclusion in the form of report which will be evaluated for term work.

Group A (Minimum 2 exercises from this group)

1. Design and fabrication of reactor/ electromagnet for different inductance values.
2. Design and fabrication of single phase Induction/three phase motor stator.
3. Start delta starter wiring for automatic and manual operation.
4. Wiring of distribution box with MCB, ELCB, RCCB and MCCB.
5. Wiring of 40 W tube, T-5, LED, Metal Halide lamps and available latest luminaries.
6. Assembly of various types of contactors with wiring.
7. Assembly of DOL and 3 point starter with NVC connections and overload operation.

Group B (Minimum 2 Exercise from this group)

This group consists of electronic circuits which must be assembled and tested on general purpose PCB or bread boards.

1. Design and development of combined ±12 V, ±5 V regulated power supply.
2. Design and development of SCR based half controlled converter using RC trigerring.
3. D.C. step down chopper.
4. Traffic light controller using time delay circuits.
5. Buck/boost converter using LM2596S.

Group C

(All interfacing circuits for Arduino boards must be assembled on general purpose PCB and tested.)

1. Arduino based temperature measurement and display.
2. Arduino based D.C. Motor speed control.
3. Arduino based ramp, sawtooth waveform generation.
4. Arduino based stepper motor control.

303153(A) : Bioenergy Systems

Course Name: Bioenergy Systems

Prerequisite: Completion of FE or equivalent

Teaching Scheme:
Lectures 2 h per week
Field Visit: 4 h
Practical: 4 h

Examination Schemes: Audit (P/F)
Written / MCQ /
Term paper

Description:

The following topics may be broadly covered in the classroom: Bioenergy, availability of biomass, methods to convert it to heat and electricity, technologies for biodiesel, biomass gasification, biogas, composting, introduction to organic fertilizers, introduction to design, manufacturing and construction of biogas and biodiesel plants, specific equipment for pre and post processing, characterization, quality assurance, standards, certification and economics. The field visits and practical will be designed for first-hand experience and basic understanding of the system elements.

Details:

- Introduction to Bioenergy
- Biomass availability in India
- Biomass and carbon cycle
- Environment pollution and biomass
- Energy from biomass
- Biomass burning for energy
- Gasification of biomass
- Biomass reforming
- Anaerobic digestion for biogas
- Biogas purification
- Biogas to electricity
- Aerobic composting
- Organic fertilizers
- Biomass to liquid fuel
- Biodiesel
- Biomass refinery
- Segregated organic waste management
- Algae as source of biomass
- Dealing with agricultural residue

Site Visit:

- Biogas plant for segregated solid waste

Practical:

- Biodiesel making

303153 (B) : Applications of Power Electronics

Teaching Scheme:
Lectures/Practicals : 2 hrs Per week
Total hrs: 22

Examination Scheme: Audit (P/F)
Written/MCQ/TERM Paper/Practical

Course Name : Applications of Power Electronics
Prerequisites:

1. Fundamentals of SCR its V-I Characteristics, construction, working principles and applications.
2. Fundamentals of transistor based devices MOSFET, IGBT,DIAC, TRIAC, GTO and their V-I Characteristics, construction, working principles and applications.
3. Study of Single phase DC-DC and AC-DC Convertor(Full convertor and Semi Convertor)
4. Fundamentals of Single phase and Three Phase DC-AC Convertor(Full convertor and Semi Convertor)

Description:

The topics may be broadly covered in the classroom. This course will introduce the hands on learning to understand power supply for real world applications. Students can analyze, simulate and optimize their PMLK Power designs online using WEBENCH Power designer.
The TI lab Kits may be used to investigate the influence of physical parameters and operation conditions of a power supply on its performance.

Broadly the topics needed to be covered are:
Working principle of step down chopper for R-L load (highly inductive) its control strategies. Performance parameters, Study of DC-to-DC converters – buck, boost, buck-boost and cuk; Study of Voltage Regulators and their Circuits using TI Lab Kits. ex: The Buck regulator May be studied using TPS54160, hysteretic buck regulator LM3475, Switching Regulator and characteristics of standard regulator ICs – TPS40200, TPS40210, Low Drop out (LDO) Regulators ICs-TPS 7A4901, TPS7A8300.
Control techniques: CLC, TRC, PWM and FM Techniques. Analysis of Step up Chopper and Numerical with RLE load. Necessity of input filter, Areas of application.

Lab setup requirement:
PMLK Buck Kit, PMLK LDO Kit, DC power supply 0-50V/4A with dynamic voltage mode capability , DC electronic load 20V/10A with dynamic current mode capability, 4 digital multimeters with 4 1/2-digit resolution ,250MHz 4-channels Digital Oscilloscope ,10 MHz Function Generator.

Any three out of the four experiments in lab can be performed:

1. With TPS7A4901 and TPS7A8300, study**-**

- Impact of capacitor on PSRR
- Impact of output capacitor on load-transient response
- Impact of line and load conditions on drop out voltage
- Impact of line and load conditions on efficiency

2.Study of DC-DC Buck converter

- Investigate how the efficiency of a TPS54160 buck regulator depends on the line and load conditions and on the switching frequency.
- Analyze the influence of switching frequency fs and of capacitance C and resistance ESR of the input and output capacitors on steady-state waveforms of TPS54160 buck regulator.

3. Study of DC-DC Boost Converter

- Analyze the influence of Input voltage, load current and switching frequency on continuous and discontinuous mode of operation of boost converter.
- Analyze the impact of operating conditions and of the operation mode on the power loss and efficiency of boost converter.

4. Analyze how the switching frequency fs, the DC accuracy and the line noise rejection of the hysteretic buck regulator depend on line voltage, the load current, the characteristics of the output capacitor and the impact of speed-up capacitor.

Webench Experiment:
Lab Requirement: PC's with internet service connection.

Any Two out of the three can be performed:
Design Statement 1:
Design a Low cost Boost Converter to derive 12V, 100mA from 5V USB
DESIGN SPECIFICATION

- Vin(min)= 4V Vin(max)=5V
- Vout=12V Iout=100mA
- The Efficiency of the converter must be greater than 80%
- The design should have a WEBENCH® tool options like Thermal solution and Electrical simulation and to export in other software's
- The BOM count should not exceed 10 parts
- The design should not have an automatic shutdown
- Lesser BOM cost is preferable
- The solution must be designed using the IC available in DIP package.

Design Statement 2:
Design a low cost and power efficient Buck Converter that could be used as a USB charger for mobile devices deriving its power from an automotive battery.
DESIGN SPECIFICATION

- Vin(min)= 9V Vin(max)=15V, Vout=5V Iout=500mA
- The Efficiency of the converter must be greater than 85%
- Footprint of the Total BOM components should be minimal
- The design should have maximum WEBENCH® tool options, for eg. Thermal simulation, Electrical simulation, Simulation export etc.
- The BOM count is expected to be within 15 parts
- Lower Shut down current is desired
- Lower BOM cost is preferred

Design Statement 3:
Design a low cost synchronous buck converter.
DESIGN SPECIFICATIONS

- Vin (Max): 15 V, Vout: 5 V, Vin (Min): 10 V, Iout: 1 A, Ambient Temp: 30°C
- IC should operate in advance eco-mode
- The efficiency should be greater than 90%
- Foot print should be less than 130 mm2
- BOM cost should be less than $2 and the solution should have lowest BOM cost
- BOM count should be less than 10
- The design should have maximum WEBENCH® tool options, for eg. Thermal simulation, Electrical simulation, Simulation export etc)
- IC should support a soft start feature
- Design should not exceed 50 Degree Celsius Temperature at IC-Die (use thermal simulation optimization if required)

Text Books:

1. M.H.Rashid - Power Electronics 2nd Edition, Pearson publication
2. Ned Mohan, T.M. Undeland, W.P. Robbins - Power Electronics, 3rd Edition, John Wiley and Sons
3. B.W. Williams: Power Electronics 2nd edition, John Wiley and sons
4. Ashfaq Ahmed- Power Electronics for Technology, LPE Pearson Edition.
5. Dr. P.S. Bimbhra, Power Electronics, Third Edition, Khanna Publication.
6. K. Hari Babu, Power Electronics , Scitech Publication.

Reference Books:

1. Vedam Donalda, Joshi,Sinha, Thyristorised Power controllers, Wiely Eastern New Delhi.
2. M. D. Singh and K. B. Khandchandani, Power Electronics, Tata McGraw Hill
3. Jai P. Agrawal, Power Electronics systems theory and design LPE, Pearson Education, Asia.
4. L. Umanand, Power Electronics – Essentials and Applications Wiley Publication.
5. J. Michael Jacob – Power Electronics Principal and Applications.
6. M.H.Rashid - Power Electronics Handbook, Butterworth-Heinemann publication,3rd edition
7. M.S. Jamil Asghar, Power Electronics, PHI.
8. V.R. Moorthi, Power Electronics Devices, circuits, and Industrial applications, Oxford University Press.
9. NPTEL Web course and video course on Power Electronics
10. PMLK BUCK Lab manual - http://www.ti.com/lit/ug/ssqu007/ssqu007.pdf
11. PMLK LDO Lab manual - http://www.ti.com/lit/ug/ssqu006/ssqu006.pdf
12. WEBENCH – www.ti.com/webench

Other Reference Material:

1. TPS54160: http://www.ti.com/product/TPS54160
2. LM3475: http://www.ti.com/product/LM3475
3. TPS40200: http://www.ti.com/product/TPS40200
4. TPS40210: http://www.ti.com/product/TPS40210
5. TPS7A4901: http://www.ti.com/product/TPS7A4901
6. TPS7A8300: http://www.ti.com/product/TPS7A8300
7. CSD17313Q2Q1: http://www.ti.com/product/ CSD17313Q2Q1
8. CSD25404Q3: http://www.ti.com/product/ CSD25404Q3
9. UCC27511: http://www.ti.com/product/ UCC27511

Faculty of Engineering

Syllabus

T.E. (Information Technology) 2015 Course

(With effect from Academic Year 2017 - 18)

SAVITRIBAI PHULE PUNE UNIVERSITY

The syllabus is prepared by

B.O.S. in Information Technology, Savitribai Phule Pune University

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PROGRAM EDUCATIONAL OBJECTIVES

The students of Information Technology course after passing out will

1. Possess strong fundamental concepts in mathematics, science, engineering and Technology to address technological challenges.
2. Possess knowledge and skills in the field of Computer Science and Information Technology for analyzing, designing and implementing complex engineering problems of any domain with innovative approaches.
3. Possess an attitude and aptitude for research, entrepreneurship and higher studies in the field of Computer Science and Information Technology.
4. Have commitment to ethical practices, societal contributions through communities and life-long learning.
5. Possess better communication, presentation, time management and teamwork skills leading to responsible & competent professionals and will be able to address challenges in the field of IT at global level.

PROGRAM OUTCOMES

The students in the Information Technology course will attain:

a. an ability to apply knowledge of mathematics, computing, science, engineering and technology;

b. an ability to define a problem and provide a systematic solution with the help of conducting experiments, analyzing the problem and interpreting the data;

c. an ability to design, implement, and evaluate a software or a software/hardware system, component, or process to meet desired needs within realistic constraints;

d. an ability to identify, formulate, and provide systematic solutions to complex engineering/Technology problems;

e. an ability to use the techniques, skills, and modern engineering technology tools, standard processes necessary for practice as a IT professional;

f. an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems with necessary constraints and assumptions;

g. an ability to analyze and provide solution for the local and global impact of information technology on individuals, organizations and society;

h. an ability to understand professional, ethical, legal, security and social issues and responsibilities;

i. an ability to function effectively as an individual or as a team member to accomplish a desired goal(s);

j. an ability to engage in life-long learning and continuing professional development to cope up with fast changes in the technologies/tools with the help of electives, professional organizations and extra-curricular activities;

k. an ability to communicate effectively in engineering community at large by means of effective presentations, report writing, paper publications, demonstrations;

l. an ability to understand engineering, management, financial aspects, performance, optimizations and time complexity necessary for professional practice;

m. an ability to apply design and development principles in the construction of software systems of varying complexity.

T.E. (Information Technology) 2015 Course to be implemented from June 2017

SYLLABUS STRUCTURE

SEMESTER – I

Subject Code	Subject	Teaching Scheme			Examination Scheme					Total Marks	Credits
		Lecture	Tutorial	Practical	In-Sem. Paper	End-Sem. Paper	TW	PR	OR		
314441	Theory of Computation	4	--	--	30	70	--	--	--	100	4
314442	Database Management Systems	4	--	--	30	70				100	4
314443	Software Engineering &Project Management	3	--	--	30	70	--	--	--	100	3
314444	Operating System	4	--	--	30	70	--	--	--	100	4
314445	Human-Computer Interaction	3	--	--	30	70	--	--	--	100	3
314446	Software Laboratory-I		--	4	--	--	25	50	50	125	2
314447	Software Laboratory-II	--	--	4	--	--	25	50	--	75	2
314448	Software Laboratory-III	--	--	2	--	--	50	--	--	50	1
314449	Audit Course 3	--	--		--	--	--	--	--	Grade	
	Total	18	--	10	150	350	100	100	50	750	23
	Total of Part-I	28 Hours				750					

SEMESTER – II

Subject Code	Subject	Teaching Scheme			Examination Scheme					Total Marks	Credits
		Lecture	Tutorial	Practical	In-Sem. Paper	End-Sem. Paper	TW	PR	OR		
314450	Computer Network Technology	3	-	--	30	70	--	--	--	100	3
314451	Systems Programming	4	-	--	30	70	--	--	--	100	4
314452	Design and Analysis of Algorithms	4	-	-	30	70	--	--	--	100	4
314453	Cloud Computing	3	-	-	30	70	--	--	--	100	3
314454	Data Science & Big Data Analytics	4	-	-	30	70	--	--	--	100	4
314455	Software Laboratory-IV	--	--	2	--	--	25	--	25	50	1
314456	Software Laboratory-V	--	--	4	--	--	50	50	--	100	2
314457	Software Laboratory-VI	--	--	2	--	--	25	25	--	50	1
314458	Project Based Seminar	--	01	--	--	--	--	--	50	50	1
314459	Audit Course 4	--	--	--	--	--	--	--	--	Grade	
	Total	18	01	08	150	350	100	75	75	750	23
	Total of Part-II	27 Hours			750						

SEMESTER-I

314441: THEORY OF COMPUTATION

Teaching Scheme:	Credits	Examination Scheme:
Lectures: 4 Hours/Week	04	In-Semester : 30 Marks End-Semester: 70 Marks

Prerequisites:

1. Discrete Structures.
2. Data structures and problem solving.

Course Objectives :

1. To understand problem classification and problem solving by machines.
2. To understand the basics of automata theory and its operations.
3. To study computing machines by describing, classifying and comparing different types of computational models.
4. Encourage students to study theory of computability and complexity.
5. To understand the P and NP class problems and its classification.
6. To understand the fundamentals of problem decidability and reducibility.

Course Outcomes :

1. To construct finite state machines to solve problems in computing.
2. To write mathematical expressions for the formal languages
3. To apply well defined rules for syntax verification.
4. To construct and analyze Push Down, Post and Turing Machine for formal languages.
5. To express the understanding of the decidability and decidability problems.
6. To express the understanding of computational complexity.

UNIT – I FINITE STATE MACHINES — 08 Hours

Basic Concepts: Symbols, Strings, Language, Formal Language, Natural Language. Basic Machine and Finite State Machine.

FSM without output: Definition and Construction-DFA, NFA, NFA with epsilon-Moves, Minimization Of FA, Equivalence of NFA and DFA, Conversion of NFA with epsilon moves to NFA, Conversion of NFA With epsilon moves to DFA.

FSM with output: Definition and Construction of Moore and Mealy Machines, Inter-conversion between Moore and Mealy Machines.

UNIT – II REGULAR EXPRESSIONS — 08 Hours

Definition and Identities of Regular Expressions, Construction of Regular Expression of the given L, Construction of Language from the RE, Construction of FA from the given RE using direct method, Conversion of FA to RE using Arden's Theorem, Pumping Lemma for RL, Closure properties of RLs, Applications of Regular Expressions.

UNIT – III CONTEXT FREE GRAMMAR AND LANGUAGES — 08 Hours

Introduction, Formal Definition of Grammar, Notations, Derivation Process: Leftmost Derivation, Rightmost Derivation, derivation trees, Context Free Languages, Ambiguous CFG, Removal of ambiguity, Simplification of CFG, Normal Forms, Chomsky Hierarchy, Regular grammar, equivalence of RG(LRG and RLG) and FA.

UNIT IV PUSHDOWN AUTOMATA AND POST MACHINES — 08 Hours

Push Down Automata: Introduction and Definition of PDA, Construction (Pictorial/ Transition diagram) of PDA, Instantaneous Description and ACCEPTANCE of CFL by empty stack and final state, Deterministic PDA Vs Nondeterministic PDA, Closure properties of CFLs, pumping lemma for CFL.

Post Machine- Definition and construction.

UNIT – V TURING MACHINES 08 Hours

Formal definition of a Turing machine, Recursive Languages and Recursively Enumerable Languages, Design of Turing machines, Variants of Turing Machines: Multi-tape Turing machines, Universal Turing Machine, Nondeterministic Turing machines. Comparisons of all automata.

UNIT – VI COMPUTATIONAL COMPLEXITY 08 Hours

Decidability: Decidable problems concerning regular languages, Decidable problems concerning context-free languages, Un-decidability, Halting Problem of TM, A Turing-unrecognizable language.

Reducibility: Un-decidable Problems from Language Theory, A Simple Un-decidable Problem PCP, Mapping Reducibility

Time Complexity: Measuring Complexity, The Class P, Examples of problems in P, The Class NP, Examples of problems in NP, NP-completeness.

Text Books

1. Michael Sipser, Introduction to the Theory of Computation, CENGAGE Learning, 3rd Edition ISBBN-13:978-81-315-2529-6.
2. Vivek Kulkarni, Theory of Computation, Oxford University Press, ISBN-13: 978-0-19-808458-7.

Reference Books

1. Hopcroft Ulman, Introduction to Automata Theory, Languages and Computations, Pearson Education Asia, 2nd Edition, ISBN: 9788131720479.
2. Daniell. A. Cohen, Introduction to Computer Theory, Wiley-India, ISBN: 978-81-265-1334-5.
3. K.L.P Mishra, N. Chandrasekaran, Theory of Computer Science (Automata, Languages and Computation), Prentice Hall India, 2nd Edition.
4. John C. Martin, Introduction to Language and Theory of Computation, TMH, 3rd Edition, ISBN: 978-0-07-066048-9.
5. Kavi Mahesh, Theory of Computation: A Problem Solving Approach, Wiley-India, ISBN: 978-81-265-3311-4.
6. Kavi Mahesh, Theory of Computation: A Problem Solving Approach, Wiley India, ISBN: 9788126533114
7. Daniel Cohen, Introduction to Computer Theory, Wiley India, ISBN: 9788126513345,2ed
8. Basavaraj S.Anami, Karibasappa K.G, Formal Languages and Automata Theory, Wiley India, ISBN: 9788126520107

314442 : DATABASE MANAGEMENT SYSTEMS

Teaching Scheme:	Credits	Examination Scheme:
Lectures: 4 Hours/Week	04	In-Semester : 30 Marks
		End-Semester: 70 Marks

Prerequisites:

1. Data structures.
2. Discrete structures.

Course Objectives :

1. To understand the fundamental concepts of database management. These concepts include aspects of database design, database languages, and database-system implementation.
2. To provide a strong formal foundation in database concepts, technology and practice.
3. To give systematic database design approaches covering conceptual design, logical design and an overview of physical design.
4. To be familiar with the basic issues of transaction processing and concurrency control.
5. To learn and understand various Database Architectures and Applications.
6. To understand how analytics and big data affect various functions now and in the future.

Course Outcomes :

1. To define basic functions of DBMS & RDBMS.
2. To analyze database models & entity relationship models.
3. To design and implement a database schema for a given problem-domain.
4. To populate and query a database using SQL DML/DDL commands.
5. Do Programming in PL/SQL including stored procedures, stored functions, cursors and packages.
6. To appreciate the impact of analytics and big data on the information industry and the external ecosystem for analytical and data services.

UNIT – I INTRODUCTION TO DBMS — 08 Hours

Introduction: Database Concepts, Database System Architecture, Data Modeling: Data Models, Basic Concepts, entity, attributes, relationships, constraints, keys.

E-R and EER diagrams: Components of E-R Model, conventions, converting E-R diagram into tables, EER Model components, converting EER diagram into tables, legacy system model.

Relational Model: Basic concepts, Attributes and Domains, Codd's Rules.

Relational Integrity: Domain, Entity, Referential Integrities, Enterprise Constraints, Schema Diagram.

Relational Algebra: Basic Operations, Selection, projection, joining, outer join, union, difference, intersection, Cartesian product, division operations (examples of queries in relational algebraic using symbols).

UNIT – II DATABASE DESIGN AND SQL — 08 Hours

Database Design: Functional Dependency, Purpose of Normalization, Data Redundancy and Update Anomalies, Single Valued Normalization: 1NF, 2NF, 3NF, BCNF. Decomposition: lossless join decomposition and dependency preservation, Multi valued Normalization (4NF), Join Dependencies and the Fifth Normal Form.

Introduction to SQL: Characteristics and advantages, SQL Data Types and Literals, DDL, DML, DCL, SQL Operators, Tables: Creating, Modifying, Deleting, Views: Creating, Dropping, Updating using Views, Indexes, Nulls SQL DML **Queries:** SELECT Query and clauses, Set Operations, Predicates and Joins, Set membership, Tuple Variables, Set comparison, Ordering of Tuples, Aggregate Functions, Nested Queries, Database Modification using SQL Insert, Update and Delete Queries.

UNIT – III QUERY PROCESSING AND DATABASE TRANSACTIONS **08 Hours**

Query Processing: Overview, Measures of query cost, Evaluation of expression, Materialization and Pipelining algorithm. **Transaction:** Basic concept of a Transaction, Transaction Management, Properties of Transactions, Concept of Schedule, Serial Schedule, Serializability: Conflict and View, Cascaded Aborts, Recoverable and No recoverable Schedules. Concept of Stored Procedures, Cursors, Triggers, assertions, roles and privileges Programmatic SQL: Embedded SQL, Dynamic SQL, Advanced SQL-Programming in MYSQL.

UNIT – IV CONCURRENCY CONTROL AND ADVANCED DATABASES **08 Hours**

Concurrency Control: Need, Locking Methods, Deadlocks, Time-stamping Methods, and Optimistic Techniques. **Recovery Methods:** Shadow-Paging and Log-Based Recovery, Checkpoints, Performance Tuning, Query Optimization with respect to SQL Database. **Database Architectures:** Centralized and Client-Server Architectures, 2 Tier and 3 Tier Architecture, Introduction to Parallel Databases, Key elements of Parallel Database Processing, Architecture of Parallel Databases, Introduction to Distributed Databases, Architecture of Distributed Databases, Distributed Database Design.

UNIT – V LARGE SCALE DATA MANAGEMENT **08 Hours**

Emerging Database Technologies: Introduction to No SQL Databases- Internet Databases, Cloud Databases, Mobile Databases, SQLite Database, XML Databases, MongoDB.
Introduction to Big Data and XML: DTD, XML Schemas, XQuery, XPath.
JSON: Overview, Data Types, Objects, Schema, JSON with Java/PHP/Ruby/Python.
Hadoop: HDFS, Dealing with Massive Datasets-Map Reduce and Hadoop.
Introduction to HBase: Overview, HBase Data Model, HBase Region, Hive.

UNIT – VI DATA WAREHOUSING AND DATA MINING **08 Hours**

Data Warehousing: Introduction, Evolution of Data Warehouse, Characteristics, Benefits, Limitation of Data Warehousing, Architecture and Components of Data Warehouse, Conceptual Models, Data Mart, OLAP.
Data Mining: Process, Knowledge Discovery, Goals of Data Mining, Data Mining Tasks, Association, Classification, Clustering, Big Data (Terminology and examples) Introduction to Machine learning for Big Data and Business Intelligence.

Text Books

1. Silberschatz A., Korth H., Sudarshan S, Database System Concepts, McGraw Hill Publication, ISBN-0-07-120413-X, Sixth Edition.
2. S. K. Singh, Database Systems: Concepts, Design and Application, Pearson Publication, ISBN-978-81-317-6092-5.

Reference Books

1. Thomas H Cormen and Charles E.L Leiserson, Introduction to Algorithm, PHI Publication, ISBN: 81-203-2141-3.
2. R. C. T. Lee, S S Tseng, R C Chang, Y T Tsai, Introduction to Design and Analysis of Algorithms, A Strategic approach, Tata McGraw Hill., ISBN-13: 978-1-25-902582-2. ISBN-10: 1-25-902582-9.
3. Anany Levitin, Introduction to the Design & Analysis of Algorithm, Pearson Publication, ISBN 81-7758-835-4.
4. Steven S Skiena, The Algorithm Design Manual, Springer, ISBN 978-81-8489-865-1, Second Edition
5. George T. Heineman, Gary Pollice, Stanley Selkow, Algorithms in a Nutshell, A Desktop Quick Reference, O'Reilly, ISBN: 9789352133611.
6. Gilles Brassard, Paul Bratle, Fundamentals of Algorithms, Pearson Publication, ISBN 978-81-317-1244-3.

314443 : SOFTWARE ENGINEERING AND PROJECT MANAGEMENT

Teaching Scheme:	Credits	Examination Scheme:
Lectures: 3 Hours/Week	03	In-Semester : 30 Marks
		End-Semester: 70 Marks

Prerequisites:

1. Problem solving and object oriented programming.
2. Fundamental of data structures.

Course Objectives :

1. To understand the nature of software complexity in various application domains, disciplined way of software development and software lifecycle process models.
2. To introduce principles of agile software development, the SCRUM process and agile practices.
3. To know methods of capturing, specifying, visualizing and analyzing software requirements.
4. To understand project management through life cycle of the project.
5. To understand current and future trends and practices in the IT industry.
6. To learn about project planning, execution, tracking, audit and closure of project.

Course Outcomes :

1. To identify unique features of various software application domains and classify software applications.
2. To choose and apply appropriate lifecycle model of software development.
3. To describe principles of agile development, discuss the SCRUM process and distinguish agile process model from other process models.
4. To analyze software requirements by applying various modeling techniques.
5. To list and classify CASE tools and discuss recent trends and research in software engineering.
6. To understand IT project management through life cycle of the project and future trends in IT Project Management.

UNIT – I INTRODUCTION TO SOFTWARE ENGINEERING — 06 HOURS

Nature of Software, Software Process, Software Engineering Practice, Software Myths, Generic Process model, Analysis and comparison of Process Models: Waterfall Model, Incremental Models, Evolutionary Models, Concurrent, Specialized Process Models, Personal and Team Process Models, Introduction to Clean Room Software Engineering.

Software Quality Assurance (SQA): Verification and Validation, SQA Plans, Software Quality Frameworks, ISO 9000 Models, CMM Models.

UNIT – II REQUIREMENT ANALYSIS — 06 HOURS

Requirements Capturing: requirements engineering (elicitation, specification, validation, negotiation, prioritizing requirements (Kano diagram) - real life application case study.

Requirements Analysis: basics, scenario based modeling, UML models: use case diagram and class diagram, data modeling, data and control flow model, behavioral modeling using state diagrams - real life application case study, software Requirement Specification.

UNIT – III PROJECT PLANNING — 06 HOURS

Project initiation, Planning Scope Management, Creating the Work Breakdown Structure, Effort estimation and scheduling: Importance of Project Schedules, Estimating Activity Resources, Estimating Activity Durations, Developing the Schedule using Gantt Charts, Adding Milestones to Gantt Charts, Using Tracking Gantt Charts to Compare Planned and Actual Dates, Critical Path Method, Program Evaluation and Review Technique (PERT) with examples. Planning Cost Management, Estimating Costs, Types of Cost Estimates, Cost Estimation Tools and Techniques, Typical Problems with IT Cost Estimates.

UNIT – IV AGILE DEVELOPMENT PROCESS 06 HOURS

Agile Development: Agile manifesto, agility and cost of change, agility principles, myth of planned development, toolset for the agile process.

Extreme Programming: XP values, process, industrial XP, SCRUM - process flow, scrum roles, scrum cycle description, product backlog, sprint planning meeting, sprint backlog, sprint execution, daily scrum meeting, maintaining sprint backlog and burn-down chart, sprint review and retrospective.

Agile Practices: test driven development, refactoring, pair programming, continuous integration, exploratory testing versus scripted testing

UNIT – V PROJECT MANAGEMENT 06 Hours

Project monitoring and control: tools for project management, Software tools like Microsoft project management or any other open source tools.

The Importance of Project Quality Management: Planning Quality Management, Performing Quality Assurance, Controlling Quality, Tools and Techniques for Quality Control (statistical control, six sigma)

The Importance of Project Risk Management, Planning Risk Management, Common Sources of Risk in IT Projects.

UNIT – VI RECENT TRENDS IN SOFTWARE ENGINEERING AND PROJECT MANAGEMENT 06 Hours

Software configuration management: SCM basics, SCM repository, SCM process, SCM tools such as GitHub, CASE – taxonomy, tool-kits, workbenches, environments, components of CASE, categories (upper, lower and integrated CASE tools).

Emerging software engineering trends: technology evolution, process trends, collaborative development, test-driven development, global software development challenges

Project Management trends: CRM, ERP: Basic concepts, Advantages and limitations, SAP, Business process reengineering, International Project Management, Case studies.

Text Books

1. Roger S Pressman, Software Engineering: A Practitioner's Approach, Mcgraw-Hill, ISBN: 0073375977, Seventh or Eighth Edition.
2. Joseph Phillips, IT Project Management –On Track From Start to Finish, Tata Mc Graw-Hill, ISBN13: 978-0-07106727-0, ISBN-10: 0-07-106727-2.

Reference Books

1. Pankaj Jalote, Software Engineering: A Precise Approach, Wiley India, ISBN: 9788126523115.
2. Marchewka, Information Technology Project Management, Wiley India, ISBN: 9788126543946.
3. Chris Dawson with Ben Straub, Building Tools with GitHub, O'Relly, Shroff publishers, ISBN: 978-93-5213-333-8.
4. C. Michael Pilato, Ben Collins-Sussman and Brian Fitzpatrick, Version Control with subversion, O'Relly, Shroff publishers, ISBN: 978-81-8404-728-8.
5. P.C. Tripathi, P.N. Reddy, Principles of Management, Tata McGrew Hill Education Private Limited, ISBN: 9780071333337, ISBN: 0071333339.

314444 : OPERATING SYSTEM

Teaching Scheme:
Lectures: 4 Hours/Week

Credits
04

Examination Scheme:
In-Semester : 30 Marks
End-Semester: 70 Marks

Prerequisites:
1. Computer Organization and Architecture.
2. Fundamentals of Data Structures.

Course Objectives :
1. To introduce basic concepts and functions of modern operating systems.
2. To understand the concept of process and thread management.
3. To understand the scheduling of processes and threads.
4. To understand the concept of concurrency control.
5. To understand the concept of I/O and File management.
6. To understand various Memory Management techniques.

Course Outcomes :
1. Fundamental understanding of the role of Operating Systems.
2. To understand the concept of a process and thread.
3. To apply the cons of process/thread scheduling.
4. To apply the concept of process synchronization, mutual exclusion and the deadlock.
5. To realize the concept of I/O management and File system.
6. To understand the various memory management techniques.

UNIT – I OVERVIEW OF OPERATING SYSTEM — 08 HOURS
Operating System Objectives and Functions, The Evolution of Operating Systems, Developments Leading to Modern Operating Systems, Virtual Machines. BASH Shell scripting: Basic shell commands, shell as a scripting language.

UNIT – II PROCESS DESCRIPTION AND CONTROL — 08 HOURS
Process: Concept of a Process, Process States, Process Description, Process Control (Process creation, Waiting for the process/processes, Loading programs into processes and Process Termination), Execution of the Operating System.
Threads: Processes and Threads, Concept of Multithreading, Types of Threads, Thread programming Using Pthreads.
Scheduling: Types of Scheduling, Scheduling Algorithms, and Thread Scheduling.

UNIT – III CONCURRENCY CONTROL — 08 HOURS
Process/thread Synchronization and Mutual Exclusion: Principles of Concurrency, Requirements for Mutual Exclusion, Mutual Exclusion: Hardware Support, Operating System Support (Semaphores and Mutex), Programming Language Support (Monitors).
Classical synchronization problems: Readers/Writers Problem, Producer and Consumer problem, Inter-process communication (Pipes, shared memory: system V).
Deadlock: Principles of Deadlock, Deadlock Modeling, Strategies to deal with deadlock: The Ostrich Algorithm, Deadlock Prevention, Deadlock Avoidance, Deadlock detection and recovery, An Integrated Deadlock Strategy, Example: Dining Philosophers Problem.

UNIT – IV MEMORY MANAGEMENT — 08 HOURS
Memory Management: Memory Management Requirements, Memory Partitioning: Fixed Partitioning, Dynamic Partitioning, Buddy System, Relocation, Paging, Segmentation.
Virtual Memory: Hardware and Control Structures, Operating System Software.

UNIT – V Input / Output And File Management **08 Hours**

I/O Management and Disk Scheduling: I/O Devices, Organization of the I/O Function, Operating System Design Issues, I/O Buffering, Disk Scheduling(FIFO, SSTF, SCAN, C-SCAN, LOOK, C-LOOK), Disk Cache.

File Management: Overview, File Organization and Access, File Directories, File Sharing, Record Blocking, Secondary Storage Management.

UNIT – VI The LINUX Operating System **08 Hours**

Linux Design Principles, Linux Booting Process, Kernel Modules, Process Management, Scheduling, Memory Management, File Systems, Input and Output, Inter-process Communication.

Text Books

1. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, ISBN-10: 0-13-380591-3, ISBN-13: 978-0-13-380591-8, 8th Edition
2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, WILEY, ISBN 978-1-118-06333-0 , 9th Edition
3. Andrew S. Tanenbaum & Herbert Bos, Modern Operating System, Pearson, ISBN-13: 9780133592221, 4th Edition

Reference Books

1. Tom Adelstein and Bill Lubanovic, Linux System Administration, O'Reilly Media, ISBN-10: 0596009526, ISBN-13: 978-0596009526
2. Harvey M. Deitel, Operating Systems, Prentice Hall, ISBN-10: 0131828274, ISBN-13: 978-0131828278
3. Thomas W. Doeppner, Operating System in depth: Design and Programming, WILEY, ISBN: 978-0-471-68723-8
4. Mendel Cooper, Advanced Shell Scripting, Linux Documentation Project

314445 : HUMAN-COMPUTER INTERACTION

Teaching Scheme:	Credits :	Examination Scheme:
Lectures: 3 Hours/Week	03	In-Semester : 30 Marks
		End-Semester: 70 Marks

Prerequisites :

1. Problem Solving and Object Oriented Technologies.

Course Objectives :

1. To introduce to the field of human-computer-interaction study.
2. To gain an understanding of the human part of human-computer-interactions.
3. To learn to do design and evaluate effective human-computer-interactions.
4. To study HCI models and theories.
5. To understand HCI design processes.
6. To apply HCI to real life use cases.

Course Outcomes :

1. To explain importance of HCI study and principles of user-centred design (UCD) approach.
2. To develop understanding of human factors in HCI design.
3. To develop understanding of models, paradigms and context of interactions.
4. To design effective user-interfaces following a structured and organized UCD process.
5. To evaluate usability of a user-interface design.
6. To apply cognitive models for predicting human-computer-interactions.

UNIT – I INTRODUCTION 06 Hours

What is HCI?, Disciplines involved in HCI, Why HCI study is important? The psychology of everyday things, Principles of HCI, User-centred Design.

UNIT – II UNDERSTANDING THE HUMAN 06 Hours

Input-output channels, Human memory, Thinking: Reasoning and Problem Solving, Human emotions, Individual differences, Psychology and Design.

UNIT – III UNDERSTANDING THE INTERACTION 06 Hours

Models of interaction, Ergonomics, Interaction styles, WIMP Interface, Interactivity, Context of interaction, User experience, Paradigms of Interactions.

UNIT – IV HCI - DESIGN PROCESS 06 Hours

What is interaction design?, The software design process, User focus, Scenarios, Navigation Design, Screen Design, Prototyping techniques, Wire-Framing, Understanding the UI Layer and Its Execution Framework, Model-View-Controller(MVC) Framework.

UNIT – V HCI - DESIGN RULES , GUIDELINES AND EVALUATION TECHNIQUES 06 Hours

Principles that support usability, Design standards, Design Guidelines, Golden rules and heuristics, Using toolkits, User interface management system (UIMS), Goals of evaluation, Evaluation Criteria, Evaluation through expert analysis, Evaluation through user participation, Choosing an Evaluation Method.

UNIT – VI HCI MODELS AND THEORIES 06 Hours

Goal and task hierarchy model, Linguistic model, Physical and device models, Cognitive architectures, Hierarchical task analysis (HTA), Uses of task analysis, Diagrammatic dialog design notations, Computer mediated communication, Ubiquitous Computing, Finding things on web Future of HCI.

Text Books:

1. Alan Dix (2008). Human Computer Interaction. Pearson Education. ISBN 978-81-317-1703-5.
2. Gerard Jounghyun Kim (20 March 2015). Human–Computer Interaction: Fundamentals and Practice. CRC Press. ISBN 978-1-4822-3390-2.

Reference Books:

1. Ben Shneiderman; Catherine Plaisant; Maxine Cohen; Steven Jacobs (29 August 2013). Designing the User Interface: Strategies for Effective Human-Computer Interaction. Pearson Education Limited. ISBN 978-1-292-03701-1.
2. Donald A. Norman (2013). The Design of Everyday Things Basic Books. ISBN 978-0-465-07299-6.
3. Jeff Johnson (17 December 2013). Designing with the Mind in Mind: Simple Guide to Understanding User Interface Design Guidelines. Elsevier. ISBN 978-0-12-411556-9.
4. Alan Cooper; Robert Reimann; David Cronin; Christopher Noessel (13 August 2014). About Face: The Essentials of Interaction Design. Wiley. ISBN 978-1-118-76658-3.
5. Alan Cooper (1 January 1999). The Inmates are running the Asylum, Sam's. ISBN 978-0-672-31649-4.
6. John M. Carroll (21 May 2003). HCI Models, Theories, and Frameworks: Toward a Multidisciplinary Science. Morgan Kaufmann. ISBN 978-0-08-049141-7.
7. Alan Cooper, Robert Reimann, David Cronin, Christopher Noessel, About Face: The Essentials of Interface Design,Wiley India, ISBN : 9788126559718,4th Ed
8. Rogers, Sharp, Preece, Interaction Design: Beyond Human Computer Interaction, Wiley India, ISBN: 9788126544912,3ed
9. Wilbert O.Galitz, The Essential Guide to user Interface Design, Wiley India, ISBN: 9788126502806

Web-links:

1. http://hcibib.org/
2. Andriod Design Guidelines - https://developer.android.com/guide/practices/ui_guidelines/index.html
3. iOS Human Interface Guidelines - https://developer.apple.com/ios/human-interface-guidelines/overview/design-principles/
4. MacOS Human Interface Guidelines - https://developer.apple.com/library/content/documentation/UserExperience/Conceptual/OSXHIGuidelines/

314446 : SOFTWARE LABORATORY - I

Teaching Scheme:
Practical : 4 Hours/Week

Credits
02

Examination Scheme:
Term Work : 25 Marks
Practical : 50 Marks
Oral : 50 Marks

Prerequisites:

1. Data structures and files.
2. Discrete Structure.
3. Software engineering principles and practices.

Course Objectives :

1. Understand the fundamental concepts of database management. These concepts include aspects of database design, database languages, and database-system implementation.
2. To provide a strong formal foundation in database concepts, recent technologies and best industry practices.
3. To give systematic database design approaches covering conceptual design, logical design and an overview of physical design.
4. To learn the SQL and NoSQL database system.
5. To learn and understand various Database Architectures and its use for application development.
6. To programme PL/SQL including stored procedures, stored functions, cursors and packages.

Course Outcomes :

1. To install and configure database systems.
2. To analyze database models & entity relationship models.
3. To design and implement a database schema for a given problem-domain
4. To understand the relational and document type database systems.
5. To populate and query a database using SQL DML/DDL commands.
6. To populate and query a database using MongoDB commands.

Guidelines for Instructor's Manual

1. The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.

Guidelines for Student's Lab Journal

1. Student should submit term work in the form of handwritten journal based on specified list of assignments.
2. Practical Examination will be based on the term work.
3. Candidate is expected to know the theory involved in the experiment.
4. The practical examination should be conducted if and only if the journal of the candidate is complete in all respects.

Guidelines for Lab /TW Assessment

1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.
2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.
3. Appropriate knowledge of usage of software and hardware related to respective laboratory should be

checked by the concerned faculty member.

As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers of the program in journal may be avoided. There must be hand-written write-ups for every assignment in the journal. The DVD/CD containing students programs should be attached to the journal by every student and same to be maintained by department/lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

Suggested List of Laboratory Assignments

Group A: Introduction to Databases (Study assignment – Any 2)

1. Study and design a database with suitable example using following database systems:
    - Relational: SQL / PostgreSQL / MySQL
    - Key-value: Riak / Redis
    - Columnar: Hbase
    - Document: MongoDB / CouchDB
    - Graph: Neo4J

    Compare the different database systems based on points like efficiency, scalability, characteristics and performance.

2. Install and configure client and server for MySQL and MongoDB (Show all commands and necessary steps for installation and configuration).

3. Study the SQLite database and its uses. Also elaborate on building and installing of SQLite.

Group B: SQL and PL/SQL

1. Design any database with at least 3 entities and relationships between them. Apply DCL and DDL commands. Draw suitable ER/EER diagram for the system.

2. Design and implement a database and apply at least 10 different DML queries for the following task. For a given input string display only those records which match the given pattern or a phrase in the search string. Make use of wild characters and LIKE operator for the same. Make use of Boolean and arithmetic operators wherever necessary.

3. Execute the aggregate functions like count, sum, avg etc. on the suitable database. Make use of built in functions according to the need of the database chosen. Retrieve the data from the database based on time and date functions like now (), date (), day (), time () etc. Use group by and having clauses.

4. Implement nested sub queries. Perform a test for set membership (in, not in), set comparison (<some, >=some, <all etc.) and set cardinality (unique, not unique).

5. Write and execute suitable database triggers .Consider row level and statement level triggers.

6. Write and execute PL/SQL stored procedure and function to perform a suitable task on the database. Demonstrate its use.

7. Write a PL/SQL block to implement all types of cursor.

8. Execute DDL statements which demonstrate the use of views. Try to update the base table using its corresponding view. Also consider restrictions on updatable views and perform view creation from multiple tables.

Group C: MongoDB

1. Create a database with suitable example using MongoDB and implement
   - Inserting and saving document (batch insert, insert validation)
   - Removing document
   - Updating document (document replacement, using modifiers, upserts, updating multiple documents, returning updated documents)

2. Execute at least 10 queries on any suitable MongoDB database that demonstrates following querying techniques:
   - find and findOne (specific values)
   - Query criteria (Query conditionals, OR queries, $not, Conditional semantics)
   - Type-specific queries (Null, Regular expression, Querying arrays)

3. Execute at least 10 queries on any suitable MongoDB database that demonstrates following:
   - $ where queries
   - Cursors (Limits, skips, sorts, advanced query options)
   - Database commands

4. Implement Map reduce example with suitable example.

5. Implement the aggregation and indexing with suitable example in MongoDB. Demonstrate the following:
   - Aggregation framework
   - Create and drop different types of indexes and explain () to show the advantage of the indexes.

Group D: Mini Project / Database Application Development

Student group of size 3 to 4 students should decide the statement and scope of the project which will be refined and validated by the faculty considering number of students in the group.
Draw and normalize the design up to at ER Diagram least 3NF in case of back end as RDBMS.

Suggested Directions for development of the mini project.

- Build a suitable GUI by using forms and placing the controls on it for any application. (E.g Student registration for admission, railway reservation, online ticket booking etc.). Proper data entry validations are expected.

- Develop two tier architecture and use ODBC/JDBC connections to store and retrieve data from the database. Make a user friendly interface for system interaction. You may consider any applications like employee management system, library management system etc.

- Implement the basic CRUD operations and execute a transaction that ensures ACID properties. Make use of commands like commit, save point, and rollback. You may use examples like transfer of money from one account to another, cancellation of e-tickets etc.

References

1. Ramon A. Mata-Toledo, Pauline Cushman, Database management systems, TMGH, ISBN: IS978-0-07-063456-5, 5th Edition.
2. Kristina Chodorow, MongoDB The definitive guide, O'Reilly Publications, ISBN:978-93-5110-269-4, 2nd Edition.
3. Dr. P. S. Deshpande, SQL and PL/SQL for Oracle 10g Black Book, DreamTech.
4. Ivan Bayross, SQL, PL/SQL: The Programming Language of Oracle, BPB Publication.
5. Reese G., Yarger R., King T., Williums H, Managing and Using MySQL, Shroff Publishers and Distributors Pvt. Ltd., ISBN: 81 - 7366 - 465 – X, 2nd Edition.
6. Dalton Patrik, SQL Server – Black Book, DreamTech Press.
7. Eric Redmond, Jim Wilson, Seven databases in seven weeks, SPD, ISBN: 978-93-5023-918-6.
8. Jay Kreibich, Using SQLite, SPD, ISBN: 978-93-5110-934-1, 1st edition.

314447 : SOFTWARE LABORATORY – II

Teaching Scheme:
Practical : 4 Hours/Week

Credits
02

Examination Scheme:
Term Work : 25 Marks
Practical : 50 Marks

Prerequisites:

1. C programming.
2. Fundamental of Data Structures.

Course Objectives :

1. To introduce and learn Linux commands required for administration.
2. To learn shell programming concepts and applications.
3. To demonstrate the functioning of OS basic building blocks like processes, threads under the LINUX.
4. To demonstrate the functioning of OS concepts in user space like concurrency control (process synchronization, mutual exclusion & deadlock) and file handling in LINUX.
5. To aware Linux kernel source code details.
6. To demonstrate the functioning of OS concepts in kernel space like embedding the system call in any LINUX kernel.

Course Outcomes :

1. To understand the basics of Linux commands and program the shell of Linux.
2. To develop various system programs for the functioning of operating system.
3. To implement basic building blocks like processes, threads under the Linux.
4. To develop various system programs for the functioning of OS concepts in user space like concurrency control and file handling in Linux.
5. To design and implement Linux Kernel Source Code.
6. To develop the system program for the functioning of OS concepts in kernel space like embedding the system call in any Linux kernel.

Guidelines for Instructor's Manual

1. The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.

Guidelines for Student's Lab Journal

1. Student should submit term work in the form of handwritten journal based on specified list of assignments.
2. Practical Examination will be based on the term work.
3. Candidate is expected to know the theory involved in the experiment.
4. The practical examination should be conducted if and only if the journal of the candidate is complete in all respects.

Guidelines for Lab /TW Assessment

1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.
2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.
3. Appropriate knowledge of usage of software and hardware related to respective laboratory should be checked by the concerned faculty member.

As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers of the program in journal may be avoided. There must be hand-written write-ups for every assignment in the journal. The DVD/CD containing students programs should be attached to the journal by every student and same to be maintained by department/lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

Suggested List of Laboratory Assignments

Assignment No. 1: Shell programming
Write a program to implement an address book with options given below:
a) Create address book. b) View address book. c) Insert a record. d) Delete a record.
e) Modify a record. f) Exit.

Assignment No. 2: Process control system calls: The demonstration of *FORK*, *EXECVE* and *WAIT* system calls along with zombie and orphan states.

a. Implement the C program in which main program accepts the integers to be sorted. Main program uses the *FORK* system call to create a new process called a child process. Parent process sorts the integers using sorting algorithm and waits for child process using *WAIT* system call to sort the integers using any sorting algorithm. Also demonstrate zombie and orphan states.

b. Implement the C program in which main program accepts an integer array. Main program uses the *FORK* system call to create a new process called a child process. Parent process sorts an integer array and passes the sorted array to child process through the command line arguments of *EXECVE* system call. The child process uses *EXECVE* system call to load new program that uses this sorted array for performing the binary search to search the particular item in the array.

Assignment No. 3: Implement multithreading for Matrix Multiplication using pthreads.

Assignment No. 4: Thread synchronization using counting semaphores. Application to demonstrate: producer-consumer problem with counting semaphores and mutex.

Assignment No. 5: Thread synchronization and mutual exclusion using mutex. Application to demonstrate: Reader-Writer problem with reader priority.

Assignment No. 6: Deadlock Avoidance Using Semaphores: Implement the deadlock-free solution to Dining Philosophers problem to illustrate the problem of deadlock and/or starvation that can occur when many synchronized threads are competing for limited resources.

Assignment No. 7: Inter process communication in Linux using following.

a. Pipes: Full duplex communication between parent and child processes. Parent process writes a pathname of a file (the contents of the file are desired) on one pipe to be read by child process and child process writes the contents of the file on second pipe to be read by parent process and displays on standard output.
b. FIFOs: Full duplex communication between two independent processes. First process accepts sentences and writes on one pipe to be read by second process and second process counts number of characters, number of words and number of lines in accepted sentences, writes this output in a text file and writes the contents of the file on second pipe to be read by first process and displays on standard output.

Assignment No. 8: Inter-process Communication using Shared Memory using System V. Application to demonstrate: Client and Server Programs in which server process creates a shared memory segment and writes the message to the shared memory segment. Client process reads the message from the shared memory segment and displays it to the screen.

Assignment No. 9: Implement an assignment using File Handling System Calls (Low level system calls like open, read, write, etc).

Assignment No. 10: Implement a new system call in the kernel space, add this new system call in the Linux kernel by the compilation of this kernel (any kernel source, any architecture and any Linux kernel distribution) and demonstrate the use of this embedded system call using C program in user space.

References

1. Das, Sumitabha, UNIX Concepts and Applications, TMH, ISBN-10: 0070635463, ISBN-13: 978-0070635463, 4th Edition.
2. Kay Robbins and Steve Robbins, UNIX Systems Programming, Prentice Hall, ISBN-13: 978-0134424071, ISBN-10: 0134424077, 2nd Edition.
3. Mendel Cooper, Advanced Shell Scripting Guide, Linux Documentation Project, Public domain.

314448 : SOFTWARE LABORATORY – III

Teaching Scheme:
Practical : 2 Hours/Week

Credits
01

Examination Scheme:
Term Work : 50 Marks

Preamble:

A major component of the course is a Graphical User Interface development. The objective is to develop a GUI by using concepts learned from Software Engineering and Project management. At the beginning of the course, Course Teacher will form project teams with maximum 3 members. During the semester, the project team will work together through all the phases of development cycle up to design, from an initial feasibility study to designing, after designing phase students will deploy the designed system and will make a series of presentations and reports of the work.

Prerequisites:

1. Programming fundamentals.
2. Problem solving skills.

Course Objectives :

1. To understand the nature of software complexity in various application domains, disciplined way of software development and software life cycle process models.
2. To introduce principles of agile software development, the SCRUM process and agile practices.
3. To know methods of capturing, specifying, visualizing and analyzing software requirements.
4. To understand concepts and principles of software design and architecture.
5. To understand user-centric design approach.
6. To apply principles of designing for effective user interfaces.

Course Outcomes :

1. To identify the needs of users through requirement gathering.
2. To apply the concepts of Software Engineering process models for project development.
3. To apply the concepts of HCI for user-friendly project development.
4. To deploy website on live webserver and access through URL.
5. To understand, explore and apply various web technologies.
6. To develop team building for efficient project development.

Guidelines for Instructor's Manual

1. The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.

Guidelines for Student's Lab Journal

1. Student should submit term work in the form of handwritten journal based on specified list of assignments.
2. Practical Examination will be based on the term work.
3. Candidate is expected to know the theory involved in the experiment.
4. The practical examination should be conducted if and only if the journal of the candidate is complete in all respects.

Guidelines for Lab /TW Assessment

1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical

assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.
2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.
3. Appropriate knowledge of usage of software and hardware related to respective laboratory should be checked by the concerned faculty member.

As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers of the program in journal may be avoided. There must be hand-written write-ups for every assignment in the journal. The DVD/CD containing students programs should be attached to the journal by every student and same to be maintained by department/lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

Suggested List of Laboratory Assignments

Group A :Website Design (HTML5, CSS, Bootstrap)

Assignment No. 1: Using HTML5 layout tags develop informative page with sections which include various images, links to other pages for navigation, make use of all possible formatting (for example font, color etc.).

Assignment No. 2: Apply CSS properties Border, margins, Padding, Navigation, dropdown list to page created in first assignment.

Group B : Website GUI Validation (JavaScript, PHP)

Assignment No. 3: Create form in HTML with all form elements apply form validations (e.g. Email, mobile, Pin code, Password).

Assignment No. 4: Validate URL, Email, Required using functions empty, preg_match, filter_var in PHP.

Group C : Website Working (Java Servlet)

Assignment No. 5: Understand servlet life cycle, create login page and apply proper validations with appropriate messages using doGet()/ doPost() methods.

Group D : Website Development (Mini-Project)

Assignment No. 6: Develop website using any CMS tool which falls into one of the categories blog, social networking, News updates, Wikipedia, E-commerce store. Website must include home page, and at least 3 forms (with Validation), use at list HTML5, PHP, CSS/Bootstrap, JavaScript web technologies. No database support is needed. Deploy website on live webserver and access through URL.

Write a complete report of web development stages for the chosen topic and attach printout of the same with screen shots of web pages. Proper use of every technique used for web designing should be followed like for designing wireframe is used. Human computer interaction and user experience concepts learned from HCI should be applied while web development process.

Guidelines for Mini project

1. Project group of maximum 3 students should be formed.
2. Every group member should participate in every stage of the web development.

3. Proper compilation of the report should be attached in the file in printed format.
4. Use of CMS should be done for only Assignment no 6 (Mini Project).
5. At the end of the semester, group should give a presentation of the Mini Project.

References:

1. HTML, XHTML and CSS, Fourth Edition by Steven M. Schafer, Wiley India Edition. ISBN: 978- 81-265-1635-3.
2. Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP, 4th Edition by Ivan Bayross, BPB Publications. ISBN: 9788183330084.
3. Professional Word Press: Design and Development by Brad Williams, David Damstra, Hal Stern, Wrox publications Web Technologies Black Book: HTML, JavaScript, PHP, Java, JSP, XML and AJAX by Kogent Learning Solutions Inc. ISBN: 9788126554560, 8126554568.
4. Wordpress for Web developers: An introduction to web professionals by Stephanie Leary, Apress Publications. ISBN: 9781430258667, 1430258667.

314449 : AUDIT COURSE 3

In addition to credits courses, it is recommended that there should be audit course (non-credit course). Audit course is for the purposes of self-enrichment and academic exploration. Audit courses carry no academic credit. Selection of the audit courses helps the learner to explore the subject of interest in greater details resulting in achieving objective of audit course's inclusion. Evaluation of audit course will be done at institute level. Method of conduction and method of assessment for audit courses is suggested.

Criteria:

The student registered for audit course shall be awarded the grade PP and shall be included such grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory in-semester performance and secured a passing grade in that audit course. No grade points are associated with this 'PP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA.

Guidelines for Conduction and Assessment(Any one or more of following but not limited to)

1. Lectures/ Guest Lectures
2. Visits (Social/Field) and reports
3. Demonstrations
4. Surveys
5. Mini Project
6. Hands on experience on Specific focused topic

Guidelines for Assessment (Any one or more of following but not limited to)

1. Written Test
2. Demonstrations/ Practical Test
3. Presentations
4. IPR/Publication
5. Report

Audit Course 3 Options

Course Code	Audit Course Title
AC3- I	Green Construction & Design
AC3-II	Leadership and Personality Development
AC3-III	Professional Ethics and Etiquettes
AC3-IV	Digital & Social Media Marketing

AC3- I : Green Construction & Design

Prerequisites:

1. General awareness of environment and eco system.

Course Objectives:

1. To motivate students for undertaking green construction projects, technical aspects of their design, obstacles to getting them done, and future directions of the field.
2. To increase awareness of green construction issues, so that students will know the range of existing knowledge and issues.
3. Proper use of energy, water and other resources without harming environment.
4. To reduce waste pollution and Environment Degradation.

Course Outcomes:

1. To understand the importance of environment friendly society.
2. To apply primary measures to reduce carbon emissions from their surroundings.
3. To learn role of IT solutions in design of green buildings.
4. To understand the use of software systems to complete statutory compliancesinvolved in the design of a new home or office building through green construction.

UNIT I

Introduction to Green Construction, need of green construction, Importance, Government Initiatives, your role in the Green Environment.

UNIT II

How to do Green Construction, Project Definition, Team Building, Education and Goal Setting, Documents and Specification.

UNIT III

Elements of Green Construction, Materials Construction Waste Management, Indoor Air Quality, Energy Efficiency.

UNIT IV

Indian Green Building Council (IGBC), Introduction to IGBC, IGBC rating system, Green building projects in India, Benefits of green building, effects on natural resources.

Team Projects:

Students will be formed into groups to research green construction and design in a particular construction context and report their results to the class. What are the particular obstacles and opportunities to integrating green construction techniques into the following sectors? Be sure to consider technical, social, political and economic issues:

1. Hotels (economy, luxury, resorts)
2. Hospitals
3. Retail(big box, malls, small scale downtown retail)
4. Office
5. Government
6. Schools
7. Universities
8. Housing
9. Transportation Stations (Airport Terminals, Train Stations)

References :

1. Kibert, C. (2008) Sustainable Construction: Green Building Design and Delivery, 2nd edition (Hoboken, NJ: John Wiley & Sons.
2. Handbook of Green Building Design and Construction 1st Edition, by Sam Kubba, eBook ISBN:9780123851291.
3. IGBC Green New Buildings Rating System, Version 3.0, Abridged Reference Guide September 2014.Available on internet https://igbc.in/igbc/html_pdfs/abridged/IGBC%20Green%20New%20Buildings%20Rating%20System%20(Version%203.0).pdf

Audit Course 3 - II : Leadership and Personality Development

Prerequisites:

1. Soft Skills.

Course Objectives:

1. To develop inter personal skills and be an effective goal oriented leader.
2. To develop personalities of students in order to empower them and get better insights into ones responsibilities in personal life to build better human being.
3. To develop professionals with leadership quality along with idealistic, practical and moral values.
4. To re-engineer attitude and understand its influence on behavior
5. To help Students evolve as leaders and effectively handle real life challenges in and across the dynamic environment.

Course Outcomes:

1. To exhibit responsible decision-making and personal accountability
2. To demonstrate an understanding of group dynamics and effective teamwork
3. To develop a range of leadership skills and abilities such as effectively leading change, resolving conflict, and motivating others.
4. To develop overall personality.

UNIT I

Personality Development: It Is Personality That Matters, Laws of Personality Development, Different Layers of Personality, How to Change Our Character, Influence of Thought, Take the Whole Responsibility on Yourself, How to Work? Attitude: Factors influencing Attitude, Challenges and lessons from Attitude, Personality Traits , Sharpening Memory Skills, Decision-Making, Negotiation and Problem-Solving

UNIT II

Techniques in Personality development :Self-confidence, Goal setting ,Stress Management : Introduction to Stress, Causes of Stress, Impact Management Stress, Managing Stress Conflict Management: Introduction to Conflict, Causes of Conflict, Managing Conflict ,Time Management: Time as a Resource, Identify Important Time Management Wasters, Individual Time Management Styles, Techniques for better Time Management, Meditation and concentration techniques, Self-hypnotism, Self-acceptance and self-growth.

UNIT III

Leadership Skills: Working individually and in a team, Levels of Leadership, Making of a leader, Types of leadership, Transactions Vs Transformational Leadership, VUCA Leaders, DART Leadership, Leadership Grid & leadership Formulation. Introduction to Interpersonal Relations, Analysis Relations of different ego states, Analysis of Transactions, Analysis of Strokes, Analysis of Life position.

UNIT IV

Group Dynamics &Team Building

Group Dynamics: Importance of groups in organization, and Team Interactions in group, Group Vs Teams, Team formation process, Stages of Group, Group Dynamics, Managing Team Performance & Team Conflicts. How to build a good team? Team work & Team building Interpersonal skills – Conversation, Feedback, Feed forward Interpersonal skills – Delegation, Humor, Trust, Expectations, Values, Status, Compatibility and their role in building team

References :

1. Barun K. Mitra; (2011), “Personality Development & Soft Skills”, First Edition; Oxford Publishers.2E, ISBN: 780199459742, ISBN:0199459746.
2. ShaliniVerma (2014); “Development of Life Skills and Professional Practice”; First Edition; Sultan

Chand (G/L) & Company. ISBN: 9789325974203, ISBN:9325974207.

3. John C. Maxwell (2014); "The 5 Levels of Leadership", Centre Street, A division of Hachette Book Group Inc, ISBN: 9789350098714, ISBN:9350098717.
4. Basic Managerial Skills for All by E. H. McGrath, S. J., PHI Personality Development and Soft Skill, Mitra, Barun, Oxford University Press, ISBN: 9788120343146, ISBN:812034314X.
5. Personality Development by Rajiv K. Mishra. Rupa& Co.
6. How to deal with Stress by Stephen Palmer & Cary Cooper, Kogan Page India Pvt. Ltd., South Asian Edition Successful Time Management by Patrick Forsyth, Kogan Page.

Audit Course 3 – III : Professional Ethics and Etiquettes

Prerequisites:

1. Communication and Language Laboratory

Course Objectives:

1. To learn the rules of good behavior for today's most common social and business situations, including the common courtesies of life
2. To imbibe basic knowledge to make informed ethical decisions when confronted with problems in the working environment.
3. To develop an understanding of how a societal moral varies with culture and how this influences ethical thought and action
4. To develop an orientation towards business etiquettes and the proper etiquette practices for different business scenarios.
5. To learn the etiquette requirements for meetings, entertaining, telephone, and Internet business interaction scenario.

Course Outcomes:

1. To summarize the principles of proper courtesy as they are practiced in the workplace.
2. To describe ways to apply proper courtesy in different professional situations.
3. To practice appropriate etiquettes in the working environment and day to day life.
4. To learn and build proper practices for global corporate world.

UNIT I

An Overview of Ethics, What Is Ethics? Definition of Ethics ,The Importance of Integrity ,The Difference Between Morals, Ethics, and Laws, Engineering Ethics: Purpose of Engineering Ethics-Professional and Professionalism, Professional Roles to be played by an Engineer, Uses of Ethical Theories, Professional Ethics, Development of Ethics, Carol Gilligan's theory of moral development, Heinz's dilemma.

UNIT II

IT Professional Ethics, Ethics in the Business World , Corporate Social Responsibility , Improving Corporate Ethics , Creating an Ethical Work Environment, Including Ethical Considerations in Decision Making ,Ethics in Information Technology ,Common Ethical Issues for IT Users , Supporting the Ethical Practices of IT Users.

UNIT III

Business Etiquette, The ABC's of Etiquette, Developing a Culture of Excellence, The Principles of Exceptional Work Behavior, The Role of Good Manners in Business, Enduring Words Making Introductions and Greeting People: Greeting Components, The Protocol of Shaking Hands, Introductions, Introductory Scenarios, Addressing Individuals Meeting and Board Room Protocol: Guidelines for Planning a Meeting, Before the Meeting, On the Day of the Meeting, Guidelines for Attending a Meeting.

UNIT IV

Professional Etiquette, Etiquette at Dining. Involuntary Awkward Actions, How to Network, Networking Etiquette, Public Relations Office(PRO)'s Etiquettes, Technology Etiquette : Phone Etiquette, Email Etiquette, Social Media Etiquette, Video Conferencing Etiquette, Interview Etiquette, Dressing Etiquettes : for Interview, offices and social functions.

References :

1. George Reynolds, —Ethics in Information Technology, Cengage Learning, ISBN- 10:1285197151.
2. Business Etiquette for Dummies, 2nd Edition by Sue Fox, Wiley Publishing, Inc.

3. Charles E Harris, Micheal J Rabins, —Engineering Ethics, Cengagen Learning , ISBN- 13:978-1133934684.4th Edition.
4. PSR Murthy, —Indian Culture Values and Professional Ethics , BS Publications, ISBN- 10:9381075700. 2nd Edition.
5. Business Etiquette in Brief by Ann Marie Sabath, Adams Media Corporation, South Asian Edition, 1st Edition.

Audit Course 3 – IV : Digital & Social Media Marketing

Prerequisites:

1. Knowledge of Social Media Networking.

Course Objectives:

1. Get strategic understanding of Digital Marketing and Social Media Marketing.
2. Understand how to use it for branding and sales.
3. Understand its advantages & limitations.
4. Become familiar with Best Practices, Tools & Technologies.
5. Blend digital and social marketing with offline marketing.
6. Plan and manage digital marketing budget.
7. Manage Reporting & Tracking Metrics.
8. Understand the future of Digital Marketing and prepare for it.

Course Outcomes:

1. Develop a far deeper understanding of the changing digital landscape.
2. Identify some of the latest digital marketing trends and skill sets needed for today's marketer.
3. Successful planning, prediction, and management of digital marketing campaigns.
4. Implement smart management of different digital assets for marketing needs.
   Assess digital marketing as a long term career opportunity.

UNIT I

Digital Marketing, History of Digital Marketing, Importance of Digital Marketing, Effective use of Digital Marketing, Effects of wrong Digital Marketing, Digital Marketing to develop brands, Digital Marketing for sales, Digital Marketing for product and service development.

UNIT II

Techniques for effective Email Marketing and pitfalls, Various online email marketing platforms such as Campaign Monitor and Mail Chimp, Web content, web usability, navigation and design, Bookmarking and News Aggregators, Really Simple Syndication (RSS),Blogging, Live Chat, User Generated Content (Wikipedia etc),Multi-media - Video (Video Streaming, YouTube etc),Multi-media - Audio & Podcasting (iTunes etc), Multi-media - Photos/Images (Flickr etc),Google Alerts and Giga Alert (Brand, product and service monitoring online),Crowdsourcing, Virtual Worlds.

UNIT III

Search Engine Optimization (SEO), Search Engine Optimization (SEO) tips and techniques, Google Adwords, Google various applications such as 'Google Analytics', Maps, Places etc to enhance a brand's products, services and operations.

UNIT IV

Facebook &LinkedIn and other Social Media for a real marketing, Utilizing Facebook and LinkedIn's Advertising functionality and Applications, Brand reputation management techniques, Systems for 'buzz monitoring' for brands, products and services, Effective Public Relations (PR) online and business development.

References :

1. Vandana Ahuja, Digital Marketing, Oxford Press, ISBN: 9780199455447, 1st Edition.
2. Email Marketing: An Hour a Day, Wiley, Jeanniey Mullen, David Daniels, David Gilmour-ISBN: 978-0-470-38673-6, 1st Edition.
3. The New Rules of Marketing and PR, David Scott, Wiley India, ISBN: 978-1-119-07048-1, 1st Edition.

SEMESTER-II

314450 : COMPUTER NETWORK TECHNOLOGY

Teaching Scheme:	Credits	Examination Scheme:
Lectures: 3 Hours/Week	03	In-Semester : 30 Marks End-Semester: 70 Marks

Prerequisites:

1. Foundation of Communication and Computer Networks.

Course Objectives :

1. To understand services offered at different layers of network.
2. To understand protocol used at different layers of network.
3. To fathom wireless network and different wireless standards.
4. To recognize differences in between different wireless networks and to learn different mechanism used at layers of wireless network.
5. To know the applications of network and use the understood concepts for new application development.
6. To explore recent trends in networking.

Course Outcomes :

1. To know Responsibilities, services offered and protocol used at each layer of network.
2. To understand different addressing techniques used in network.
3. To know the difference between different types of network.
4. To know the different wireless technologies and IEEE standards.
5. To use and apply the standards and protocols learned, for application development.
6. To understand and explore recent trends in network domain.

UNIT – I NETWORK LAYER 06 Hours

Network Layer Services, IPv4 Addresses: Classful and Classless Addressing, Special Addresses, NAT, Subnetting, Supernetting, Delivery and Forwarding of IP Packet, Structure of Router, IPv4: Fragmentation, Options, Checksum, ARP: Address Mapping, ARP Protocol, RARP, DHCP, ICMPv4, Unicast Distance Vector Routing, Link State Routing, Unicast Routing Protocols: RIP,EIGRP,OSPF,BGP, IPv6 Addressing.

UNIT – II TRANSPORT LAYER 06 Hours

Transport Layer Services, UDP: Datagram, Services, Applications, TCP: Services, Features, Segment, TCP Connection, Window in TCP, Flow control, Congestion Control, Congestion Control Algorithms, Leaky Bucket, Token Bucket and QoS, TCP Timers, Options, TCP Package, Applications, SCTP: Features, Services, Packet Format, Socket: TCP and UDP Socket, Applications.

UNIT – III APPLICATION LAYER 06 Hours

Client Server Paradigm: Communication using TCP and UDP, Peer to Peer Paradigm, Application Layer Protocols: DNS, FTP, TFTP, HTTP, SMTP, POP, IMAP, MIME, Network Management: SNMP.

UNIT – IV WIRELESS STANDARDS 06 Hours

Electromagnetic Spectrum: Spectrum Allocation, Radio Propagation Mechanism, Characteristics of Wireless Channel, Wireless LANs: Architectural Comparison, Characteristics, Access Control, IEEE 802.11: Architecture, MAC Sub Layer, Addressing Mechanism, Physical Layer, Bluetooth: Architecture, Layers, IEEE 802.16/WiMax: Services, Architecture, Layers, Differences between Bluetooth, IEEE 802.11 and IEEE 802.16.

UNIT – V ADHOC WIRELESS NEWTORK 06 Hours

Infrastructure Network and Infrastructure-less Wireless Networks, Issues in Adhoc Wireless Network, Adhoc

Network MAC Layer: Design Issues, Design Goal, Classification, MACAW, Adhoc Network Routing Layer: Issues in Designing a Routing Protocol for Ad-hoc Wireless Networks – Classifications of Routing Protocols, DSDV, AODV, DSR, Adhoc Transport Layer: Issues in Designing a Transport Layer Protocol for Ad hoc Wireless Networks – Design Goals of a Transport Layer Protocol for Ad hoc Wireless Networks –Classification of Transport Layer Solutions, TCP over Adhoc Wireless Networks.

UNIT – VI RECENT TRENDS IN COMMUNICATION NETWORKS 06 Hours

Satellite Network: Operation, GEO Satellites, MEO Satellites, LEO Satellites, Wireless Sensor Network: Functioning, Characteristics, Operation, Cluster Management, Computational Grid: Design, Issues, Internet of Things: Vision, Trends, Significance, Technical Building Blocks, Issues and Challenges, Applications, IoE. Software Defined Network: SDN Implication for research and innovation, Genesis of SDN, Characteristics of SDN, SDN Operations, SDN Devices, SDN Controllers, SDN Application, OpeFLow Overview, Network Function Virtualization: Introduction, Applications, Network Neutrality: Need, Requirements ([e] Reference from research papers and web)

Text Books

1. Behrouz A. Forouzan, TCP/IP Protocol Suite, McGraw Hill Education, ISBN: 978-0-07-070652-1, 4th Edition.
2. C. Siva Ram Murthy, B. S. Manoj, Adhoc Wireless Networks: Architecture and Protocols, Pearson Education, ISBN: 978-81-317-0688-6, 1st Edition.
3. Behrouz A. Forouzan, Data Communication and Networking, McGraw Hill Education, ISBN: 978-1-25-906475-3, 5th Edition.

Reference Books

1. Andrew S. Tanenbaum, David J. Wethrall, Computer Network, Pearson Education, ISBN: 978-0-13-212695-3.
2. Kurose Ross, Computer Networking: A Top Down Approach Featuring the Internet, Pearson Education, ISBN: 978-81-7758-878-1.
3. Charles E. Perkins, Adhoc Networking, Pearson Education, 978-81-317-2096-7.
4. Andrea Goldsmith, Wireless Communication, Cambridge University Press, ISBN:978-0-521-83716-3.
5. Mayank Dave, Computer Network, Cengage Learning, ISBN: 978-81-315-0986-9.
6. C. K. Toh, Ad Hoc Mobile Wireless Networks Protocols and Systems, Prentice Hall, ISBN: 978-01-324-42046.
7. Paul Goransson, Chuck Black, Software Defined Networks: A Comprehensive Approach, Morgan Kaufmann, ISBN: 978-0124166752.
8. Natalia Olifer, Victor Olifer, Computer Networks: Principles, Technologies and Protocols for Network Design, Wiley India, ISBN: 9788126509171
9. Kazem Sohraby, Daniel Minoli, Taieb Znati, Wireless Sensor Networks: Technology, Protocols and Applications, Wiley India, ISBN: 9788126527304
10. P. Nicopolitidis, M.S. Obaidat, G.I. Papadimitriou, A.S. Pomportsis, Wireless Networks, Wiley India, ISBN : 9788126522200

314451 : SYSTEMS PROGRAMMING

Teaching Scheme:
Lectures: 4 Hours/Week

Credits
04

Examination Scheme:
In-Semester : 30 Marks
End-Semester: 70 Marks

Prerequisites:

1. Computer Organization and architecture.
2. Processor Architecture and Interfacing.
3. Fundamentals of Data Structures, Data Structures and Files.
4. Theory of Computation: DFA, NFA, Regular expressions, Grammars.

Course Objectives :

1. To study and understand different system software like Assembler, Macro-processor and Loaders / Linkers.
2. To design and develop useful system software.
3. To study and understand compiler design.
4. To understand semantic analysis and storage allocation in compilation process.
5. To understand different code generation techniques.
6. To study different code optimization methods.

Course Outcomes :

1. To learn independently modern software development tools and creates novel solutions for language processing applications.
2. To design and implement assemblers and macro processors.
3. To use tool LEX for generation of Lexical Analyzer.
4. To use YACC tool for generation of syntax analyzer.
5. To generate output for all the phases of compiler.
6. To apply code optimization in the compilation process.

UNIT – I INTRODUCTION TO SYSTEMS PROGRAMMING AND ASSEMBLERS — 08 Hours

Introduction: Need of System Software, Components of System Software, Language Processing Activities, Fundamentals of Language Processing.
Assemblers: Elements of Assembly Language Programming, A simple Assembly Scheme, Pass structure of Assemblers, Design of Two Pass Assembler, Single pass assembler.

UNIT – II MACROPROCESSORS, LOADERS AND LINKERS — 08 Hours

Macro Processor: Macro Definition and call, Macro Expansion, Nested Macro Calls and definition, Advanced Macro Facilities, Design of two-pass Macro Processor.
Loaders: Loader Schemes, Compile and Go, General Loader Scheme, Absolute Loader Scheme, Subroutine Linkages, Relocation and linking concepts, Self-relocating programs, Relocating Loaders, Direct Linking Loaders, Overlay Structure.

UNIT - III INTRODUCTION TO COMPILERS — 08 Hours

Phase structure of Compiler and entire compilation process.
Lexical Analyzer: The Role of the Lexical Analyzer, Input Buffering. Specification of Tokens, Recognition of Tokens, Design of Lexical Analyzer using Uniform Symbol Table, Lexical Errors.
LEX: LEX Specification, Generation of Lexical Analyzer by LEX.

UNIT – IV PARSERS — 08 Hours

Role of parsers, Classification of Parsers: Top down parsers- recursive descent parser and predictive parser.

Bottom up Parsers – Shift Reduce: SLR, CLR and LALR parsers. Error Detection and Recovery in Parser. YACC specification and Automatic construction of Parser (YACC).

UNIT – V SEMANTIC ANALYSIS AND STORAGE ALLOCATION 08 Hours

Need, Syntax Directed Translation, Syntax Directed Definitions, Translation of assignment Statements, iterative statements, Boolean expressions, conditional statements, Type Checking and Type conversion.

Intermediate Code Formats: Postfix notation, Parse and syntax tress, Three address code, quadruples and triples.

Storage Allocation: Storage organization and allocation strategies.

UNIT – VI CODE GENERATION AND OPTIMIZATION 08 Hours

Code Generation: Code generation Issues. Basic blocks and flow graphs, A Simple Code Generator.

Code Optimization: Machine Independent: Peephole optimizations: Common Sub-expression elimination, Removing of loop invariants, Induction variables and Reduction in strengths, use of machine idioms, Dynamic Programming Code Generation.

Machine dependent Issues: Assignment and use of registers, Rearrangement of Quadruples for code optimization.

Text Books

1. D. M. Dhamdhere, Systems Programming and Operating Systems, Tata McGraw-Hill, ISBN 13:978-0-07-463579-7, Second Revised Edition.
2. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, Compilers Principles, Techniques and Tools, Addison Wesley, ISBN:981–235–885 - 4, Low Price Edition.
3. J. J. Donovan, Systems Programming, McGraw-Hill, ISBN 13:978-0-07-460482-3, Indian Edition.

Reference Books

1. Leland L. Beck, "System Software An introduction to Systems Programming", Pearson Education, ISBN13: 9788177585551.

314452 : DESIGN AND ANALYSIS OF ALGORITHMS

Teaching Scheme:	Credits	Examination Scheme:
Lectures: 4 Hours/Week	04	In-Semester : 30 Marks
		End-Semester: 70 Marks

Prerequisites:

1. Fundamentals of Data Structures, Data Structures and Files.
2. Discrete Structures.
3. Basic mathematics: Induction, probability theory, logarithms.

Course Objectives :

1. To understand the problem solving and problem classification.
2. To know the basics of computational complexity analysis and various algorithm design strategies.
3. To provide students with solid foundations to deal with a wide variety of computational problems.
4. To provide a thorough knowledge of the most common algorithms and data structures.
5. To analyze a problem and identify the computing requirements appropriate for its solutions.
6. To understand the design of parallel algorithms.

Course Outcomes :

1. To calculate computational complexity using asymptotic notations for various algorithms.
2. To apply Divide & Conquer as well as Greedy approach to design algorithms.
3. To practice principle of optimality.
4. To illustrate different problems using Backtracking.
5. To compare different methods of Branch and Bound strategy.
6. To explore the concept of P, NP, NP-complete, NP-Hard and parallel algorithms.

UNIT – I INTRODUCTION 08 Hours

Brute Force method: Introduction to Brute Force method & Exhaustive search, Brute Force solution to 8 queens' problem.

Proof Techniques: Minimum 2 examples of each: Contradiction, Mathematical Induction, Direct proofs, Proof by counterexample, Proof by contraposition.

Analysis of Algorithm: Efficiency- Analysis framework, asymptotic notations – big O, theta and omega.

Amortized Analysis: Aggregate, Accounting & Potential method with the example of stack operations.

Analysis of Non-recursive and recursive algorithms: Solving Recurrence Equations (Homogeneous and non-homogeneous).

UNIT – II DIVIDE AND CONQUER AND GREEDYMETHOD 08 Hours

Divide & Conquer: General method, Control abstraction, Merge sort, Quick Sort – Worst, Best and average case. Binary search, Finding Max-Min, Large integer Multiplication (for all above algorithms analysis to be done with recurrence).

Greedy Method: General method and characteristics, Prim's method for MST , Kruskal's method for MST (using nlogn complexity), Dijkstra's Algorithm, Optimal storage on tapes, Fractional Knapsack problem, Job Sequencing.

UNIT - III DYNAMIC PROGRAMMING 08 Hours

General strategy, Principle of optimality, 0/1 knapsack Problem, Bellman-Ford Algorithm , Multistage Graph problem, Optimal Binary Search Trees, Travelling Salesman Problem.

UNIT – IV BACKTRACKING 08 Hours

General method, Recursive backtracking algorithm, Iterative backtracking method. 8-Queen problem, Sum of subsets, Graph coloring, Hamiltonian Cycle , 0/1 Knapsack Problem.

UNIT – V BRANCH AND BOUND 08 Hours

The method, Control abstractions for Least Cost Search, Bounding, FIFO branch and bound, LC branch and bound, 0/1 Knapsack problem – LC branch and bound and FIFO branch and bound solution, Traveling sales person problem

UNIT – VI COMPUTATIONAL COMPLEXITY AND PARALLEL ALGORITHMS 08 Hours

Computational Complexity: Non Deterministic algorithms, The classes: P, NP, NP Complete, NP Hard, Satisfiability problem, Proofs for NP Complete Problems: Clique, Vertex Cover.

Parallel Algorithms: Introduction, models for parallel computing, computing with complete binary tree, Pointer doubling algorithm.

Text Books

1. Horowitz and Sahani, Fundamentals of computer Algorithms, Galgotia, ISBN 81-7371-612-9.
2. S. Sridhar, Design and Analysis of Algorithms, Oxford, ISBN 10 : 0-19-809369-1.

Reference Books

1. Thomas H Cormen and Charles E.L Leiserson, Introduction to Algorithm, PHI, ISBN:81-203-2141-3.
2. R. C. T. Lee, SS Tseng, R C Chang, Y T Tsai, Introduction to Design and Analysis of Algorithms, A Strategic approach, Tata McGraw Hill, ISBN-13: 978-1-25-902582-2. ISBN-10: 1-25-902582-9.
3. Anany Levitin, Introduction to the Design & Analysis of Algorithm, Pearson, ISBN 81- 7758-835-4.
4. Steven S Skiena, The Algorithm Design Manual, Springer, ISBN 978-81-8489-865-1.
5. George T. Heineman, Gary Pollice, Stanley Selkow, Algorithms in a Nutshell, A Desktop Quick Reference, O'Reilly, ISBN: 9789352133611.
6. Gilles Brassard, Paul Bratle, Fundamentals of Algorithms, Pearson, ISBN 978-81-317-1244-3.
7. Michael T. Goodrich, Roberto Tamassia, Algorithm Design: Foundations, Analysis and Internet Examples, Wiley India, ISBN: 9788126509867
8. Rod Stephens, Essential Algorithms: A Practical Approach to Computer Algorithms, Wiley India, ISBN: 9788126546138

314453 : CLOUD COMPUTING

Teaching Scheme:
Lectures: 3 Hours/Week

Credits
03

Examination Scheme:
In-Semester : 30 Marks
End-Semester: 70 Marks

Prerequisites:

1. Operating Systems.
2. Fundamentals of Computer Networks.

Course Objectives :

1. To become familiar with Cloud Computing and its ecosystem.
2. To learn basics of virtualization and its importance.
3. To evaluate in-depth analysis of Cloud Computing capabilities.
4. To give technical overview of Cloud Programming and Services.
5. To understand security issues in cloud computing.
6. To be exposed to Ubiquitous Cloud and Internet of Things.

Course Outcomes :

1. To understand the need of Cloud based solutions.
2. To understand Security Mechanisms and issues in various Cloud Applications
3. To explore effective techniques to program Cloud Systems.
4. To understand current challenges and trade-offs in Cloud Computing.
5. To find challenges in cloud computing and delve into it to effective solutions.
6. To understand emerging trends in cloud computing.

UNIT – I FUNDAMENTALS OF CLOUD COMPUTING — 06 Hours

Origins and Influences, Basic Concepts and Terminology, Goals and Benefits, Risks and Challenges, Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models, Federated Cloud/Intercloud, Types of Clouds.

Cloud-Enabling Technology: Broadband Networks and Internet Architecture, Data Center Technology, Virtualization Technology, Web Technology, Multitenant Technology, Service Technology.

UNIT – II VIRTUALIZATION AND COMMON STANDARDS IN CLOUD COMPUTING — 06 Hours

Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Types of Hypervisors, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation.

Common Standards: The Open Cloud Consortium, Open Virtualization Format, Standards for Application Developers: Browsers (Ajax), Data (XML, JSON), Solution Stacks (LAMP and LAPP),Syndication (Atom, Atom Publishing Protocol, and RSS), Standards for Security.

UNIT - III CLOUD PROGRAMMING, ENVIRONMENTS AND APPLICATIONS — 06 Hours

Features of Cloud and Grid Platforms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments, Understanding Core OpenStack Ecosystem.

Applications: Moving application to cloud, Microsoft Cloud Services, Google Cloud Applications, Amazon Cloud Services, Cloud Applications (Social Networking, E-mail, Office Services, Google Apps, Customer Relationship Management).

UNIT –IV CLOUD SECURITY AND ISSUES — 06 Hours

Basic Terms and Concepts, Threat Agents, Cloud Security Threats and Attacks, Additional Considerations.

Cloud Security Mechanisms: Encryption, Hashing, Digital Signature, Public Key Infrastructure (PKI), Identity and Access Management (IAM), Single Sign-On (SSO), Hardened Virtual Server Images.
Cloud Issues: Stability, Partner Quality, Longevity, Business Continuity, Service-Level Agreements, Agreeing on the Service of Clouds, Solving Problems, Quality of Service, Regulatory Issues and Accountability.

UNIT – V UBIQUITOUS CLOUDS AND THE INTERNET OF THINGS 06 Hours

Cloud Trends in Supporting Ubiquitous Computing, Performance of Distributed Systems and the Cloud, Enabling Technologies for the Internet of Things (RFID, Sensor Networks and ZigBee Technology, GPS), Innovative Applications of the Internet of Things (Smart Buildings and Smart Power Grid, Retailing and Supply-Chain Management, Cyber-Physical System), Online Social and Professional Networking.

UNIT – VI FUTURE OF CLOUD COMPUTING 06 Hours

How the Cloud Will Change Operating Systems, Location-Aware Applications, Intelligent Fabrics, Paints, and More, The Future of Cloud TV, Future of Cloud-Based Smart Devices, Faster Time to Market for Software Applications, Home-Based Cloud Computing, Mobile Cloud, Autonomic Cloud Engine, Multimedia Cloud, Energy Aware Cloud Computing, Jungle Computing.
Docker at a Glance: Process Simplification, Broad Support and Adoption, Architecture, Getting the Most from Docker, The Docker Workflow.

Text Books

1. Jack J. Dongarra, Kai Hwang, Geoffrey C. Fox, Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, Elsevier, ISBN :9789381269237, 9381269238, 1st Edition.
2. Thomas Erl, Zaigham Mahmood and Ricardo Puttini, Cloud Computing: Concepts, Technology & Architecture, Pearson, ISBN :978 9332535923, 9332535922, 1st Edition.

Reference Books

1. Srinivasan, J. Suresh, Cloud Computing: A practical approach for learning and implementation, Pearson, ISBN :9788131776513.
2. Brian J.S. Chee and Curtis Franklin, Jr., Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center, CRC Press, ISBN :9781439806128.
3. Kris Jamsa, Cloud Computing: Saas, Paas, Iaas, Virtualization, Business Models, Mobile, Security, and More, Jones and Bartlett, ISBN :9789380853772.
4. John W. Ritting house, James F. Ransome, Cloud Computing Implementation, Management, and Security, CRC Press, ISBN : 978 1439806807, 1439806802.
5. Karl Matthias, Sean P. Kane, Docker: Up and Running, OReilly, ISBN:9781491917572, 1491917571.
6. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, Mastering Cloud Computing: Foundations and Applications Programming, McGraw Hill, ISBN: 978 1259029950, 1259029956.
7. Barrie Sosinsky, Cloud Computing Bible, Wiley, ISBN: 978 8126529803.
8. Gautham Shroff, Enterprise Cloud Computing, Cambridge, ISBN: 9781107648890.
9. Ronald L. Krutz and Russell D. Vines, Cloud Security: A Comprehensive guide to Secure Cloud Computing, Wiley, ISBN: 9788126528097.
10. Scott Adkins, John Belamaric, Vincent Giersch, Denys Makogon, Jason E. Robinson, OpenStack: Cloud Application Development, Wrox, ISBN :9781119194316.
11. Rajkumar Buyya, James Broberg, Andrzej Goscinski, Cloud Computing: Principles and Paradigms, Wiley India, ISBN: 9788126541256
12. Kailash Jayaswal, Jagannath Kallakurchi, Donald J. Houde, Cloud Computing Black Book ,Wiley Dreamtech,ISBN:9789351194187
13. Barrie Sosinsky, Cloud Computing Bible Wiley India, ISBN :9788126529803

314454 : DATA SCIENCE AND BIG DATA ANALYTICS

Teaching Scheme:	Credits	Examination Scheme:
Lectures: 4 Hours/Week	04	In-Semester : 30 Marks End-Semester: 70 Marks

Prerequisites:

1. Engineering and discrete mathematics.
2. Database Management Systems, Data warehousing, Data mining.
3. Programming skill.

Course Objectives :

1. To introduce basic need of Big Data and Data science to handle huge amount of data.
2. To understand the basic mathematics behind the Big data.
3. To understand the different Big data processing technologies.
4. To understand and apply the Analytical concept of Big data using R and Python.
5. To visualize the Big Data using different tools.
6. To understand the application and impact of Big Data.

Course Outcomes :

1. To understand Big Data primitives.
2. To learn and apply different mathematical models for Big Data.
3. To demonstrate their Big Data learning skills by developing industry or research applications.
4. To analyze each learning model come from a different algorithmic approach and it will perform differently under different datasets.
5. To understand needs, challenges and techniques for big data visualization.
6. To learn different programming platforms for big data analytics.

UNIT – I INTRODUCTION: DATA SCIENCE AND BIG DATA — 08 hours

Introduction to Data science and Big Data, Defining Data science and Big Data, Big Data examples, Data explosion, Data volume, Data Velocity, Big data infrastructure and challenges, Big Data Processing Architectures, Data Warehouse, Re-Engineering the Data Warehouse, Shared everything and shared nothing architecture, Big data learning approaches.

UNIT – II MATHEMATICAL FOUNDATION OF BIG DATA — 08 Hours

Probability theory, Tail bounds with applications, Markov chains and random walks, Pair wise independence and universal hashing, Approximate counting, Approximate median, The streaming models, Flajolet Martin Distance sampling, Bloom filters, Local search and testing connectivity, Enforce test techniques, Random walks and testing, Boolean functions, BLR test for linearity.

UNIT - III BIG DATA PROCESSING — 08 Hours

Big Data technologies, Introduction to Google file system, Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands, Anatomy of File Write and Read, NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce paradigm, Map Reduce tasks, Job, Task trackers - Cluster Setup – SSH & Hadoop Configuration, **Introduction to:** NOSQL, Textual ETL processing.

UNIT – IV BIG DATA ANALYTICS — 08 Hours

Data analytics life cycle, Data cleaning , Data transformation, Comparing reporting and analysis, Types of analysis, Analytical approaches, Data analytics using R, Exploring basic features of R, Exploring R GUI, Reading data sets, Manipulating and processing data in R, Functions and packages in R, Performing graphical analysis in R, Integrating R and Hadoop, Hive, Data analytics.

UNIT – V Big Data Visualization 08 Hours

Introduction to Data visualization, Challenges to Big data visualization, Conventional data visualization tools, Techniques for visual data representations, Types of data visualization, Visualizing Big Data, Tools used in data visualization, Propriety Data Visualization tools, Open –source data visualization tools, Analytical techniques used in Big data visualization, Data visualization with Tableau, **Introduction to:** Pentaho, Flare, Jasper Reports, Dygraphs, Datameer Analytics Solution and Cloudera, Platfora, NodeBox, Gephi, Google Chart API, Flot, D3, and Visually.

UNIT – VI BIG DATA TECHNOLOGIES APPLICATION AND IMPACT 08 Hours

Social media analytics, Text mining, Mogile analytics , Roles and responsibilities of Big data person, Organizational impact, Data analytics life cycle, Data Scientist roles and responsibility, Understanding decision theory, creating big data strategy, big data value creation drivers, Michael Porter's valuation creation models, Big data user experience ramifications, Identifying big data use cases.

Text Books

1. Krish Krishnan, Data warehousing in the age of Big Data, Elsevier, ISBN: 9780124058910, 1st Edition.
2. DT Editorial Services, Big Data, Black Book, DT Editorial Services, ISBN: 9789351197577, 2016 Edition.

Reference Books

1. Mitzenmacher and Upfal, Probability and Computing: Randomized Algorithms and Probabilistic Analysis, Cambridge University press, ISBN :521835402 hardback.
2. Dana Ron, Algorithmic and Analysis Techniques in Property Testing, School of EE.
3. Graham Cormode, Minos Garofalakis, Peter J. Haas and Chris Jermaine, Synopses for Massive Data: Samples, Histograms, Wavelets, Sketches, Foundation and trends in databases, ISBN :10.1561/1900000004.
4. A.Ohri, R for Business Analytics, Springer, ISBN:978-1-4614-4343-8.
5. Alex Holmes, Hadoop in practice, Dreamtech press, ISBN:9781617292224.
6. AmbigaDhiraj, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business, Wiely CIO Series.
7. Arvind Sathi, Big Data Analytics: Disruptive Technologies for Changing the Game, IBM Corporation, ISBN:978-1-58347-380-1.
8. EMC Education Services, Data Science and Big Data Analytics- Discovering, analyzing Visualizing and Presenting Data.
9. Li Chen, Zhixun Su, Bo Jiang, Mathematical Problems in Data Science, Springer, ISBN :978-3-319-25127-1.
10. Philip Kromer and Russell Jurney, Big Data for chips, O'Reilly, ISBN :9789352132447.
11. EMC Education services, Data Science and Big Data Analytics, EMC2 Wiley, ISBN :978812655653-3.
12. Mueller Massaron, Python for Data science, Wiley, ISBN :9788126557394.
13. EMC Education Services, Data Science and Big Data Analytics, Wiley India, ISBN: 9788126556533
14. Benoy Antony, Konstantin Boudnik, Cheryl Adams,,Professional Hadoop, Wiley India, ISBN :9788126563029
15. Mark Gardener, Beginning R: The Statistical Programming Language ,Wiley India, ISBN :9788126541201
16. Mark Gardener, The Essential R Reference ,Wiley India, ISBN : 9788126546015
17. Judith Hurwitz, Alan Nugent, Big Data For Dummies, Wiley India, ISBN : 9788126543281

314455 : SOFTWARE LABORATORY – IV

Teaching Scheme:
Practical : 2 Hours/Week

Credits
01

Examination Scheme:
Term Work : 25 Marks
Oral : 25 Marks

Prerequisites:
1. Fundamentals of computer Networks.

Course Objectives :
1. To design and implement small size network and to understand various networking commands
2. To provide the knowledge of various networking tools and their related concepts
3. To understand various application layer protocols for its implementation in client/server environment
4. To understand network layer protocols and its implementations.
5. To explore and understand various simulations tools for network applications.
6. To understand the fundamentals of wireless networks and standards.

Course Outcomes :
1. To implement small size network and its use of various networking commands.
2. To understand and use various networking and simulations tools.
3. To configure various client/server environments to use application layer protocols
4. To understand the protocol design at various layers.
5. To explore use of protocols in various wired and wireless applications.
6. To develop applications on emerging trends.

Guidelines for Instructor's Manual
1. The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant

Guidelines for Student's Lab Journal
1. Student should submit term work in the form of handwritten journal based on specified list of assignments.
2. Practical Examination will be based on the term work.
3. Candidate is expected to know the theory involved in the experiment.
4. The practical examination should be conducted if and only if the journal of the candidate is complete in all respects.

Guidelines for Lab /TW Assessment
1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.
2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.
3. Appropriate knowledge of usage of software and hardware related to respective laboratory should be checked by the concerned faculty member.

As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers of the program in journal may be avoided. There must be hand-written write-ups for every assignment in the journal. The DVD/CD containing students programs should be attached to the journal by every student and same to be maintained by department/lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

Suggested List of Laboratory Assignments

1. Explore and Study of TCP/IP utilities and Network Commands on Linux.

a)	Ping	g)	Tracert/Traceroute/Tracepath
b)	ipconfig / ifconfig	h)	NSlookup
c)	Hostname	i)	Arp
d)	Whois	j)	Finger
e)	Netstat	k)	Port Scan / nmap
f)	Route		

2.Using a Network Simulator (e.g. packet tracer) Configure

Sub-netting of a given network
Super-netting of a given networks.

3. Using a Network Simulator (e.g. packet tracer) Configure

A router using router commands,
Access Control lists – Standard & Extended.

4. Using a Network Simulator (e.g. packet tracer) Configure

EIGRP – Explore Neighbor-ship Requirements and Conditions, its K Values Metrics Assignment and Calculation,
RIPv2 and EIGRP on same network.
WLAN with static IP addressing and DHCP with MAC security and filters

5. Using a Network Simulator (e.g. packet tracer) Configure

VLAN, Dynamic trunk protocol and spanning tree protocol
OSPF – Explore Neighbor-ship Condition and Requirement, Neighbor-ship states, OSPF Metric Cost Calculation.
Network Address Translation : Static, Dynamic & PAT (Port Address Translation)

6. Socket Programming in C/C++ on Linux.

TCP Client , TCP Server
UDP Client , UDP Server

7. Introduction to server administration (server administration commands and their applications) and configuration any three of below Server : (Study/Demonstration Only)

FTP, Web Server, DHCP, Telnet, Mail, DNS

8. Using any open source Network Simulator, Implement

MANET / Wireless Sensor Network

9. Write a program using Arduino / Rasberry Pi Kit for Demonstration of IOT Application on any one of the following Topics.

Appliance Remote Control
Time Lapse Camera Controller
Security / Automation Sensors
The Traffic Light Controller
Temperature Controller

References

1. Andrew S. Tanenbaum, David J. Wethrall, Computer Network, Pearson Education, ISBN : 978-0-13-212695-3.
2. Kurose Ross, Computer Networking: A Top Down Approach Featuring the Internet, Pearson Education, ISBN :978-81-7758-878-1.

3. Charles E. Perkins, Adhoc Networking, Pearson Education, 978-81-317-2096-7.
4. Andrea Goldsmith, Wireless Communication, Cambridge University Press, ISBN:978-0-521-83716-3.
5. Mayank Dave, Computer Network, Cengage Learning, ISBN :978-81-315-0986-9.
6. C. K. Toh, Ad Hoc Mobile Wireless Networks Protocols and Systems, Prentice Hall, ISBN:978-01-324-42046.
7. Paul Goransson, Chuck Black, Software Defined Networks: A Comprehensive Approach, Morgan Kaufmann, ISBN:978-0124166752.

314456 : SOFTWARE LABORATORY - V

Teaching Scheme:
Practical : 4 Hours/Week

Credits
02

Examination Scheme:
Term Work : 50 Marks
Practical : 50 Marks

Prerequisites:

1. Discrete Structure.
2. C/ C++ Programming.
3. Fundamentals of Data Structure and Files.

Course Objectives :

1. To learn the concepts of assembler to design and implement two pass assembler.
2. To study use of macros and its expansion process.
3. To understand lexical analyzer and parser and its applications in compiler design.
4. To learn the various algorithmic design paradigms.
5. To apply appropriate algorithmic strategy in problem solving.
6. To find the space and running time requirements of the algorithms.

Course Outcomes :

1. To design and implement two pass assembler for hypothetical machine instructions.
2. To design and implement different phases of compiler (Lexical Analyzer, Parser, Intermediate code generation)
3. To use the compile generation tools such as “Lex" and "YACC”.
4. To apply algorithmic strategies for solving various problems.
5. To compare various algorithmic strategies.
6. To analyze the solution using recurrence relation.

Guidelines for Instructor's Manual

1. The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.

Guidelines for Student's Lab Journal

1. Student should submit term work in the form of handwritten journal based on specified list of assignments.
2. Practical Examination will be based on the term work.
3. Candidate is expected to know the theory involved in the experiment.
4. The practical examination should be conducted if and only if the journal of the candidate is complete in all respects.

Guidelines for Lab /TW Assessment

1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.
2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.
3. Appropriate knowledge of usage of software and hardware related to respective laboratory should be

checked by the concerned faculty member

As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers of the program in journal may be avoided. There must be hand-written write-ups for every assignment in the journal. The DVD/CD containing students programs should be attached to the journal by every student and same to be maintained by department/lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

Suggested List of Laboratory Assignments

Group A: System Programming

1. Write a program to implement Pass-I of Two-pass assembler for Symbols and Literal processing (For hypothetical instruction set from Dhamdhere) considering following cases
   i. Forward references
   ii. DS and DC statement
   iii. START, EQU, LTORG, END.
   iv. Error handling: symbol used but not defined, invalid instruction/register etc.
2. Write a program to implement Pass-II of Two-pass assembler for output of Assignment 1 (The subject teacher should provide input file for this assignment)
3. Study Assignment for Macro Processor. (Consider all aspects of Macro Processor)
4. Write a program to implement Lexical Analyzer for subset of C.
5. Write a program to implement a Recursive Descent Parser .
6. Write a program to implement calculator using LEX and YACC.
7. Write a program for Intermediate code generation using LEX &YACC for Control Flow statement (Either While loop or Switch case)

Group B: Design & Analysis of Algorithms

1. Write a program to find Maximum and Minimum element in an array using Divide and Conquer strategy and verify the time complexity.
2. Write a program to solve optimal storage on tapes problem using Greedy approach.
3. Write a program to implement Bellman-Ford Algorithm using Dynamic Programming and verify the time complexity.
4. Write a program to solve the travelling salesman problem and to print the path and the cost using Dynamic Programming.
5. Write a recursive program to find the solution of placing n queens on chessboard so that no two queens attack each other using Backtracking.
6. Write a program to solve the travelling salesman problem and to print the path and the cost using Branch and Bound.

Note: All the assignments should be conducted on Latest version of Open Source/Proprietary Operating Systems, tools and Multi-core CPU supporting Virtualization and Multi-Threading.

References :

1. D. M. Dhamdhere, Systems Programming and Operating Systems, Tata McGraw-Hill, ISBN 13: 978-0-07-463579-7, Second Revised Edition.
2. Horowitz and Sahani, Fundamentals of computer Algorithms, Galgotia.,ISBN : 81-7371-612-9.

314457 : SOFTWARE LABORATORY - VI

Teaching Scheme:	Credits	Examination Scheme:
Lectures: 2 Hours/Week	01	Term Work : 25 Marks
		Practical : 25 Marks

Prerequisites:

1. Engineering and discrete mathematics.
2. Database Management Systems, Data warehousing, Data mining.
3. Programming skill.

Course Objectives :

1. To understand Big data primitives and fundamentals.
2. To understand the different Big data processing techniques.
3. To understand and apply the Analytical concept of Big data using R/Python.
4. To understand different data visualization techniques for Big Data.
5. To understand the application and impact of Big Data
6. To understand emerging trends in Big data analytics

Course Outcomes :

1. To apply Big data primitives and fundamentals for application development.
2. To explore different Big data processing techniques with use cases.
3. To apply the Analytical concept of Big data using R/Python.
4. To visualize the Big Data using Tableau.
5. To design algorithms and techniques for Big data analytics.
6. To design Big data analytic application for emerging trends.

Guidelines for Instructor's Manual

1. The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.

Guidelines for Student's Lab Journal

1. Student should submit term work in the form of handwritten journal based on specified list of assignments.
2. Practical Examination will be based on the term work.
3. Candidate is expected to know the theory involved in the experiment
4. The practical examination should be conducted if and only if the journal of the candidate is complete in all respects.

Guidelines for Lab /TW Assessment

1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.
2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.
3. Appropriate knowledge of usage of software and hardware related to respective laboratory should be checked by the concerned faculty member

As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers of the program in journal may be avoided. There must be hand-written write-ups for every assignment in the journal. The DVD/CD containing students programs should be attached to the journal by every student and same to be maintained by department/lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

Suggested List of Laboratory Assignments

Part A : Assignments based on the Hadoop

1. Hadoop Installation on a)Single Node b)Multiple Node

2. Design a distributed application using MapReduce which processes a log file of a system. List out the users who have logged for maximum period on the system. Use simple log file from the Internet and process it using a pseudo distribution mode on Hadoop platform.

3. Design and develop a distributed application to find the coolest/hottest year from the available weather data. Use weather data from the Internet and process it using MapReduce.

4. Write an application using HBase and HiveQL for flight information system which will include

   1) Creating, Dropping, and altering Database tables
   2) Creating an external Hive table to connect to the HBase for Customer Information Table
   3) Load table with data, insert new values and field in the table, Join tables with Hive
   4) Create index on Flight information Table 5) Find the average departure delay per day in 2008.

Part B : Assignments based on R and Python

1. Perform the following operations using R/Python on the Amazon book review and facebook metrics data sets
   5) Create data subsets
   6) Merge Data
   7) Sort Data
   8) Transposing Data
   9) Melting Data to long format
   10) Casting data to wide format

2. Perform the following operations using R/Python on the Air quality and Heart Diseases data sets
   1) Data cleaning
   2) Data integration
   3) Data transformation
   4) Error correcting
   5) Data model building

3. Integrate R/Python and Hadoop and perform the following operations on forest fire dataset
   1) Text mining in RHadoop
   2) Data analysis using the Map Reduce in Rhadoop
   3) Data mining in Hive

4. Visualize the data using R/Python by plotting the graphs for assignment no. 2 and 3

5. Perform the following data visualization operations using Tableau on Adult and Iris datasets
   1) 1D (Linear) Data visualization
   2) 2D (Planar) Data Visualization
   3) 3D (Volumetric) Data Visualization
   4) Temporal Data Visualization
   5) Multidimensional Data Visualization
   6) Tree/ Hierarchical Data visualization
   7) Network Data visualization

Part C : Case Study Assignment

1) Social Media Analytics
2) Text Mining/ Text Analytics
3) Mobile Analytics

References :

1. Big Data, Black Book, DT Editorial services, 2015 edition.
2. A.Ohri, “R for Business Analytics”, Springer, 2012.
3. Robert I.Kbacoff , R in Action, Dreamtech press, Second edition
4. Alex Holmes, Hadoop in practice, Dreamtech press.
5. Online References for data set 1) http://archive.ics.uci.edu/ml/

314458 : PROJECT BASED SEMINAR

Teaching Scheme:
Tutorial : 1 Hour/Week

Credits
01

Examination Scheme:
Oral: 50 Marks

Introduction:

Graduates of final year IT program are supposed to design and implement projects through knowledge and skills acquired in previous semesters. Students should identify complex engineering problems and find effective, efficient and innovative ways of solving them through their projects.
In a technical seminar, students should aim to review literature in a focused way for identifying a complex problem to be attempted in their final year project. Seminar should make the student attain skills like (a) gathering of literature in specific area in a focused manner (b) effectively summarizing the literature to find state-of-the-art in proposed area (c) identifying scope for future work (d) presenting (arguing) the case for the intended work to be done as project (e) reporting literature review and proposed work in scientific way using good English.

Prerequisites:

1. Basic Communication, reading and writing skills.

Course Objectives :

1. To perform focused study of technical and research literature relevant to a specific topic.
2. To study, interpret and summarize literature scientifically.
3. To build independent thinking on complex problems.
4. To build collaborative work practices.
5. To communicate scientific information to a larger audience in oral and written form.
6. To use presentation standards and guidelines effectively.

Course Outcomes :

1. To Gather, organize, summarize and interpret technical literature with the purpose of formulating a project proposal.
2. To write a technical report summarizing state-of-the-art on an identified topic.
3. Present the study using graphics and multimedia presentations.
4. Define intended future work based on the technical review.
5. To explore and enhance the use of various presentation tools and techniques.
6. To understand scientific approach for literature survey and paper writing.

Guidelines for Project Based Seminars

1. A project group consisting of 3 to 4 students shall identify problem(s) in Computer Engineering / Information Technology referring to recent trends and developments in consultation with institute guide.
2. The group must review sufficient literature (reference books, journal articles, conference papers, white papers, magazines, web resources etc.) in relevant area on their project topic as decided by the guide.
3. Internal guide shall define a project statement based on the study by student group.
4. Students should identify individual seminar topic based on the project undertaken in consultation with guide.
5. Seminar topics should be based on project undertaken. Guide should thoughtfully allocate seminar topics on different techniques to solve the given problem (project statement), comparative analysis of the earlier algorithms used or specific tools used by various researchers.
6. Research articles could be referred from IEEE, ACM, Science direct, Springer, Elsevier, IETE,CSI or

from freely available digital libraries like Digital Library of India (dli.ernet.in), National Science Digital Library, JRD Tata Memorial Library, citeseerx.ist.psu.edu, getcited.org, arizona.openrepository.com, Open J-Gate, Research Gate, worldwidescience.org etc.

7. The group shall present the study as individual seminars in 20 – 25 minutes.

Guidelines for Seminar Report

1. Each student shall submit two copies of the seminar report in a prescribed format duly signed by the guide and Head of the department/Principal.
2. First chapter of a project group may talk about the project topic. At the end of the first chapter individual students should begin with introduction of seminar topic and its objectives.
3. Broad contents of review report (20-25 pages) shall be
   i. Introduction of Project Topic
   ii. Motivation, purpose and scope of project and seminar
   iii. Related work (of the seminar title) with citations
   iv. Discussion (your own reflections and analysis)
   v. Conclusions
   vi. Project definition. (Short version of RUP's vision document if possible).
   vii. References in IEEE Format
4. Students are expected to use open source tools for writing seminar report, citing the references and plagiarism detection. (Latex, Lex for report writing ; Mendeley, Zatero for collecting, organizing and citing the resources; DupliChecker , PaperRater, PlagiarismChecker and Viper for plagiarism detection)

Guidelines for Seminar Evaluation

1. A panel of examiners appointed by University will assess the seminar externally during the presentation.
2. Attendance for all seminars for all students is compulsory.
3. Criteria for evaluation
   i. Relevance of topic - 05 Marks
   ii. Relevance + depth of literature reviewed- 10 Marks
   iii. Seminar report (Technical Content) - 10 Marks
   iv. Seminar report (Language) - 05 Marks
   v. Presentation Slides - 05 Marks
   vi. Communication Skills - 05 Marks
   vii. Question and Answers - 10 Marks

Guidelines for Seminar Presentation

1) A panel of examiner will evaluate the viability of project scope and seminar delivery.
2) Oral examination in the form of presentation will be based on the project and seminar work completed by the candidates.
3) Seminar report must be presented during the oral examination.

References

1. Sharon J. Gerson, Steven M. Gerson, Technical Writing: Process and Product, Pearson Education Asia, ISBN :130981745, 4th Edition.
2. Andrea J. Rutherfoord, Basic Communication Skills for Technology, Pearson Education Asia, 2nd Edition.
3. Lesikar, Lesikar's Basic Business Communication, Tata McGraw, ISBN :256083274, 1st Edition.

314459 : Audit Course 4

In addition to credits course, it is recommended that there should be audit course (non-credit course) preferably in third year. Audit course is for the purposes of self-enrichment and academic exploration.Audit courses carry no academic credit. Though not mandatory, such a selection of the audit courses helps the learner to explore the subject of interest in greater details resulting in achieving the very objective of audit course's inclusion. Evaluation of audit course will be done at institute level. Method of conduction and method of assessment for audit courses is suggested.

Criteria:

The student registered for audit course shall be awarded the grade PP and shall be included such grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory in-semester performance and secured a passing grade in that audit course. No grade points are associated with this 'PP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA.

Guidelines for Conduction and Assessment(Any one or more of following but not limited to)

Lectures/ Guest Lectures
Visits (Social/Field) and reports
Demonstrations
Surveys
Mini Project
Hands on experience on Specific focused topic

Guidelines for Assessment (Any one or more of following but not limited to)

Written Test
Demonstrations/ Practical Test
Presentations
IPR/Publication
Report

Audit Course 4 Options

Course Code	Audit Course Title
AC 4- I	Intellectual Property Rights and Patenting
AC 4-II	Social Awareness and Governance Program
AC 4-III	Sustainable Energy System
AC 4-IV	Health & Fitness Management

Audit Course 4 - I : Intellectual Property Rights and Patenting

Prerequisites:

Concepts of Software Engineering

Course Objectives:

1. To gain the knowledge of the different types of Intellectual Property Rights (IPR).
2. To understand Trademark, Industrial Designs, Copyright and Trade Secret.
3. To learn about Patenting Systems in the World – USPTO, EPO.
4. To get Knowledge of Indian Patenting System – IPO.
5. To learn and understand different types of Contracts and Licensing and Open Source Software.

Course Outcomes:

1. To understand Intellectual Property Rights (IPR).
2. To explore applications of Trademark, Industrial Designs, Copyright and Trade Secret.
3. To understand function of USPTO, EPO.
4. To know the process of filing patent with IPO.
5. To understand the process of copyright and licensing.

UNIT I

An overview of the IPR Regime: Introduction, Intellectual Assets IA, The Intellectual Property System IPR, Types of IPR, Patents, Trademarks, Copyrights, Industrial Designs, Layout Designs of Integrated Circuits, Trade Secrets.

Patent: Definition of Patent, The Patent System, Requirement for getting a Patent, Inventions excluded from Patenting, Process and Product Patent, Acquiring a Patent, Method of Getting a Patent, Parts of an Patent Application, Patent Specification and Claims, Grant of Patents, Working of Patent and system, Voluntary Licensing and Compulsory Licensing, Licenses of Right.

UNIT II

Copyright: Copyright in Context, The terms of Copyright, Owning a Copyright, Rights granted by Copyright. Trademark: Trademarks Defined, The economic functions of Trademarks, Modern Trademarks Law. Trade Secrets: Trade Secrets defined The life and death of a Trade Secret, Trade Secret and Software Development, Trade Secrets and Business and Consultants.

UNIT III

Contracts and Licenses: Licenses and Firewalls, Why Contracts and Licenses matters, Contract Law Principles, Intellectual Property Contracts, Applying to License to Intellectual Property, Understanding Open Source, Credit unions and Open Source: An Analogy, The role of Open Source Licenses, The Open Source Definition, Different types of Open Source Licenses, Proprietary Commercial Licensing, Open Source Licensing, Choosing an Open Source License.

UNIT IV

Indian Patent Regime: IPO and Patent: Indian Patents Act 1970, Patents Amendment Act, Patent Offices in India, Procedures for Applying Patent Applications, Provisional Patent Application, Non-Provisional Patent Application, Patentability, Exclusions from Patentability, Acquisition of Patents, Preparation of Patent Application Specification, Patent Office Procedures

References:

1. Intellectual Property and Open Source – A Practical Guide to Protecting Code by Van Lindberg, O'REILLY Publication (www.oreilly.com) ISBN 13: 978-81-8404-563-5.
2. Open Source and Free Software Licensing by Andrew M. ST. Laurent, O'REILLY Publication

(www.oreilly.com) ISBN: 978-93-5213-280-5.

3. Intellectual Property Rights: Unleashing the Knowledge Economy by Prabuddha Ganguli, Tata McGraw-Hill Publishing Company, 2001, ISBN: 0074638602, 9780074638606.
4. IPO Manual of patent office practice and procedure - Intellectual Property Rights http://www.ipindia.nic.in/writereaddata/Portal/IPOGuidelinesManuals/1_28_1_manual-of-patent-office-practice_and-procedure.pdf.

Audit Course 4 - II : Social Awareness and Governance Program

Prerequisites:

Awareness about basic terms in Social Science and Governance

Course Objectives:

1. To Increase community awareness about social issues and to promote the practice of good governance in both private and public institutions, through policy advocacy and awareness creation in order to ensure proper utilization of public resources and good service delivery.
2. Increase community awareness on health, education, and human rights.
3. Transferring costs of social activities to other various segments of society.
4. To enhance youth participation in decision-making, democracy and economic development.

Course Outcomes:

1. Understand social issues and responsibilities as member of society.
2. Apply social values and ethics in decision making at social or organizational level
3. Promote obstacles in national integration and role of youth for National Integration
4. Demonstrate basic features of Indian Constitution.

UNIT I

Indian Society as Pluralistic, Fundamentals of unity in diversity, diversity and disparity in Indian society, women in mass media, disparities due to disability.

UNIT II

The Indian constitution as unifying factor, Introduction Making of Indian Constitution, Basic features of Indian Constitution, Strengths of Indian Constitution, and Fundamental Duties.

UNIT III

National Integration: Introduction, The Value of Tolerance, Minority Classes And Constitution, Pre-Requisites of National Integration, Obstacles To National Integration, Promotion of National Integration, Role of Youth In Promoting Communal Harmony.

UNIT IV

Socialization, Ethics, Values and Prejudices, Meaning of Socialization, Functions of Socialization, Agents of Socialization, Importance of Socialization, Role of Ethics In Individual Development, Role of Basic Human Values In Individual Development, Relative Value System.

Activities:

1. Conducting training/workshops/debates on HIV/AIDS prevention and stigma reduction.
2. Public shows on girls' education and empowerment.
3. Conducting campaigns on adult/disabled education.
4. To support the government to develop policy that encourages youth participation in decision-making through government agencies.

References:

1. Social Awareness and Personality Development by Devidas M. Muley , S Chand, ISBN: 812193074X.
2. Introduction to the Constitution of India, Bhagabati Prosad Banerjee, Durga Das Basu, Shakeel Ahmad Khan, V. R. Manohar, ISBN : 9788180385599.

Audit Course 4 – III : Sustainable Energy System

Prerequisites:

1. Awareness about energy consumption and energy utilization.
2. Awareness about effects of global warming.

Course Objectives:

1. To understand the impact of engineering solutions on a global, economic, environmental, and societal context.
2. To design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

Course Outcomes:

1. To demonstrate an overview of the main sources of renewable energy.
2. To understand benefits of renewable and sustainable energy systems.

UNIT I

Introduction and Energy Fundamentals, Sustainable Energy Systems: Issues for the 21st century, What are the critical challenges for a sustainable energy future? Sustainable energy systems: definitions, indicators, Physics of Energy: Laws of Thermodynamics Energy Forms and Conversion, First and Second Laws and Efficiencies Devices: Heat Engines, Refrigerators and Heat Pumps Instantaneous and Average Power.

UNIT II

Introduction to Renewable Energy, Wind Energy Wind Turbine Technologies Wind Resources and Modeling Energy Performance and Environmental Impacts Economics and Economic Development Impacts, Photovoltaic: PV and BIPV Technologies Solar Resources and Modeling Energy Performance and Environmental Impacts, Economics and Net Metering

UNIT III

Biomass: Electricity Biomass Technologies Introduction Biomass Productivity and Modeling Biopower: MSW, willows/switch grass/ poplar, wood waste, Biomass: Transport Fuels Biofuels , Bioethanol, Biodiesel, Algal, Jatropha Biofuels and Water Land Use Impacts, Food vs Fuel, Renewable Fuels Standards

UNIT IV

Building Energy Technologies and Policy, Smart buildings, Lighting and LEDs, Heating/cooling, technologies.

References :

1. Sustainable Energy Systems and Applications Textbook by İbrahim Dinçer, Calin Zamfirescu.
2. Fundamentals of Renewable Energy Systems, Book by D. Mukherjee.
3. “An introduction to global warming” John R. Barker and Marc H. Ross Am. J. Phys. 67(2): 1216-1226.

Audit Course 4 – IV : Health & Fitness Management

Prerequisites:

Awareness about healthy living.

Course Objectives:

1. To provide students a general concept of Health education and fitness.
2. To provide knowledge and understanding regarding health and nutrition.
3. To familiarize the students regarding safety education and health primitive measures for day to day life.
4. To promote and understanding of the value of physical and mental fitness for life skill development.

Course Outcomes:

1. Identify the health- and skill-related fitness components.
2. Understand the benefits of physical fitness, and the underlying principles, physiology, and practices for fitness development.
3. Apply of fitness management skills and strategies for the development of physical activity habits and personal fitness by the students.
4. Aware about healthy diet for physical and mental fitness of an individual.
5. Understand importance of mental fitness along with physical fitness by practicing yoga, meditation and relaxation techniques.

UNIT I

Importance of Health and Fitness, Physical fitness and mental fitness, Health and fitness issues in India, Government policies for Healthy Society, World Health Organization (WHO), and practicing good Habits for Healthy living.

UNIT II

Nutrition and Health : Concept of Food and Nutrition, Nutrients and Nutrient types, ,Balanced Diet, Vitamins – Malnutrition–Deficiency Diseases, Determining Caloric Intake and Expenditure, Obesity, Causes and Preventing Measures – Role of Diet.

UNIT III

Physical Exercise : Physical Activity and Health Benefits, Effect of Exercise on Body systems, Circulatory, Respiratory, Endocrine, Skeletal and Muscular, Role of Physical Education Programme on Community Health Promotion (Individual, Family and Society).

UNIT IV

Mental Health and Relaxation Techniques: Importance of mental health, Perspectives of mental health, Role of Emotional and Ethical Values in Mental Health, Preventing mental illness, Practicing Yoga and Meditation, Relaxation Techniques, Stress management Techniques.

References:

1. Fitness Management by Stephen J. Tharrett, James A. Peterson, Healthy Learning, ISBN: 9781606792155.
2. What to Eat by Marion Nestle, Macmillan Publication, ISBN 978-0865477384.
3. Light on Yog by B.K.S. Iyengar, Yehudi Menuhin, ISBN: 9780805210316.
4. Managing Your Mind: The Mental Fitness Guide by Gillian Butler, Tony Hope, ISBN: 9780195314533.

SAVITRIBAI PHULE PUNE UNIVERSITY

FACULTY OF ENGINEERING

SYLLABUS FOR
T. E. (MECHANICAL ENGINEERING)
(2015 Course)

WITH EFFECT FROM YEAR 2017-2018

Savitribai Phule Pune University
T.E. Mechanical Engineering 2015 – Course
T. E. (Mechanical) (2015 Course) Semester – I

Code	Subject	Teaching Scheme Hrs / week			Examination Scheme					Total Marks	Credits	
		Lecture	Tut	Pract	In-Sem	ESE	TW	PR	OR		Th	TW / PR / OR
302041	Design of Machine Elements-I	4	-	2	30@	70@	50	-		150	4	1
302042	Heat Transfer*	4	-	2	30	70		50	-	150	4	1
302043	Theory of Machines-II$	3	1		30	70	25	-	25	150	3	1
302044	Turbo Machines	3	-	2	30	70	-	-	25	125	3	1
302045	Metrology and Quality Control$	3	-	2	30	70	-	-	25	125	3	1
302046	Skill Development	-	-	2	-	-	25	25	-	50	-	1
Total		17	1	10	150	350	100	75	75	750	17	6
											23	

T. E. (Mechanical) (2015 Course) Semester – II

Code	Subject	Teaching Scheme Hrs / week			Examination Scheme					Total Marks	Credits	
		Lecture	Tut	Pract	In-Sem	ESE	TW	PR	OR		Th	TW / PR / OR
302047	Numerical Methods and Optimization*	4	-	2	30	70	-	50	-	150	4	1
302048	Design of Machine Elements-II	4	-	2	30@	70@	25	-	25	150	4	1
302049	Refrigeration and Air Conditioning	3	-	2	30	70	-	-	25	125	3	1
302050	Mechatronics%	3	1		30	70	-	-	25	125	3	1
302051	Manufacturing - Process-II$	3	-	-	30	70	-	-	-	100	3	-
302052	Machine Shop-II$	-	-	2	-	-	50	-	-	50	-	1
302053	Seminar$	-	-	2	-	-	25	-	25#	50	-	1
302054	Audit Course*	--	--	--	--	--	-	-	-	-	-	-
Total		17	1	10	150	350	100	50	100	750	17	6
											23	

 # Though it is under Oral head Internal Panel to be appointed by Principal and HOD. Examination schedule will not be prepared at University level.
*** Marked subjects are common with TE (Auto. Engg.) and TE Mech. Sandwich**
$ Marked subjects are common with TE (Auto. Engg.) only
% Marked subjects are common with TE Mech. Sandwich only
@ Examination time for Insem examination 1 Hr 30 Min. and Endsem examination 3Hrs.

Savitribai Phule Pune University, Pune
Third Year of Mechanical
(2015 Course)

Course Code: 302041 **Course Name : Design of Machine Elements – I**

Teaching Scheme:	Credits	Examination Scheme:		
TH: -- 4 Hrs/ Week	TH:--04	TH	In-Sem:	-- 30
			End-Sem:	-- 70
PR: - 2 Hrs/ Week	TW:--01		TW:	-- 50

Course Objective:

1. Student shall gain appreciation and understanding of the design function in Mechanical Engineering, different steps involved in designing and the relation of design activity with manufacturing activity.

2. The student shall learn to choose proper materials for different machine elements depending on their physical and mechanical properties. They will learn to apply the knowledge of material science in real life situations.

3. Student shall gain a thorough understanding of the different types of failure modes and criteria. They will be conversant with various failure theories and be able to judge which criterion is to be applied for a particular situation.

4. Student shall gain design knowledge of the different types of elements used in the machine design process, for e.g. fasteners, shafts, couplings etc. and will be able to design these elements for each application.

Course Outcome:

1. Ability to identify and understand failure modes for mechanical elements and design of machine elements based on strength.
2. Ability to design Shafts, Keys and Coupling for industrial applications.
3. Ability to design machine elements subjected to fluctuating loads.
4. Ability to design Power Screws for various applications.
5. Ability to design fasteners and welded joints subjected to different loading conditions.
6. Ability to design various Springs for strength and stiffness.

Course Contents

UNIT 1: Design of Simple Machine Elements **(10 hrs)**

Machine Design, Design cycle, Design considerations - Strength, Rigidity, Manufacture, Assembly and Cost, Standards and codes, Use of preferred series, Factor of safety, Service factor. Design of Cotter joint, Knuckle joint, Levers - hand / foot lever, lever for safety valve, bell crank lever, and components subjected to eccentric loading.

UNIT 2: Design of Shafts, Keys and Couplings **(08 hrs)**

Shaft design on the basis of strength, torsional rigidity and lateral rigidity, A.S.M.E. code for shaft design. Transmission shaft:- Theoretical treatment only. Design of keys and splines. Design of Flange Coupling and Flexible Bushed Pin Coupling.

UNIT 3: Design for Fluctuating Load **(08 hrs)**

Stress concentration - causes & remedies, fluctuating stresses, fatigue failures, S-N curve, endurance limit, notch sensitivity, endurance strength modifying factors, design for finite and infinite life, cumulative damage in fatigue failure, Soderberg, Gerber, Goodman, Modified Goodman diagrams, Fatigue design of components under combined stresses:- Theoretical treatment only.

UNIT 4: Power Screws **(06 hrs)**

Forms of threads, multiple start screws, Torque analysis and Design of power screws with square and trapezoidal threads, Self locking screw, Collar friction torque, Stresses in power screws, design of a C-Clamp. Design of screw jack, Differential and Compound Screw and Re-circulating Ball Screw (Theoretical treatment only).

UNIT 5: Threaded joints and Welded joints s **(10 hrs)**

Basic types of screw fasteners, Bolts of uniform strength, I.S.O. Metric screw threads, Bolts under tension, eccentrically loaded bolted joint in shear, Eccentric load perpendicular and parallel to axis of bolt, Eccentric load on circular base, design of Turn Buckle. Welding symbols, Stresses in butt and fillet welds, Strength of butt, parallel and transverse fillet welds, Axially loaded unsymmetrical welded joints, Eccentric load in plane of welds, Welded joints subjected to bending and torsional moments.

UNIT 6: Mechanical Springs **(06 hrs)**

Types, applications and materials for springs, Stress and deflection equations for helical compression Springs, Style of ends, Design of helical compression and tension springs, Springs in series and parallel, Concentric helical springs, Surge in springs, Design of Multi-leaf springs. Helical torsion Spring (Theoretical treatment only).

Books:

Text:

1) Bhandari V.B., Design of Machine Elements, Tata McGraw Hill Publication Co. Ltd.
2) Shigley J.E. and Mischke C.R., Mechanical Engineering Design, McGraw Hill Publication Co. Ltd.
3) Spotts M.F. and Shoup T.E., Design of Machine Elements, Prentice Hall International.
4) Juvinal R.C., Fundamentals of Machine Components Design, John Wiley and Sons

References:

1) Black P.H. and O. Eugene Adams, Machine Design, McGraw Hill Book Co. Inc.
2) Willium C. Orthwein, Machine Components Design, West Publishing Co. and Jaico Publications House.
3) Hall A.S., Holowenko A.R. and Laughlin H.G, Theory and Problems of Machine Design, Schaum's Outline Series.
4) C. S. Sharma and Kamlesh Purohit, Design of Machine Elements, PHI Learing Pvt. Ltd.
5) D. K. Aggarwal & P. C. Sharma, Machine Design, S.K Kataria and Sons
6) P. C. Gope, Machine Design: Fundamentals and Applications, PHI Learing Pvt. Ltd.
7) Design Data - P.S.G. College of Technology, Coimbatore.
8) Bhandari, V. B. Machine Design data book, Tata McGraw Hill Publication Co. Ltd.
9) K. Mahadevan, K. Balveera Reddy, Design Data Handbook for Mechanical Engineers, CBS Publishers.
10) Kanhhia, Design of Machine Elements-1, Scitech Publications

Term-Work

Term work shall consist of

1. **Two design projects on Assemblies covering above syllabus**.
   The design project shall consist of half imperial sheets (A2 size) involving assembly-drawing with a bill of material and overall dimensions and drawings of individual components. The Project should be assigned to a group of three to five students.

   Project 1 shall be based on any one of the following topics-
   i) Cotter joint/ knucle joint/turn buckle for a specified application.
   ii) Transmission Shaft/Machine tool spindles/coupling for specified application.
   iii) Hand or foot operated levers/lever for safety valve.
   Project 2 shall be based on any one of the following topics-
   i) Bench vice/Machine vice for specified applications.
   ii) Bottle type/toggle jack for vehicles.
   iii) Lead screw for machine tool/other applications.
   Manufacturing tolerances, surface finish symbols and geometric tolerances should be specified for important surfaces. A design report giving all necessary calculations of the design of components and assembly should be submitted in a separate file. Design data book shall be used wherever necessary for selection of standard components.

   Drawings of design project should be done manually.
2. **Assignments**
   The assignment shall be internally presented in the form of power point presentation, by a group of three to five students**.** A report of assignment (Max 8 to 10 pages) along with print out of ppt is to be submitted. Each student shall complete any two of the following assignments, with Assignment
   (a) compulsory.

   a. Use of dimensional tolerances, Geometrical tolerances and surface finish symbols in machine component drawings.

   A. Selection of materials using weighted point method.
   B. Selection of manufacturing methods for machine elements designed in any one of the above design projects.
   C. Theories of failures and their applications.

Savitribai Phule Pune University, Pune
Third Year of Mechanical, Mechanical Sandwich & Automobile
(2015 Course)

Course Code: 302042 **Course Name : HEAT TRANSFER**

Teaching Scheme:	Credits	Examination Scheme:
TH: - 4 Hrs/ Week	TH:--04	TH In-Sem: -- 30
		End-Sem: -- 70
PR: - 2 Hrs/ Week	PR:--01	PR: -- 50

Course Objectives:

1. Identify the important modes of heat transfer and their applications.
2. Formulate and apply the general three dimensional heat conduction equations.
3. Analyze the thermal systems with internal heat generation and lumped heat capacitance.
4. Understand the mechanism of convective heat transfer
5. Determine the radiative heat transfer between surfaces.
6. Describe the various two phase heat transfer phenomenon. Execute the effectiveness and rating of heat exchangers.

Course Outcomes:

CO 1: Analyze the various modes of heat transfer and implement the basic heat conduction equations for steady one dimensional thermal system.

CO 2: Implement the general heat conduction equation to thermal systems with and without internal heat generation and transient heat conduction.

CO 3: Analyze the heat transfer rate in natural and forced convection and evaluate through experimentation investigation.

CO 4: Interpret heat transfer by radiation between objects with simple geometries.

CO 5: Analyze the heat transfer equipment and investigate the performance.

Course Contents

UNIT 1: **(10 hrs)**

Introduction and Basic Concepts: Application areas of heat transfer, Modes and Laws of heat transfer, Three dimensional heat conduction equation in Cartesian coordinates and its simplified equations, thermal conductivity, Thermal diffusivity, Thermal contact Resistance

Boundary and initial conditions: Temperature boundary condition, heat flux boundary condition, convection boundary condition, radiation boundary condition.

One dimensional steady state heat conduction without heat generation: Heat conduction in plane wall, composite slab, composite cylinder, composite sphere, electrical analogy, concept of thermal resistance and conductance, three dimensional heat conduction equations in cylindrical and spherical coordinates (no derivation) and its reduction to one dimensional form, critical radius of insulation for cylinders and spheres, economic thickness of insulation.

UNIT 2: **(08 hrs)**

One dimensional steady state heat conduction with heat generation: Heat conduction with uniform heat generation in plane wall, cylinder & sphere with different boundary conditions.

Heat transfer through extended surface: Types of fins and its applications, Governing Equation for constant cross sectional area fins, solution for infinitely long & adequately long (with insulated end) fins, efficiency & effectiveness of fins.

UNIT 3: **(06 hrs)**

Thermal Insulation – Types and selection, Economic and cost considerations, Payback period

Transient heat conduction: Validity and criteria of lumped system analysis, Biot and Fourier number, Time constant and response of thermocouple, Transient heat analysis using charts.

UNIT4: **(08hrs)**

Convection

Fundamentals of convection: Mechanism of natural and forced convection, local and average heat transfer coefficient, concept of velocity & thermal boundary layers.

Forced convection: Dimensionless numbers and their physical significance, empirical correlations for external & internal flow for both laminar and turbulent flows.

Natural convection: Introduction, dimensionless numbers and their physical significance, empirical correlations for natural convection.

UNIT 5: Radiation **(08 hrs)**

Fundamental concepts, Spectral and total emissive power, real and grey surfaces, Stefan Boltzmann law, Radiation laws – Planks, Wiens, Kirchoff's and Lambart's cosine law with simple applications, Irradiation and radiosity, Electrical analogy in radiation, Radiation shape factor, radiation heat exchange between two black and diffuse gray surfaces, radiation shield.

UNIT 6: Heat Transfer Equipments **(08 hrs)**

Condensation and Boiling: Boiling heat transfer, types of boiling, pool boiling curve and forced boiling phenomenon, condensation heat transfer, film wise and drop wise condensation (simple numerical treatment).

Heat exchangers: Classification and applications, heat exchanger analysis – LMTD for parallel and counter flow heat exchanger, effectiveness– NTU method for parallel and counter flow heat exchanger, cross flow heat exchanger, LMTD correction factor, design criteria for heat exchanger, Introduction to TEMA standards.

Introduction to heat pipe, Introduction to electronic cooling - Discussion on active and passive methods.

Books:

Text:

1. F.P. Incropera, D.P. Dewitt, Fundamentals of Heat and Mass Transfer, John Wiley.
2. Y. A. Cengel and A.J. Ghajar, Heat and Mass Transfer – Fundamentals and Applications, Tata McGraw Hill Education Private Limited.
3. S.P. Sukhatme, A Textbook on Heat Transfer, Universities Press.
4. R.C. Sachdeva, Fundamentals of Engineering Heat and Mass Transfer, New Age Science.
5. P.K. Nag, Heat & Mass Transfer, McGraw Hill Education Private Limited.
6. M. M. Rathod, Engineering Heat and Mass Transfer, Third Edition, Laxmi Publications, New Delhi
7. V. M. Domkundwar, Heat Transfer,

References:

1. A.F. Mills, Basic Heat and Mass Transfer, Pearson.
2. S. P. Venkatesan, Heat Transfer, Ane Books Pvt. Ltd.
3. Holman, Fundamentals of Heat and Mass Transfer, McGraw – Hill publication.
4. M. Thirumaleshwar, Fundamentals of Heat and Mass Transfer, Pearson Education India.
5. B.K. Dutta, Heat Transfer-Principles and Applications, PHI.
6. C.P. Kothandaraman, S. V. Subramanyam, Heat and Mass Transfer Data Book, New Academic Science.
7. Databook, SPPU provided by the Exam Center

LIST OF EXPERIMENTS

Any eight experiments (1-11) and two assignments (12-14) from the following list

1. Determination of Thermal Conductivity of metal rod
2. Determination of Thermal Conductivity of insulating powder
3. Determination of Thermal Conductivity of Composite wall
4. Determination of Thermal Contact Resistance
5. Determination of heat transfer coefficient in Natural Convection
6. Determination of heat transfer coefficient in Forced Convection
7. Determination of temperature distribution, fin efficiency in Natural / Forced Convection
8. Determination of Emissivity of a Test surface
9. Determination of Stefan Boltzmann Constant
10. Determination of effectiveness of heat exchanger
11. Study of pool boiling phenomenon and determination of critical heat flux
12. Assignment on 1-D transient heat transfer program using finite difference methods.
13. Assignment to solve transient heat transfer problem using Heisler and Grober charts.
14. Assignment on multi-pass / cross-flow heat exchanger using effectiveness charts.

Savitribai Phule Pune University, Pune

TE Mechanical and TE Automobile (2015 course)

Course Code: 302043 **Course Name : Theory of Machine – II**

Teaching Scheme:	**Credits**	**Examination Scheme:**
TH: -- 03 Hrs/week	**TH:--03**	**TH In-Sem: -- 30** **End-Sem: --70**
Tut.:- 01 Hr /week	**TW/OR:--01**	
		OR: -- 25
		TW: -- 25

Course Objectives:

1. To develop competency in understanding of theory of all types of gears.
2. To understand the analysis of gear train.
3. To develop competency in drawing the cam profile.
4. To make the student conversant with synthesis of the mechanism.
5. To understand step-less regulations.
6. To understand mechanisms for system control – Gyroscope.

Course Outcomes:

1. Student will be able to understand fundamentals of gear theory which will be the prerequisite for gear design.
2. Student will be able to perform force analysis of Spur, Helical, Bevel, Worm and Worm gear.
3. The student to analyze speed and torque in epi-cyclic gear trains which will be the prerequisite for gear box design.
4. Student will be able to design cam profile for given follower motions and understand cam Jump phenomenon, advance cam curves.
5. The student will synthesize a four bar mechanism with analytical and graphical methods.
6. ***a.*** The student will analyze the gyroscopic couple or effect for stabilization of Ship Aeroplane and Four wheeler vehicle.
   b. Student will choose appropriate drive for given application (stepped / step-less).

Course Contents

Unit – I: Spur Gear **(08 hrs)**

Classification, Spur gear: definition, terminology, fundamental law of toothed gearing, involute and cycloidal profile, path of contact, arc of contact, conjugate action, contact ratio, interference and under cutting – Methods to avoid interference. Minimum number of teeth on gear and pinion only, Force analysis and Friction in gears.

Unit – II: Helical, Bevel, Worm and Worm Wheel **(06 hrs)**

Helical and Spiral Gears: terminology, geometrical relationships, tooth forces, torque transmitted and efficiency, virtual number of teeth for helical gears
Bevel Gear & Worm and worm wheel: terminology, geometrical relationships, tooth forces, torque transmitted.
Bevel Gear: Theoretical treatment only

Unit – III Gear Trains **(06 hrs)**

Types of Gear Trains, analysis of epicyclic gear trains, Holding torque – Simple, compound and epicyclic gear trains, torque on sun and planetary gear train, compound epicyclic gear train, Bevel epicyclic Gear train.

Unit –IV Cam and Follower **(08 hrs)**

Types of cams and followers, analysis of standard motions to the follower, Determination of cam profiles for different follower motions, Methods of control: pressure angle, radius of curvature and undercutting. Jump phenomenon of Eccentric cam, Introduction to advanced cam curves (up to 3-4-5 Polynomial cam only)

Unit –V Synthesis of Mechanism **(06 hrs)**

Steps in synthesis process: Type, number and dimensional synthesis. Tasks of Kinematic synthesis: Path, function and motion generation (Body guidance). Precision Positions, Chebychev spacing, Mechanical and structural errors. Three position synthesis of four bar mechanism using Freudenstein's equation. Analytical synthesis using kinematic coefficient in four bar mechanism.

Unit –VI Step–Less-Regulation (Theoretical Treatment only) & Gyroscope **(06 hrs)**

Continuous Variable Transmissions - Geometry, Velocity and torque analysis of Faceplate variators, conical variators, Spheroidal and cone variators, Variators with axially displaceable cones, PIV drives. Gyroscopes, Gyroscopic forces and Couples, Gyroscopic stabilisation for ship and Aeroplane, Stability of four wheel vehicle moving on curved path.

Books:

Text:

1. S. S. Rattan, Theory of Machines, Third Edition, McGraw Hill Education (India) Pvt. Ltd. New Delhi.
2. Bevan T, Theory of Machines, Third Edition, Longman Publication.
3. A. G. Ambekar, Mechanism and Machine Theory, PHI.
4. N. K. Mehta, Machine Tool Design and Numerical Control, Tata McGraw Hill Publication,
5. J. J. Uicker, G. R. Pennock, J. E. Shigley, Theory of Machines and Mechanisms, Third Edition, International Student Edition, OXFORD.

References:

1. Ghosh Malik, Theory of Mechanism and Machines, East-West Pvt. Ltd.
2. Hannah and Stephans, Mechanics of Machines, Edward Arnolde Publication.
3. R L Norton, Kinematics and Dynamics of Machinery, First Edition, McGraw Hill Education (India) P Ltd. New Delhi
4. Sadhu Singh, Theory of Machines, Pearson
5. D.K. Pal, S.K. Basu, Design of Machine Tools, Oxford & Ibh Publishing Co Pvt. Ltd.
6. Dr. V. P. Singh, Theory of Machine, Dhanpatrai and sons.
7. C. S. Sharma & Kamlesh Purohit, "Theory of Machine and Mechanism", PHI.

Tutorial (Term-work) shall consist of

Part A: Compulsory

1. To study manufacturing of gear using gear generation with rack as a cutter and to generate involute profile
2. Kinematic analysis of synchromesh, machine tool gear box, differential gear box (Self Study)
3. Speed and torque analysis of epicyclic gear train to determine holding torque
4. To draw the cam profile and study variation in pressure angle with respect to change in base circle diameter and draw pitch circle for both the cases.(Half imperial drawing sheet)
5. To synthesize the four bar and slider crank mechanism using relative pole and inversion method with three accuracy points. (Half imperial drawing sheet)
6. To determine the effect of active gyroscopic couple on a spinning disc and verify the gyroscopic effect.
7. Study of Continuous Variable Transmission and Infinite Variable Transmission.

Part B: Any two from the following

1. To draw conjugate profile for any general type of gear tooth. (Half imperial drawing sheet)
2. To verify the cam jump phenomenon for an eccentric cam.
3. Synthesis a four bar mechanism based on Freudenstein's equation using any programming Language.
4. To measure the range of speeds obtained using any one type of continuously variable transmission device.
5. Industrial visit to understand Machines and Mechanisms.

Savitribai Phule Pune University, Pune

T.E Mechanical (2015 course)

Course Code: 302044 **Course Name : Turbo Machines**

Teaching Scheme:	**Credits:**	**Examination Scheme:**
TH: -- 03 hrs/week	**TH:-- 03**	**TH In-Sem: -- 30**
PR: -- 02 hrs/week	**OR:-- 01**	**End-Sem: -- 70**
		OR: -- 25

Course Objectives:

1. To provide the knowledge of basic principles, governing equations and applications of turbo machine.
2. To provide the students with opportunities to apply basic thermo-fluid dynamics flow equations to Turbo machines.
3. To explain construction and working principle and evaluate the performance characteristics of Turbo Machines.

Course Outcomes:

On successful completion of the course, the student will be able to,

1. Apply thermodynamics and kinematics principles to turbo machines.
2. Analyze the performance of turbo machines.
3. Ability to select turbo machine for given application.
4. Predict performance of turbo machine using model analysis.

Course Contents

Unit – I: Introduction to Turbo Machinery (08hrs)

Turbo machines (Hydraulic & Thermal), Classification of Turbo machines, Comparison with positive displacement machines, Fundamental equation governing turbo machines, Different losses associated with turbo-machinery, Applications of Turbo machines.

Impact of Jet

Impulse momentum principle and its applications, Force exerted on fixed and moving flat plate, hinged plate, curved vanes, series of flat plates and radial vanes, velocity triangles and their analysis, work done equations, vane efficiency.

Unit –II: Impulse Water Turbines (06hrs)

Introduction to Hydro power plant, classification of hydraulic turbines construction, principle of working, velocity diagrams and analysis, design aspects, performance parameters, performance characteristics, specific speed, selection of turbines, multi-jet Pelton wheel.

Unit –III: Reaction Water Turbines (08 hrs)

Classifications, Francis, Propeller, Kaplan Turbines, construction features, velocity diagrams and analysis, degree of reaction, performance characteristics.

Draft tubes: types and analysis, causes and remedies for cavitation phenomenon

Governing of turbines, Similitude and dimensional analysis of hydraulic turbines

Unit –IV: Steam Turbines (08 hrs)

Steam nozzles: types and applications, Equation for velocity and mass flow rate [No numerical treatment].

Steam Turbines: Classifications, construction details, compounding of steam turbines, velocity diagrams and analysis of Impulse and reaction turbines (single & multi stage), governing, dimensional analysis, performance characteristics. Losses in steam turbines, selection of turbines.

Unit –V: Centrifugal Pumps **(08 hrs)**

Classification of rotodynamic pumps, components of centrifugal pump, types of heads, velocity triangles and their analysis, effect of outlet blade angle, cavitation, NPSH, Thoma's cavitation factor, priming of pumps, installation, specific speed, performance characteristics of centrifugal pump, series and parallel operation of pumps, system resistance curve, selection of pumps.

Dimensional and Model analysis of hydraulic machines

Unit –VI: Centrifugal & Axial Compressor **(07 hrs)**

Centrifugal compressor: Classification of compressors, Construction, velocity diagram, flow process on T-S Diagram, Euler's work, actual work input, performance characteristics, various losses in centrifugal compressor.

Axial Compressor: Construction, stage velocity triangles and its analysis, enthalpy entropy diagram, stage losses and efficiencies, performance characteristics. [No numerical treatment]

Books:

Text:

1. Turbines, Compressors & Fans, S.M. Yahya, Tata-McGraw Hill
2. Turbomachines, B. U. Pai, Wiley India
3. Fluid mechanics and hydraulic machines, Dr. R.K. Bansal
4. Hydraulic Machines, Dr. J. Lal, Metropolitan Book Co. Pvt. Ltd., Delhi.
5. Hydraulics, Fluid Mechanics and Machinery, Modi P N & Seth S N, Standard Book House ,New Delhi.
6. R. Yadav, Steam and Gas Turbines and Power Plant Engineering, VII edition, Central Publ. house

References:

1. William W. Perg, Fundamentals of Turbomachinery, John Wiley & Sons.
2. Thermal Turbomachines, Dr. Onkar Singh, Wiley India
3. V. P. Vasandani, Theory of Hydraulic Machinary, Khanna Publishers, Delhi.
4. Karassik, Hand Book of Pumps, Tata McGraw Hills Ltd., New Delhi.
5. S.L. Dixon, Fluid Mechanics, Thermodynamics of Turbomachinery, IV edition, Butterworth-Heinemann Publ., 1966.

Term-Work

List of Experiments

1. Verification of impulse momentum principle
2. Study and trial on impulse water turbine (Pelton wheel) and plotting of main and operating characteristics
3. Study and trial on any one hydraulic reaction turbine (Francis/Kaplan) and plotting of main and operating characteristics
4. Study and trial on centrifugal pump and plotting operating characteristics
5. Study and trial on centrifugal air compressor and plotting its characteristics
6. Visit to hydro/steam power plant and report to be submitted.
7. Study of different types of nozzles and trial on convergent-divergent air/steam nozzle.
8. Study of axial flow compressors/ centrifugal air blower.
9. Study of multi-staging of steam turbines.
10. Design of pumping system installation using manufacturers' catalogue, specific to housing or industrial application.
11. Visit to pumping station and report to be submitted.

Notes

1. Eight experiments from above list should be performed; out of which at least four trials should be conducted. Data from any one trial performed should be analyzed by using suitable software.
2. One Experiment out of Expt. no. 10 and 11 is compulsory.
3. Visit to Hydro or Steam power plant is compulsory.

Savitribai Phule Pune University, Pune

TE Mechanical and TE Automobile (2015 course)

Course Code: 302045 **Course Name : Metrology And Quality Control**

Teaching Scheme:	**Credits**	**Examination Scheme:**		
TH: 03 Hrs/week	**TH:--03**	**TH**	**In-Sem:**	**-- 30**
			End-Sem:	**-- 70**
PR: 02 Hrs/week	**OR:--01**			
			OR:	**-- 25**

Course Objectives:
Students are expected to –

1. Select suitable instrument / gauge / method of inspection for determining geometrical and dimensional measurements.
2. Calibrate measuring instruments and also design inspection gauges.
3. Understand the advances in Metrology such as use of CMM, Laser, Machine Vision System for Metrology etc.
4. Select and apply appropriate Quality Control Technique for given application.
5. Select and Apply appropriate Quality Management Tool and suggest appropriate Quality Management System (QMS).

Course Outcomes:
The student should be able to –

1. Understand the methods of measurement, selection of measuring instruments / standards of measurement, carryout data collection and its analysis.
2. Explain tolerance, limits of size, fits, geometric and position tolerances and gauge design
3. Understand and use/apply Quality Control Techniques/ Statistical Tools appropriately.
4. Develop an ability of problem solving and decision making by identifying and analyzing the cause for variation and recommend suitable corrective actions for quality improvement.

Course Contents

Unit – I Measurement standards and Design of gauges (06 hrs)

Introduction: Principles of Engineering metrology, Measurement standards, Types and sources of errors, Accuracy and Precision, Calibration: Concept and procedure, traceability,

Geometric Form Measurement: Straightness, Flatness, Roundness - Straight edge, use of level beam comparator, autocollimator testing of flatness of surface plate.

Design of Gauges: Tolerances, Limits and Fits [IS 919-1993], Taylor's principle, Types of gauges, Wear allowance on gauges, Types of gauges-plain plug gauge, ring gauge, snap gauge, limit gauge and gauge materials, Considerations of gauge design (numerical).

Unit –II Comparators, Thread and Gear Metrology, Surface Roughness Measurement (08 hrs)

Comparators: Mechanical, Pneumatic, Optical, Electrical (LVDT).

Measurement of Thread form: Thread form errors, Measurement of Minor, Major and Effective diameter (Three Wire Method), Flank angle and Pitch, Floating Carriage Micrometer (Numerical).

Gear Metrology: Errors in Spur Gear form, Gear tooth Vernier, Constant chord, Base tangent (Numerical), Gear Rolling Tester. Profile Projector, Tool maker's microscope and their applications

Surface Roughness Measurement: Introduction to Surface texture, Parameters for measuring surface roughness, Surface roughness measuring instrument: TalySurf.

Unit – III Advances in Metrology (06 hrs)

Coordinate Measuring Machine (CMM): Fundamental features of CMM – development of CMMs – role of CMMs – types of CMM and Applications, – types of probes
Machine Vision Systems: vision system measurement – Multisensory systems.
Interferometer: Principle, NPL Interferometer
Laser Metrology: Basic concepts of lasers, advantages of lasers, laser interferometers, types, applications

Unit – IV Introduction to Quality and Quality Tools (06 hrs)

Concept of Quality: Various Definitions and Quality Statements, Cost of quality & value of quality, Deming's cycles & 14 Points, Juran Trilogy approach, Old New Seven Tools, Quality Circles.

Importance of Quality deployment at Design and Manufacturing Engineering: Opportunities for improvement product design, Importance of– initial planning for quality, concept of controllability: self-controls – defining quality responsibilities on the factory flow – self inspection.

Unit –V Statistical quality control (08 hrs)

Statistical quality control: Statistical concept, Frequency diagram, Concept of variance analysis, Control Chart for Variable (**X & R** Chart) & Attribute (**P & C** Chart), Process capability(Indices: cp, cpk, ppk), Statistical Process Control (Numerical). Production Part Approval Method (PPAP).

Acceptance Sampling: Sampling Inspection, OC Curve and its characteristics, sampling methods, Sampling Plan: Single, Double (Numerical), Multiple, Comparison of Plan, calculation of sample size, AOQ, Probability of Acceptance (Numerical)

Unit –VI Total Quality Management (06 hrs)

TQM: Introduction, Quality Function Deployment, 5S, Kaizen, Poka yoke, Kanban, JIT, FMECA, Zero defects, TPM. Six Sigma: DMAIC - Concept and Applications.

Quality Management System
Need for quality management system – design of quality management system - quality management system requirements – ISO 9001, TS-16949, ISO-14000, Quality Audit.

Books:

Text:

1. Jain R.K., Engineering Metrology, Khanna Publication.

2. I. C. Gupta, Engineering Metrology, Dhanpath Rai.

3. Bewoor A. K. and Kulkarni V. A., Metrology and Measurements, Tata McGraw hill Publication.

4. Juran J. M., Quality Handbook, McGraw Hill Publications.

5. Grant S.P., Statistical Quality Control, Tata McGraw hill Publication.

References:

1. Narayana K.L., Engineering Metrology.

2. Galyer J.F & Shotbolt C.R., Metrology for engineers

3. Gupta I.C., Engineering Metrology, Dhanpatrai Publiartions

4. Judge A.W., Engineering Precision Measurements, Chapman and Hall

5. Francis T. Farago, Mark A. Curtis, Handbook of dimensional measurement.

6. ASTME, Handbook of Industrial Metrology, Prentice Hall of India Ltd.

7. Connie Dotson, Fundamentals of Dimensional Metrology, Thamson Publn., 4th Edition.

8. Basterfield D. H., Quality control, Pearson Education India, 2004.

9. Kulkarni V. A. and Bewoor A. K., Quality Control, John Wiley Publication.

10. Harrison M. Wordsworth, Stefeen Godfrey, Modern Methods for Quality control and Improvement, Willy Publication.

Online Education resources: viz. NPTEL web site:

(1) nptel.ac.in/courses/112106179;

(2) www.nptelvideos.in/2012/12/mechanical-measurements-and-metrology.html;

(3) www.me.iitb.ac.in/~ramesh/courses/ME338/metrology6.pdf; nptel.ac.in/courses/110101010/;

(4) freevideolectures.com › Mechanical › IIT Madras

(5) nptel.ac.in/courses/112107143/37;

Term-Work

LIST OF EXPERIMENTS

Part: A] Experiment no. 1, 4 and 6 are mandatory. Perform any three from experiment no. 2 to 5 & any three from experiment no. 7 to 10.

1. Demonstration of linear and angular measuring instruments, slip gauges and their applications.
2. Error determination of linear / angular measuring instruments and determination of linear and angular dimensions of given part, (MSA: Gauge R & R).
3. Calibration of measuring instrument. Example – Dial gauge, Micrometer, Vernier (any one) (Refer ISO 17025).
4. Verification of dimensions and geometry of given components using Mechanical /Pneumatic comparator. [An assignment with this experiment write-up as, Introduction to use of Standard CODE viz. ASME-Y14.5, ISO-1101].
5. Machine tool alignment testing on machine tool – Lathe / Drilling / Milling.
6. Demonstration of surfaces inspection using optical flat/interferometers. / Demonstration of surface roughness measurement using surface roughness tester.
7. Determination of geometry and dimensions of given composite object / single point tool, using profile projector and tool maker's microscope.
8. Measurement of thread parameters using floating carriage diameter measuring machine.
9. Measurement of spur gear parameters using Gear Tooth Vernier / Span Micrometer / Gear Rolling Tester.
10. Determination of given geometry using coordinate measuring machine (CMM).

Part: B] Statistical Quality Control (SQC) (Any Two)
Note - Use of computational tools [such as Minitab / Matlab / MS Excel] are recommended

1. Analyze the fault in given batch of specimens by using seven quality control tools for engineering application. Submission of these assignments USING STANDAED FORMATS.
2. Determination of process capability from given components and plot variable control chart/ attribute chart.
3. Case study on various tools in Total Quality Management (TQM).

Part: C] Industrial visit to:

Calibration lab /Quality control lab / CMM Lab / Gear Inspection Unit

OR

QA/QC Unit of Automotive Industry / Engineering Industry.

Savitribai Phule Pune University, Pune
Third Year of Mechanical
(2015 Course)

Course Code: 302046 **Course Name: Skill Development**

Teaching Scheme:	Credits	Examination Scheme:
PR: -- 2 Hrs/ Week	TW/PR:--01	TW:-- 25 PR:-- 25

COURSE OBJECTIVES

1. To develop the skill for required in shop floor working.
2. To have knowledge of the different tools and tackles used in machine assembly shop.
3. Use of theoretical knowledge in practice.
4. Practical aspect of the each component in the assembly of the machine.

Course Contents

List of Experiments

1. Tail stock assembly
2. Valve Assembly (PRV, Sluice valve, Steam stop valve)
3. IC engine of Two Wheeler (4 stroke single cylinder)
4. Hermetically sealed compressor
5. Hydraulic actuator
6. Industrial Gear box
7. Sheet drawing (Sheet will be given per group and a group consist of 04 students. The sheet will be drawn manually by every student)

Note: 1-6 experiments are for assembly and disassembly only

Term-Work

1. Sheet drawing of assembly, which should contain the display of Geometric tolerances, Limits, Fits, BOM, Dimensional measurements techniques. Special Operations.. Students should make process sheet of each assembly. (One topic per four students group will be given for sheet drawing and each student should draw the sheet manually)

Practical Examination

Practical examination will be based on opening and closing of any assembly. In addition to this some questioning will be asked to the student based on assembly drawing, GD&T Sequencing and tools and tackles. For this the assemblies and their drawings should be provided to students for examination

Note: Term work will carry 25 Marks and practical examination will carry 25 marks.

A. The assessment has to be carried out based on close monitoring of involvement and intellectual contribution of student.
B. The student should maintain the record of work in the form of diary and has to be submitted at the end of semester.
C. The batch teacher should assess the concerned student

SEM-II

Savitribai Phule Pune University, Pune

TE Mechanical, Mechanical Sandwich and Automobile (2015 course)

Course Code: 302047 **Course Name : Numerical Methods and Optimization**

Teaching Scheme:	Credits	Examination Scheme:
TH: -04 hrs/week	TH:--04	TH In-Sem: -- 30 End-Sem: --70
PR: 02 hrs /week	PR:--01	PR: -- 50

Course Objectives:
Students are expected to –
1 Recognize the difference between analytical and Numerical Methods.
2 Effectively use Numerical Techniques for solving complex Mechanical engineering Problems.
3 Prepare base for understanding engineering analysis software.
4 Develop logical sequencing for solution procedure and skills in soft computing.
5 Optimize the solution for different real life problems with available constraints.
6 Build the foundation for engineering research.

Course Outcomes:
The student should be able to –
1. Use appropriate Numerical Methods to solve complex mechanical engineering problems.
2. Formulate algorithms and programming.
3. Use Mathematical Solver.
4. Generate Solutions for real life problem using optimization techniques.
5. Analyze the research problem

Course Contents

Unit – I: Roots of Equation and Error Approximations (08 hrs.)

Roots of Equation
Bisection Method, Newton Raphson method and Successive approximation method.
Error Approximations
Types of Errors: Absolute, Relative, Algorithmic, Truncation, Round off Error, Error Propagation, Concept of convergence-relevance to numerical methods.

Unit – II: Simultaneous Equations (08 hrs.)

Gauss Elimination Method with Partial pivoting, Gauss-Seidal method and Thomas algorithm for Tri-diagonal Matrix, Jacob iteration method.

Unit – III: Optimization (08 hrs.)

Introduction to optimization, Classification, Constrained optimization (maximum two constrains): Graphical and Simplex method, One Dimensional unconstrained optimization: Newton's Method. Modern Optimization Techniques: Genetic Algorithm (GA), Simulated Annealing (SA).

Unit – IV: Numerical Solutions of Differential Equations (10 hrs.)

Ordinary Differential Equations [ODE]

Taylor series method, Euler Method, Runge-Kutta fourth order, Simultaneous equations using RungeKutta2nd order method.

Partial Differential Equations [PDE]: Finite Difference methods

Introduction to finite difference method, Simple Laplace method, PDEs- Parabolic explicit solution, Elliptic-explicit solution.

Unit – V: Curve Fitting and Regression Analysis (08 hrs.)

Curve Fitting

Least square technique- Straight line, Power equation, Exponential equation and Quadratic equation.

Regression Analysis

Introduction to multi regression analysis, Lagrange's Interpolation, Newton's Forward interpolation, Inverse interpolation (Lagrange's method only).

Unit – VI: Numerical Integration (06 hrs.)

Numerical Integration (1D only)

Trapezoidal rule, Simpson's 1/3rdRule, Simpson's 3/8thRule, Gauss Quadrature 2 point and 3 point method.

Double Integration

Trapezoidal rule, Simpson's 1/3rdRule.

Books:

Text:

1. Steven C. Chapra, Raymond P. Canale, Numerical Methods for Engineers, 4/e, Tata McGraw Hill Editions

2. Dr. B. S. Garewal, Numerical Methods in Engineering and Science, Khanna Publishers,.

3. Steven C. Chapra, Applied Numerical Methods with MATLAB for Engineers and Scientist, Tata Mc-Graw Hill Publishing Co-Ltd

4. Rao V. Dukkipati, Applied Numerical Methods using Matlab, New Age International Publishers

References:
1. Gerald and Wheatley, Applied Numerical Analysis, Pearson Education Asia

2. E. Balagurusamy, Numerical Methods, Tata McGraw Hill

3. P. Thangaraj, Computer Oriented Numerical Methods, PHI

4. S. S. Sastry, Introductory Methods of Numerical Analysis, PHI.

Term-Work

1. Program on Roots of Equation (Validation by suitable solver, all three compulsory)
a) Bisection Method, b) Newton Raphson method c) Successive approximation method

2. Program on Simultaneous Equations (Validation by suitable solver, all three compulsory)
a) Gauss Elimination Method, b) Thomas algorithm for tridiagonal matrix, c) Gauss-Seidal method.

3. Demonstration of optimization technique using suitable solver.

4. Program on ODE(Validation by suitable solver, all three compulsory)
a) Euler Method, b) Runge-Kutta Methods- fourth order, c) Simultaneous equations.(Runge-Kutta 2nd order: *One step only*).Simple pendulum equation or Spring mass damper equation

5. Program on PDE(Validation by suitable solver): Laplace equation

6. Program on Curve Fitting using Least square technique (Validation by suitable solver, all four compulsory)
a) Straight line, b) Power equation, c) Exponential equation, d) Quadratic equation

7. Program on Interpolation(Validation by suitable solver, all three compulsory)
a) Lagrange's Interpolation, b) Newton's Forward interpolation,

8. Program on Numerical Integration(Validation by suitable solver, all four compulsory)
a) Trapezoidal rule, b) Simpson's Rules (1/3rd, 3/8th) [In one program only], c) Gauss Quadrature Method- 2 point, 3 point. [In one program only], d) Double integration: Trapezoidal rule

NOTE:
1. Solver is compulsory for all above programs and compared with actual solution.
2. Manual solution for each problem.
3. Algorithms and Flowcharts are compulsory for all programs.

GUIDELINES TO CONDUCT PRACTICAL EXAMINATION

Any one program from each set A & B with flowchart and solver: **Duration: 2 hrs.**

Set A: (Weightage – 60 %)
a) Simultaneous Equation, b) Partial Differential Equation (Laplace equation with solver)
c) Interpolation: Lagrange's interpolation, Newton's Forward interpolation (Any one)

Set B: (Weightage – 40 %)
a) Roots of Equations, b) Curve Fitting, c) Ordinary Differential Equations, d) Integration

Savitribai Phule Pune University, Pune
Third Year of Mechanical (2015 Course)

Course Code: 302048 **Course Name : Design of Machine Elements – II**

Teaching Scheme:	Credits	Examination Scheme:		
TH: -- 4 Hrs/ Week	TH:--04	TH:	In-Sem:	-- 30
			End-Sem:	-- 70
PR: - 2 Hrs/ Week	TW/OR:--01		TW:	-- 25
			OR:	-- 25

Course Objective:

1. Enable students to attain the basic knowledge required to understand, analyze, design and select machine elements required in transmission systems.
2. Reinforce the philosophy that real engineering design problems are open-ended and challenging
3. Impart design skills to the students to apply these skills for the problems in real life industrial applications
4. Inculcate an attitude of team work, critical thinking, communication, planning and scheduling through design projects
5. Create awareness amongst students about safety, ethical, legal, and other societal constraints in execution of their design projects
6. Develop an holistic design approach to find out pragmatic solutions to realistic domestic and industrial problems

Course Outcome:

The student should be able to –

CO 1: To understand and apply principles of gear design to spur gears and industrial spur gear boxes.

CO 2 : To become proficient in Design of Helical and Bevel Gear

CO 3: To develop capability to analyse Rolling contact bearing and its selection from manufacturer's Catalogue.

CO 4: To learn a skill to design worm gear box for various industrial applications.

CO 5: To inculcate an ability to design belt drives and selection of belt, rope and chain drives.

CO 6: To achieve an expertise in design of Sliding contact bearing in industrial applications.

Course Contents

Unit –I Spur Gears (08 hrs)

Introduction to gears: Gear Selection, material selection, Basic modes of tooth failure, Gear Lubrication Methods.

Spur Gears: Number of teeth and face width, Force analysis, Beam strength (Lewis) equation, Velocity factor, Service factor, Load concentration factor, Effective load on gear, Wear strength (Buckingham's) equation, Estimation of module based on beam and wear strength, Estimation of dynamic tooth load by velocity factor and Buckingham's equation**.**

Unit –I Helical and Bevel Gears (08 hrs)

Types of helical and Bevel gears, Terminology, Virtual number of teeth**,** and force analysis of Helical and Straight Bevel Gear. Design of Helical and Straight Bevel Gear based on Beam Strength, Wear strength and estimation of effective load based on Velocity factor (Barth factor) and Buckingham's equation. Mountings of Bevel Gear**. (No numerical on force analysis of helical & Bevel Gear)**

Unit – III Rolling Contact Bearings (08 hrs)

Types of rolling contact Bearings, Static and dynamic load carrying capacities, Stribeck's Equation,

Equivalent bearing load, Load- life relationship, Selection of bearing life Selection of rolling contact bearings from manufacturer's catalog, Design for cyclic loads and speed, bearing with probability of survival other than 90%

Taper roller bearing: Force analysis and selection criteria. (Theoretical Treatment only)

Unit - IV:

Worm and worm gear terminology and proportions of worm and worm gears, Force analysis of worm gear drives, Friction in Worm gears, efficiency of worm gears, Worm and worm gear material, Strength and wear ratings of worm gears (Bending stress factor, speed factor, surface stress factor, zone factor) IS 1443-1974, Thermal consideration in worm gear drive, Types of failures in worm gear drives, Methods of lubrication

Unit - V:

Belt drive: Materials and construction of flat and V belts, geometric relationships for length of belt, power rating of belts, concept of slip & creep, initial tension, effect of centrifugal force, maximum power condition,

Selection of Flat and V-belts from manufacturer's catalog, belt tensioning methods, relative advantages and limitations of Flat and V- belts, construction and applications of timing belts.

Wire Ropes (Theoretical Treatment Only): Construction of wire ropes, lay of wire rope, stresses in wire rope, selection of wire ropes, rope drums construction and design.

Chain Drives (Theoretical Treatment Only): Types of chains and its Geometry, selection criteria for chain drive, Polygon effect of chain, Modes of failure for chain, Lubrication of chains

UNIT VI:

Classification of sliding contact bearing.

Lubricating oils: Properties, additives, selection of lubricating oils, Properties & selection of bearing materials.

Hydrodynamic Lubrication: Theory of Hydrodynamic Lubrication, Pressure Development in oil film, 2DBasic Reynolds Equation, Somerfield number, Raimondi and Boyd method, Thermal considerations, Parameters of bearing design, Length to Diameter ratio, Unit bearing Pressure, Radial Clearance, minimum oil film thickness.

Books:

Text:

1) Bhandari V.B, Design of Machine Elements, Tata McGraw Hill Publication Co. Ltd.
2) Shigley J.E. and Mischke C.R., Mechanical Engineering Design, McGraw Hill Publication Co. Ltd.
3) Spotts M.F. and Shoup T.E., Design of Machine Elements, Prentice Hall International.
4) Juvinal R.C, Fundamentals of Machine Components Design, John Wiley and Sons.

References:

1. Black P.H. and O. Eugene Adams, Machine Design, McGraw Hill Book Co. Inc.
2. Willium C. Orthwein, Machine Components Design, West Publishing Co. and Jaico Publications House.
3. Hall A.S., Holowenko A.R. and Laughlin H.G, Theory and Problems of Machine Design, Schaum's Outline Series
4. C.S. Sharma and Kamlesh Purohit, Design of Machine Elements, PHI Learing Pvt. Ltd.
5. D. K. Aggarwal & P.C. Sharma, Machine Design, S.K Kataria and Sons
6. P. C. Gope, Machine Design: Fundamentals and Applications, PHI Learing Pvt. Ltd.
7. Design Data - P.S.G. College of Technology, Coimbatore.
8. Bhandari, V. B. Machine Design data book, Tata McGraw Hill Publication Co. Ltd.
9. K. Mahadevan, K. Balveera Reddy, Design Data Handbook for Mechanical Engineers, CBS Publishers

Term-Work

Term work shall consist of

1. One design project based on either Design of a Two Stage Gear Box (the two stages having different types of gear pair) or single stage worm gear box.

The design project shall consist of two full imperial (A1) size sheets involving assembly drawing with a part list and overall dimensions and drawings of individual components.

Manufacturing tolerances, surface finish symbols and geometric tolerances should be specified for important surfaces. A design report giving all necessary calculations of the design of components and assembly should be submitted in a separate file. Design data book shall be used wherever necessary to achieve selection of standard components

Note:

1. Design project should be assigned to group of 5 to 7 students.
2. Assembly drawing of project should be drawn using any CAD software.
3. Detailed parts of project should be drawn manually.

Design projects should be practical oriented, below is the list of practical applications:

i) Design of gearbox for wind mill application
ii) Design of gearbox for sluice gate application.
iii) Design of gearbox for machine tool applications like Lathe, Drilling, Milling machines etc.
iv) Design of in-line gearbox for Automobile application.
v) Design of gearbox for building Elevator
vi) Design of gearbox for Hoist.
vii) Design of gearbox for 2 wheeler .
viii) Design of gearbox for Tumbling barrel (Mixer).
ix) Design of gearbox for Cannon adjustment mechanism (Military application).
x) Design of gearbox for Worm gear box for Sugar Industry.

2. Presentation (PPT/slides) (on following topics (Any Two):
   i) Application of belt drive and its selection method for Industrial application. (By using Manufacturer's Catalog).
   ii) Application of chain drive and its selection method for Automobile application. (By using Manufacturer's Catalog).
   iii) Mounting of machine elements on transmission shaft (like Bearings, gears, Pulley, Sprocket, etc).
   iv) Selection of Bearing from Manufacturer's Catalog.
   v) Construction and details of Gears.

Savitribai Phule Pune University, Pune

TE Mechanical (2015 course)

Course Code: 302049 **Course Name : Refrigeration and Air Conditioning**

Teaching Scheme:	Credits	Examination Scheme:
TH : 03 hrs/week	TH:-- 03	TH In-Sem: -- 30
		End-Sem: -- 70
PR : 02 hrs/ week	OR:- 01	OR: -- 25

Prerequisites:

Basic Thermodynamics- Laws of thermodynamics, Ideal gas processes, Thermodynamic cycles, Properties of pure substance, Mollier Charts, Basic Psychrometry terms and process, Fluid properties, Fluid dynamics, Modes of heat transfer, Governing Equations in Heat Transfer, Extended Surfaces, Condensation and Boiling, Heat Exchangers.

Course Objectives:

- Learning the fundamental principles and different methods of refrigeration and air conditioning.
- Study of various refrigeration cycles and evaluate performance using Mollier charts and/ or refrigerant property tables.
- Comparative study of different refrigerants with respect to properties, applications and environmental issues.
- Understand the basic air conditioning processes on psychometric charts, calculate cooling load for its applications in comfort and industrial air conditioning.
- Study of the various equipment-operating principles, operating and safety controls employed in refrigeration air conditioning systems

Course Outcomes:

At the end of this course the students should be able to

- Illustrate the fundamental principles and applications of refrigeration and air conditioning system
- Obtain cooling capacity and coefficient of performance by conducting test on vapour compression refrigeration systems
- Present the properties, applications and environmental issues of different refrigerants
- Calculate cooling load for air conditioning systems used for various
- Operate and analyze the refrigeration and air conditioning systems.

Course Contents

Unit I: Applications of Refrigeration and Air Conditioning and Refrigerants [8 hrs]

Applications

Domestic Refrigerator, Domestic Air Conditioners, Automotive Air Conditioners, Evaporative coolers, water coolers, Commercial Refrigeration- Dairy, Cold storage, Ice plant, Commercial Air Conditioning-Multiplex, Hospitals.

Refrigerants

Classification of refrigerants, Designation of refrigerants, Desirable properties of refrigerants, environmental issues, Ozone depletion and global warming, ODP, GWP & LCCP, selection of environment friendly refrigerants, secondary refrigerants, anti-freeze solutions, Zeotropes and Azeotropes, refrigerant: recovery reclaims, recycle and recharge.

Unit II: Vapour Refrigeration Systems [8 hrs]

Vapour compression systems

Working of simple vapour compression system, representation of vapour compression cycle (VCC) on T-s and P-h diagram, COP, EER, SEER, IPLV, NPLV, effect of operating parameters on performance of VCC, actual VCC, methods of improving COP using flash chamber, sub-cooling, liquid vapour heat exchanger, comparison of VCC with Reverse Carnot cycle.

Vapour absorption systems

Introduction, Working of simple vapour absorption system (VAS), desirable properties of binary mixture (aqua-ammonia), performance evaluation of simple VAS (simple numerical treatment), actual VAS, Li-Br absorption system, three fluid system (Electrolux refrigeration), applications of VAS, comparison between VCC and VAC

Unit III: Multiple pressure Refrigeration Systems [8 hrs]

Introduction, need of multistage system, Intermediate pressure, two stage compression with flash gas removal and liquid intercooler, single compressor with multiple evaporator: individual and multiple expansion valves, individual compressors, cascade system: application and numerical(numerical only by using p-h chart),

Introduction to cryogenics (Linde - Hampson cycle) and applications (no numerical treatment)

Unit IV: Psychrometry and Air conditioning load estimation **[8 hrs]**

Psychrometry

Basic Psychrometry and processes, BPF of coil, ADP, adiabatic mixing of two air streams, SHF, RSHF, GSHF, ESHF. Factors contributing to cooling load, Numerical based on load analysis

Human Comfort

Thermodynamics of human body, comfort and comfort chart, factors affecting human comfort, concept of infiltration and ventilation, indoor air quality requirements,

Unit V: Air Conditioning Systems **[8 hrs]**

Air Conditioning Systems

Working of summer, winter and all year round AC systems, all air system, all water system, air water system, variable refrigerant flow and variable air volume systems, unitary and central air conditioning.

Components of refrigeration and air conditioning systems

Working of reciprocating, screw and scroll compressors, working of air cooled, water cooled and evaporative condensers, working of DX, Flooded, Forced feed evaporators, Expansion devices – Capillary tube, TXV, EXV, operating and safety controls.

Unit VI **[8 hrs]**

Air Distribution Systems

Part A] Ducts

Classification of ducts, duct material, pressure in ducts, flow through duct, pressure losses in duct (friction losses, dynamic losses), air flow through simple duct system, equivalent diameter, Methods of duct system design: equal friction, velocity reduction, static regain method (numerical on duct system design)

Part B] Air handling unit

Air handling unit, Fan coil unit, types of fans used air conditioning applications, fan laws, filters, supply and return grills, sensors (humidity, temperature, smoke).

Books:

Text:

1. Arora C. P., Refrigeration and Air Conditioning, Tata McGraw-Hill
2. Manohar Prasad, Refrigeration and Air Conditioning, Willey Eastern Ltd, 1983
3. McQuiston, ― Heating Ventilating and air Conditioning: Analysis and Design‖ 6th Edition, Wiley India
4. Arora and Domkundwar, Refrigeration & Air Conditioning, Dhanpatrai & Company, New Delhi
5. Khurmi R.S. and Gupta J.K., Refrigeration and Air conditioning, Eurasia Publishing House Pvt. Ltd, New Delhi,1994.
6. Ballaney P.L., Refrigeration and Air conditioning, Khanna Publishers, New Delhi, 1992

References:

1. Dossat Ray J, Principles of refrigeration, S.I. version, Willey Eastern Ltd, 2000

2. Stockers W.F and Jones J.W., Refrigeration and Air conditioning, McGraw Hill International editions 1982.

3. Threlkeld J.L, Thermal Environmental Engineering, Prentice Hall Inc., New Delhi4. Aanatnarayan, Basics of refrigeration and Air Conditioning, Tata McGraw Hill Publications

5. Roger Legg, Air Conditioning System Design, Commissioning and Maintenance

6. ASHRAE & ISHRAE handbook

Term-Work

The term work shall consist of minimum eight experiments out of the following (It should include the visit to clod storage plant or central air-condition plant) :

1. Test on Domestic Refrigerator for evaluation of EER
2. Test on vapour compression test rig
3. Test on air conditioning test rig
4. Test on ice plant test rig
5. Test on Heat Pump test rig
6. Test/visit on Vapour absorption refrigeration test rig
7. Estimation of cooling load of simple air conditioning system (case study)
8. Visit to cold storage plant.
9. Visit to any air conditioning plant
10. Thermal analysis of refrigeration cycle using suitable software
11. Installation and servicing of split air conditioner.

Savitribai Phule Pune University, Pune

TE Mechanical and Mechanical Sandwich (2015 course)

Course Code: 302050	**Course Name : Mechatronics**

Teaching Scheme:	**Credits**	**Examination Scheme:**
TH: -- 03 hrs/week	**TH:--03**	**TH In-Sem: -- 30**
		End-Sem: --70
Tut.: - 01 hr/week	**OR:- 01**	
		OR: --25

Course Objectives:

- Understand key elements of Mechatronics system, representation into block diagram
- Understand concept of transfer function, reduction and analysis
- Understand principles of sensors, its characteristics, interfacing with DAQ microcontroller
- Understand the concept of PLC system and its ladder programming, and significance of PLC systems in industrial application
- Understand the system modeling and analysis in time domain and frequency domain.
- Understand control actions such as Proportional, derivative and integral and study its significance in industrial applications

Course Outcomes:

On completion of the course, students will be able to –

- Identification of key elements of mechatronics system and its representation in terms of block diagram
- Understanding the concept of signal processing and use of interfacing systems such as ADC, DAC, digital I/O
- Interfacing of Sensors, Actuators using appropriate DAQ micro-controller
- Time and Frequency domain analysis of system model (for control application)
- PID control implementation on real time systems
- Development of PLC ladder programming and implementation of real life system.

Course Contents

UNIT 1: Introduction to Mechatronics, Sensors & Actuators (08 Hrs)

Introduction to Mechatronics and its Applications; Measurement Characteristics: Static and Dynamic; Sensors: Position sensors- Potentiometer, LVDT, incremental Encoder; Proximity sensors-Optical, Inductive, Capacitive; Temperature sensor-RTD, Thermocouples; Force / Pressure Sensors-Strain gauges; Flow sensors-Electromagnetic; Actuators: Stepper motor, Servo motor, Solenoids; Selection of Sensor & Actuator.

UNIT 2: Block Diagram Representation (08 Hrs)

Introduction to Mechatronic System Design; Identification of key elements of Mechatronics systems and represent into Block Diagram; Open and Closed loop Control System; Concept of Transfer Function; Block Diagram & Reduction principles; Applications of Mechatronic systems: Household, Automotive, Industrial shop floor.

UNIT 3: Data Acquisition (08 Hrs)

Introduction to Signal Communication & Types-Synchronous, Asynchronous, Serial, Parallel; Bit width, Sampling theorem, Aliasing, Sample and hold circuit, Sampling frequency; Interfacing of Sensors / Actuators to Data Acquisition system; 4 bit Successive Approximation type ADC; 4 bit R-2R type DAC; Current and Voltage Amplifier.

UNIT 4: Programmable Logic Control (08 Hrs)

Introduction to PLC; Architecture of PLC; Selection of PLC; Ladder Logic programming for different types of logic gates; Latching; Timers, Counter; Practical examples of Ladder Programming.

UNIT 5: Frequency Domain Modelling and Analysis (08 Hrs)

Transfer Function based modeling of Mechanical, Thermal and Fluid system; concept of Poles & Zeros; Stability Analysis using Routh Hurwitz Criterion; Bode Plots: Introduction to Bode Plot, Gain Margin, Phase Margin, Relative Stability Analysis, Frequency Domain Parameters-Natural Frequency, Damping Frequency and Damping Factor; Mapping of Pole Zero plot with damping factor, natural frequency and unit step response.

UNIT VI: Control System (08 Hrs)

Proportional (P), Integral (I) and Derivative (D) control actions; PI, PD and PID control systems in parallel form; Unit step Response analysis via Transient response specifications: Percentage overshoot, Rise time, Delay time, Steady state error; Manual tuning of PID control; Linear Quadratic Control (LQR).

Books:

Text:

- K.P. Ramchandran, G.K. Vijyaraghavan, M.S. Balasundaram, Mechatronics: Integrated Mechanical Electronic Systems, Willey Publication, 2008
- Bolton, Mechatronics - A Multidisciplinary approach, 4th Edition, Prentice Hall, 2009.

References:

- Alciatore & Histand, Introduction to Mechatronics and Measurement system, 4th Edition, Mc-Graw Hill publication, 2011
- Bishop (Editor), Mechatronics – An Introduction, CRC Press, 2006
- Mahalik, Mechatronics – Principles, concepts and applications, Tata Mc-Graw Hill publication, New Delhi
- C. D. Johnson, Process Control Instrumentation Technology, Prentice Hall, New Delhi

Term Work shall consist of following assignments:

The common minimum submission mentioned in point 1 and 2 should comprise of the following. From the table below: Submission No. 04, 05, 10, 11 and 12 are mandatory; any one from 01 to 03, any one from 06 or 07, any one from 08 or 09.

Submission No	Title
01	Measurement of Load / Force using a suitable sensor
02	Measurement of Temperature using a suitable sensor
03	Measurement of Position using a suitable sensor
04	Demonstration of **any one** of the following applications: • Water Level Indicator • Bottle Filling Plant • Pick and Place Robot • Any other suitable application which comprises of components of Mechatronic system
05	Interfacing of suitable sensor with Data Acquisition system
06	Ladder Diagram simulation, using suitable software, for logic gates
07	Real time application of PLC using Ladder logic
08	Real time control of Temperature / Flow using PID control
09	Real time control of speed of DC motor using PID control
10	PID control Design, Tuning using suitable Simulation Software
11	Study of Modeling and Analysis of a typical Mechanical System (Estimation of poles, zeros, % overshoot, natural frequency, damping frequency, rise time, settling time)
12	Case Study: Design of Mechatronic System (to be performed in a group of 4)

Savitribai Phule Pune University, Pune
Third Year of Mechanical & Automobile
(2015 Course)

Course Code: 302051 **Course Name : MANUFATCURING PROCESS – II**

Teaching Scheme:	Credits	Examination Scheme:
TH: -- 3 Hrs/ Week	TH:03	TH In-Sem: -- 30 End-Sem: -- 70

Course Objective:

1. To analyze and understand the metal cutting phenomena.
2. To select process parameter and tools for obtaining desired machining characteristic
3. To understand principles of manufacturing processes.

Course Outcome:

1. Student should be able to apply the knowledge of various manufacturing processes.
2. Student should be able to identify various process parameters and their effect on processes.
3. Student should be able to figure out application of modern machining.
4. Students should get the knowledge of Jigs and Fixtures for variety of operations.

Course Contents

Unit – I Theory of Metal cutting **(07hrs)**

Single point cutting tool: Tool geometry, Mechanics of shearing (orthogonal and oblique), Shear plane angle, Shear stress, strain and Shear strain rate. Process parameters and their effect on machining.

Merchant's circle of forces (analytical) Estimation of shear force, Normal shear force, Friction force, Normal friction force, Material Removal Rate (MRR), Cutting power estimation, Calculation of Total power and Specific energy. Introduction to tool dynamometers.

Machinability - Factors affecting machinability, Tool life, Tool wear, Types of tool wear and remedial actions, Cutting fluid and their types, Effect of process parameters on tool life, Taylor's tool life equation (Derivation along with numerical).

Unit – II Machine tools and their application **(07 hrs)**

Drilling machine: Types of drills and operations. Twist drill geometry, Types of drilling machine, Tool holder. Machining time calculations.

Milling machine: Types of milling machines, Cutter-types and geometry and their applications. Universal dividing head, Methods of Indexing: Simple, Compound, Differential. (Numericals based on simple and compound Indexing).Machining time calculations

Broaching: Introduction to broaching, Broach tool geometry, Planner and Boring Machines: Introduction.

Unit – III Finishing processes **(07hrs)**

Grinding machines

Introduction: Types and Operations of grinding machines.

Grinding wheel – Shapes, Designation and selection, Mounting, Balancing and Dressing of grinding wheels, Machining time calculation for cylindrical and plunge grinding.

Super-finishing processes – Introduction to Honing, Lapping, Buffing and Burnishing. (Construction, working and controlling parameters)

Unit – IV Advanced Machining Processes **(07 hrs)**

Introduction, classification of advanced machining processes.

Principles, Working, Process Parameters, Advantages, Limitations and Application for following processes:

Electric Discharge Machining (EDM), LASER Beam Machining (LBM), Abrasive Jet Machining (AJM), Ultra Sonic Machining (USM) and Electro Chemical Machining (ECM)
Introduction to micro machining.

Unit –V CNC Technology **(07 hrs)**

Introduction, Classification, Construction and working of NC, CNC, DNC and machining center. CNC axes and drives. Automatic Tool Changer (ATC) and Automatic pallet changer (APC)

CNC Programming: Word address format (WAF) –ISO Standards, G & M codes, Type of CNC Control systems, Manual part programming (plain milling and Turning), Subroutine, Canned cycles.

Unit –VI Jigs and fixtures **(07 hrs)**

Concept of degree of freedom, 3-2-1 principle of location, General guidelines to design Jigs and fixtures, advantages of jig and fixtures

Jigs: Definition. Elements of jig with the types, Location guidelines, Principles of clamping, Principles of guiding element, Channel jig, Template jig, Plate jig, Angle plate jig, Turn over jig, Box jig, and Latch type jig.

Fixtures: Definition. Elements of fixtures, Location guidelines, Principles of clamping, Principles of setting element, Turning fixture, Welding fixture, Milling fixture, Introduction to Assembly and Inspection fixtures. Indexing fixtures.
Concept, elements and advantages of modular fixture, Pokayoke concept in jigs and fixtures.

Books:

Text:

1. S. K Hajra Choudhury , Elements of workshop technology – Vol. II,, Media Promoters And Publishers, Mumbai
2. Amitabh Ghosh and Asok kumar Mallik, Manufacturing science, Ellis Horwood Ltd
3. Mikell. P. Grover, Fundamentals of Modern Manufacturing, Pearson Publications
4. P. C. Sharma, Production Engineering, S. Chand Publication.

References:

1. Production technology –HMT, Tata McGraw Hill publication
2. Lindberg, Roy A., Processes and materials of manufacture, P H I Learning
3. Serope Kalpakjian and Steven R. Schmid, Manufacturing Processes for Engineering Materials, Pearson Education, Fourth Edition.
4. G. K Lal, Fundamentals of Design and Manufacturing, Alpha Science International Ltd(2005)
5. M.C Shaw, Metal Cutting Principles, Oxford university press
6. Yoram Koren , Numerical Control of Machine Tools Khanna Publication
7. P. K Mishra, Non- conventional machining, Narosa Publishing House
8. V. K Jain, Advanced machining processes , Allied Publisher, New Delhi
9. M. H. A Kempster, An Introduction to Jig and Tool Design, ELBS
10. P. H. Joshi, Jigs and fixtures , Tata McGraw Hill
11. P. N. Rao, CAD/CAM Principles and Applications, McGraw Hill Education, Third Edition.
12. Cyrll Donaldson, George H. LeCain and V. C. Goold, Tool design, Tata McGraw- Hill. Third Edition

Savitribai Phule Pune University, Pune
Third Year of Mechanical & Automobile
(2015 Course)

Course Code: 302052 **Course Name : MACHINE SHOP – II**

Credits	**Examination Scheme:**
PR: -2 Hrs/ Week	
TW:-01	**TW: 50**

Course Objective:

1. To set the manufacturing set–up appropriately and study the corresponding set up parameters.
2. To select appropriate process parameter for obtaining desired characteristic on work piece.
3. To understand the operational problems and suggest remedial solution for adopted manufacturing process.

Course Outcome:

1. Ability to develop knowledge about the working and programming techniques for various machines and tools

Term-Work

Each student must complete and submit following term work:

I. **Jobs (Both the following jobs should be completed individually)**

a. Any one marketable assembly consisting of at least three components with tolerance involving use of lathe, drilling, milling, grinding and any additional machine tool or processes as per requirement.

b. Development and execution of one simple turning job on CNC (Trainer) machine.

II. **Journal consisting of following assignments.**

a. Two views of at least one jig and one fixture designed, for a component on a half imperial sheet.(manual drafting)

b. Process planning sheets for job 1.a and 1.b.

c. Report based on industrial visit to manufacturing plant.

Note: - Practical are to be performed under the guidance of concerned faculty member.
Job drawing essentially consisting of Geometric Dimensioning and Tolerance

Savitribai Phule Pune University, Pune
Third Year of Mechanical & Automobile
(2015 Course)

Course Code: 302053 **Course Name : SEMINAR**

Teaching Scheme:	**Credits**	**Examination Scheme:**
PR:-- 2 Hrs/Week	**OR:--01**	**TH In-Sem: --** **End-Sem: --** **TW: -- 25** **OR: -- 25**

Prerequisites:

Course Objective:

1. Identify and compare technical and practical issues related to the area of course specialization.
2. Outline annotated bibliography of research demonstrating scholarly skills.
3. Prepare a well organized report employing elements of technical writing and critical thinking.
4. Demonstrate the ability to describe, interpret and analyze technical issues and develop competence in presenting.

Course Outcome:

With this seminar report and presentation, the student is expected to learn/achieve the following:

- Establish motivation for any topic of interest and develop a thought process for technical presentation.
- Organize a detailed literature survey and build a document with respect to technical publications.
- Analysis and comprehension of proof-of-concept and related data.
- Effective presentation and improve soft skills.
- Make use of new and recent technology (e.g. Latex) for creating technical reports

Course Contents:

The evaluation of the seminar report is proposed with the following stages.

Stage-I

In this stage the student is expected to deliver the following:

1. Topic selection
2. Literature review
3. State of the art related to the topic of interest

Stage-II

1. Problem statement
2. Methodology
3. Scope and objectives

A review of the student's progress should be made after In-Sem examination, within a week. During this review, the student is expected to complete Stage-1 and Stage-2.

Stage-III

1. Quantification of results
2. Concluding remarks or summary

Stage-IV

3. Final report
4. Final presentation/viva

The final presentation/viva will be assessed by a committee including an expert (preferably from industry with minimum 5 years experience) and an internal panel. The internal panel will consist of the seminar guide and two subject experts, approved by the HOD and the principal of the institute.

Examination schedule will be prepared at institute level (and not at University level), though it is under Oral head. The appointment of the internal panel and the external (industrial) expert will be taken care by the respective institute. The seminar presentation will be help after the term end and before university external viva

Contents of the Seminar report

The contents of the seminar report as mentioned in section-3 are expected to include the following:

- Abstract/Summary
- Introduction: Scope and Methodology
- Literature review: The review should be conducted from at least five research papers published during last five year.
- Case study
- References

Instructions for seminar report writing

It is important that the procedures listed below be carefully followed by all the students.

1. Prepare two spiral bound copies of your Seminar report.

2. Limit your seminar report to preferably 20 to 25 pages only.

3. Header For e.g. Title of the seminar.

4. The footer For e.g. page numbers

5. Institute Name, Mechanical Engineering and centrally aligned.

6. The report shall be prepared using LateX preferably (default font througout) with double spacing throughout on A4 page.

Page	Left margin	Right margin	Top margin	Bottom margin
A-4 (8.5 11 inch)	1.5"	1"	1"	1"

7. Section titles should be bold typed in all capital letters and should be left aligned.
8. Sub-Section headings should be aligning at the left, bold and Title Case (the first letter of each word is to be capitalized).
9. Figure No. and Title at bottom with 10 pt; Legends below the title in 10 pt
10. Please use SI system of units only.
11. References should be either in order as they appear in the report or in alphabetical order by last name of first author.
12. Symbols and notations if any should be included in nomenclature section only

The report will be made in the following order:

1. Cover page and Front page as per specimen on separate sheet
2. Certificate from Institute as per specimen on separate sheet
3. Acknowledgement
4. List of Figures
5. List of Tables
6. Nomenclature
7. Contents
8. All section headings and subheadings should be numbered. For sections use numbers 1, 2, 3, ... and for subheadings 1.1, 1.2, ... etc and section subheadings 2.1.1, 2.1.2, ... etc.
9. References should be given in the body of the text and well spread. No verbatim copy or excessive text from only one or two references. If figures and tables are taken from any reference then indicate source of it. Please follow the following procedure for references

Reference Books: Collier, G. J. and Thome, J. R., Convective boiling and condensation, 3 rd ed., Oxford University Press, UK, 1996, pp. 110 112.

Papers from Journal or Transactions:

1. Jung, D. S. and Radermacher, R., Transport properties and surface tension of pure and mixed refrigerants, ASHRAE Trans, 1991, 97 (1), pp. 90 98.
2. Bansal, P. K., Rupasinghe, A. S. and Jain, A. S., An empirical correction for sizing capillary tubes, Int. Journal of Refrigeration, 1996, 19 (8), pp.497 505.

Papers from Conference Proceedings:

1. Colbourne, D. and Ritter, T. J., Quantitative assessment of flammable refrigerants in room air conditioners, Proc. of the Sixteenth International Compressor Engineering Conference and Ninth International Refrigeration and Air Conditioning Conference, Purdue University, West Lafayette, Indiana, USA, 2002, pp. 34 40.

Reports, Handbooks etc.

1. United Nations Environmental Programme, Report of the Refrigeration, Air Conditioning and Heat Pumps, Technical Option Committee, 2002, Assessment - 2002. ASHRAE Handbook: Refrigeration, 1994 (Chapter 44)

Patent: Patent no, Country (in parenthesis), date of application, title, year.

Web-links: www.(Site) [Give full length URL]

Savitribai Phule Pune University, Pune
Third Year of Mechanical, Mechanical Sandwich & Automobile
(2015 Course)

Course Code: 302054 **Course Name : Audit Course I :- Fire & Safety Technology**

Teaching Scheme:	**Credits**	**Examination Scheme:** Audit (P/F) Written and MCQ
PR:	**Th/Tut:--**	**TH In-Sem: --**
		End-Sem: --
Tut:	**TW:**	**PR: --**
		OR: --

Description:

To generate, develop and sustain a voluntary movement on Fire & Safety Engineering at the National Level aimed at educating and influencing society to adopt appropriate policies, practices and procedures that prevent and mitigate human suffering and economic loss arising from all types of accidents.

Course Objective:

On completion of this Basic Fire Safety Course, participants will be able to:-

- Describe the chemistry of fire
- Identify fire hazards in the workplace
- Follow evacuation procedures
- Select and use appropriate firefighting equipment

Course Outcome:

- **Students will be able**

1. To create and sustain a community of learning in which students acquire knowledge in fire, safety and hazard management and learn to apply it professionally with due consideration for ethical, human life & property safety issues.
2. To pursue research and development in fire safety engineering, hazard management and disseminate its findings.
3. To meet the challenges of today and tomorrow in the most effective, efficient and contemporary educational manner.
4. To help in building national capabilities in fire safety engineering, disaster management, hazard management, industrial safety education through practical training to ensure a fire safe nation.

Course Contents:

1. **Fire & Safety Overview**

Fire & safety legislation, Safety Personnel Supplier for construction sites/commissioning of plants. Understanding the physics and chemistry of fire. Development and spread of fire. Action in the event of fire

2. **Fire Fighting Techniques**

Means of raising alarm, means of summoning the fire brigade, action on hearing the fire alarm Evacuation procedures Practical demonstration in the use of foam and CO_2 fire extinguishers using our state of the art gas fired training system.

3. **Fundamentals of Fire Engineering Science**

Fire Tech & Design, Fire Risk Assessment, Fire Control Technology, Fire Fighting Drills, Fire Tender with Crew on Hire. Fire & Safety Audit. Fire & Safety Consultancy Services.

4. **Industrial Aspects of Fire & Safety**

Industrial Training on Fire & Safety and Disaster Management. Repair of all kinds of Fire Equipment including Flooding System. Repair of Fire Tender including Pump and power take-off systems.

5. **Maintenance of Fire Safety Equipments**

AMC of Fire System. Refilling of Fire Extinguishers. Ultrasonic Thickness Test of Extinguishers, Vessels and Pipe lines. Hydro Testing of Fire Extinguishers, Vessels and Pipe Lines. Supply of Fire & Safety Equipment and Spares.

Case Study & Group Work:

- Identification of fire & safety technology
- To study the Fire Fighting Properties of Foam Concentrate
- Case Studies of Salvage operations in different types of occupancy
- Design and drawing of parts contained in the syllabus
- Compilation of Results & Presentation
- Case Study on the projects (products or processes) carried out by your institution or an organization in your vicinity, for safety.

Books:

References:

1. Accident Prevention manual for Industrial Operations, NSC, Chicago 1982.
2. The manual of fire ship – 6 – A by HMSO
3. Electricity Fire Risks – G.S. Hodges
4. Fire Pumps and Hydraulics: I.E. Ditts and T. M. Harris.
5. Fire Service Manual (Volume 2) Fire Service Operations – Petrochemical Incidents
6. The Principles and Practice of Fire Salvage Operation by Fire Salvage association.

Savitribai Phule Pune University, Pune
Third Year of Mechanical, Mechanical Sandwich & Automobile
(2015 Course)

Course Code: 302054 **Course Name : Audit Course II - Entrepreneurship Development**

Teaching Scheme:	**Credits**	**Examination Scheme:** Audit (P/F) Written and MCQ
PR:	**Th/Tut:--**	**TH In-Sem: --**
		End-Sem: --
Tut:	**TW:**	**PR: --**
		OR: --

Description:

EDP is a program meant to develop entrepreneurial abilities among the people. In other words, it refers to inculcation, development, and polishing of entrepreneurial skills into a person needed to establish and successfully run his enterprise. Thus, the concept of entrepreneurship development programme involves equipping a person with the required skills and knowledge needed for starting and running the enterprise.

This course will help in developing the awareness and interest in entrepreneurship and create employment for others. Students get familiar with the characteristics and motivation of successful entrepreneurs. Students learn how to identify and refine market opportunities, how to secure financing, how to develop and evaluate business plans and manage strategic partnerships. Students learn various concepts including the basics of management, leadership, motivation, decision-making, conflict management, human resource development, marketing and sustaining an organization. Students also get basic knowledge of accounting practices and finance. The core course in Entrepreneurship Development & Management equips students with skills and knowledge required to start and sustain their own business.

Course Objective: • To impart basis managerial knowledge and understanding; • Develop and strengthen entrepreneurial quality, i.e., motivation or need for achievement. • To analyze environmental set up relating to small industry and promoting it. • Collect and use the information to prepare project report for business venture. • Understand the process and procedure involved in setting up small units. • Develop awareness about enterprise management.
Course Outcome: **The students will be able to** • Appreciate the concept of Entrepreneurship • Identify entrepreneurship opportunity. • Develop winning business plans

Course Contents:

Entrepreneurship- Definition; Growth of small scale industries in developing countries and their positions large industries; role of small scale industries in the national economy; characteristics and types of small scale industries; demand based and resources based ancillaries Government policy for small scale industry; stages in starting a small scale industry, requirements to be an entrepreneur, SWOT Analysis.

Projects: Identification and Selection of projects; project report: contents and formulation, concept of project evaluation, methods of project evaluation: internal rate of return method and net present value method.

Market Assessment and Product feasibility

Marketing -Concept and Importance Market Identification,

Customer needs assessment, Market Survey Product feasibility analysis

Business Finance & Accounts

Business Finance: Costing basics, Sources of Finance, Break Even Analysis,

Business Accounts: Preparation of balance sheets and assessment of economic viability, decision, making, expected costs, planning and production control, quality control, marketing, Book Keeping, Financial Statements, Financial Ratios and its importance, Concept of Audit.

Project Planning and control:

The financial functions cost of capital approach in project planning and control. Economic evaluation, risk analysis, capital expenditures, policies and practices in public enterprises. Profit planning and programming, planning cash flow, capital expenditure and operations. Control of financial flows, control and communication.

Institutional Support and Policies: institutional support towards the development of entrepreneurship in India, technical consultancy organizations, E-Commerce: Concept and process, government policies for small scale enterprises.

Case Study & Group Work:

- Assess yourself-are you an entrepreneur?
- Prepare a Project Report for starting a small scale business.
- An Interview with an Entrepreneur.

Books:
References: 1. Ram Chandran, 'Entrepreneurial Development', Tata McGraw Hill, New Delhi 2. Saini, J. S., 'Entrepreneurial Development Programmes and Practices', Deep & Deep Publications (P), Ltd. 3. Khanka, S. S. 'Entrepreneurial Development', S Chand & Company Ltd. New Delhi 4. Badhai, B 'Entrepreneurship for Engineers', Dhanpat Rai & co. (p) Ltd. 5. Desai, Vasant, 'Project Management and Entrepreneurship', Himalayan Publishing House, Mumbai, 2002. 6. Gupta and Srinivasan, 'Entrepreneurial Development', S. Chand & Sons, New Delhi.

Savitribai Phule Pune University, Pune
Third Year of Mechanical, Mechanical Sandwich & Automobile
(2015 Course)

Course Code: 302054 **Course Name : Audit Course III - Intellectual Property Right**

Teaching Scheme:	**Credits**	**Examination Scheme:** Audit (P/F) Written and MCQ
PR:	**Th/Tut:--**	**TH In-Sem: --**
		End-Sem: --
Tut:	**TW:**	**PR: --**
		OR: --

Objective:

Intellectual property refers to the rights which are attached to the creation of the mind and which take the form of a property. Though intangible in nature, intellectual property has become the driving force of many companies today. Fortune 500+ companies undoubtedly are the best examples of what a company can achieve through the proper understanding and management of IPR.

Thus the study of intellectual property rights is inevitable for managers, considering the fact that India is fast emerging as an economy with considerable investment in cutting-edge research and development. India is also emerging as an economy where foreign companies propose to invest considerably, both technically and financially, provided proper protection is guaranteed to their intangible assets which form the cornerstone of their business.

Topics:

1. Introduction
    - Concepts of IPR
    - The history behind development of IPR
    - Necessity of IPR and steps to create awareness of IPR

2. IP Management
    - Concept of IP Management
    - Intellectual Property and Marketing
    - IP asset valuation

3. Patent Law
    - Introduction to Patents
    - Procedure for obtaining a Patent
    - Licensing and Assignment of Patents
        Software Licensing
        General public Licensing
        Compulsory Licensing
    - Infringement of Patents
    - Software patent US and Indian scenario

4. Copyrights
    - Concept of Copyright Right
    - Assignment of Copyrights
    - Registration procedure of Copyrights
    - Infringement (piracy) of Copyrights and Remedies
    - Copyrights over software and hardware

5. Designs
    - Concept of Industrial Designs
    - Registration of Designs
    - Piracy of registered designs and remedies

6. Trademark Law
    - Concept of trademarks
    - Importance of brands and the generation of "goodwill"
    - Trademark registration procedure
    - Infringement of trademarks and Remedies available
    - Assignment and Licensing of Trademarks

Case Study & Group Work:

• Identify the projects (products or processes) carried out by your institution or an organization in your vicinity, which have been patented.

• A case study on significance of patents for a developing nation like India.

• Group discussion on creative / novel ideas and the feasibility of converting the idea into product or process.

• Discussion on Correlation between IPR and Entrepreneurship in the backdrop of Make in India Initiative.

References:

1. Ganguli Prabuddha, 'Intellectual Property Rights: Unleashing the knowledge economy', Tata McGraw Hill, New Delhi

2. Wadehra R. L., 'Law Relating to patents, trademarks, copyrights, designs and geographical indicators – 2nd', Universal Law Publishing.

3. Narayan P. S. 'Intellectual Property Law in India', Asia Law House Hyderabad.

Savitribai Phule Pune University, Pune
Third Year of Mechanical, Mechanical Sandwich & Automobile
(2015 Course)

Course Code: 302054 **Course Name : Audit Course IV - Lean Management**

Teaching Scheme:	**Credits**	**Examination Scheme:** Audit (P/F) Written and MCQ	
PR:	**Th/Tut:--**	**TH**	**In-Sem: --**
			End-Sem: --
Tut:	**TW:**		**PR: --**
			OR: --

Course Objective:

- To learn Lean Thinking and its applications
- To get knowledge of Tools & Techniques used in Lean Management
- To understand Business Impact of Lean Management

Course Outcome: Students

- Will be able to do practice Lean Management at the workplace
- Will be able to contribute in Continuous Improvement program of the Organization

Course Contents:

- Brief History of Lean Thinking
- Toyota Production System
- Five Steps to Lean
- Seven Types of MUDA – Waste in Manufacturing
- MURA – Unevenness / Fluctuation
- MURI – Overburden, Physical Strain
- Lean Tools & Techniques
- Value Stream Mapping
- Five 'S'
- Visual Management
- Plan-Do-Check-Act (PDCA)
- Kanban
- Lean Distribution
- Various Lean Management Systems
- Just In Time Production
- Total Quality Management (TQM)
- Total Productive Maintenance (TPM)
- Problem Solving Techniques
- A3 Reporting Technique

Books:
References: 1. Lean Thinking: Banish Waste and Create Wealth in Your Corporation, Second Edition James P. Womack and Daniel T. Jones, Free Press, June 2003, ISBN: 0743249275 2. Learning to See: Value Stream Mapping to Create Value and Eliminate Muda Mike Rother and John Shook, Lean Enterprise Institute, June 2003, ISBN: 0966784308 3.Lean Production Simplified: A Plain-Language Guide to the World's Most Powerful Production System, Second Edition Pascal Dennis, Productivity Press Inc, September 2007, ISBN: 9781563273568 4. Gemba Kaizen: A Commonsense, Low-Cost Approach to Management Masaaki Imai, McGraw-Hill, March 1997, ISBN: 0070314462 5. World of Kaizen : By Shyam Talawadekar Paperback Publisher: Kaizen Publisher; 4 th edition (2016) ISBN-10: 819326780X ISBN-13: 978-8193267806

Savitribai Phule Pune University, Pune
Third Year of Mechanical, Mechanical Sandwich & Automobile
(2015 Course)

Course Code: 302054 **Course Name : Audit Course V - Smart Manufacturing**

Teaching Scheme:	**Credits**	**Examination Scheme:** Audit(P/F) Written and MCQ
PR:	**Th/Tut:--**	**TH In-Sem: --**
		End-Sem: --
Tut:	**TW:**	**PR: --**
		OR: --

Description:

Smart Manufacturing is an amalgamation of Information Technology, Cloud Computing & traditional Mechanical, Production Engineering towards achieving excellence in manufacturing. Maximum results with minimum resources being used. The course will introduce the concepts of Smart Manufacturing, how various technologies can be leveraged to achieve minimum breakdowns, First Time Right Production, 100% Delivery on Time with minimum turnaround time. Nine Pillars of Smart Manufacturing will be explained to the Students.

The course will make the students aware of developments in Technology those are going to alter the Traditional Manufacturing scenario. The following topics may be broadly covered in the classroom. The practical will be in the form of Group Discussion based on Case Study.

Course Objective:

- To know more about Smart Manufacturing & Industry 4.0
- To get knowledge of various converging Technologies
- To prepare ourselves for the ever changing Manufacturing Techniques

Course Outcome: The students will be

- Comfortable with terminology and practices in Smart Manufacturing
- Able to face the challenges in Industry & also contribute towards advancement.
- Active part of Industry 4.0 (Fourth Industrial Revolution)

Course Contents:

- Introduction to Industry 4.0
- Historical Background
- Nine Pillars of Smart Manufacturing
- Big Data & analytics
- Autonomous Robots
- Simulation
- Universal System Integration
- IIOT – Industrial Internet of Things
- 3 D Printing – Additive Manufacturing
- Cloud Computing
- Augmented Reality
- Convergence of Nine Pillars
- Business Propositions delivered with Smart Manufacturing
- Adding Smartness to Manufacturing – Adoption & Scaling
- Economic Aspects
- Ecosystem Required for Smart Manufacturing
- Skill set Required for Smart Manufacturing
- Effects on 4 M- Man, Machine, Materials & Methods in Smart Manufacturing

References:

1. Smart Manufacturing by Shoukat Ali; Publisher: LAP LAMBERT Academic Publishing (10 August 2016)Language: EnglishISBN-10: 3659933554ISBN-13: 978-3659933554

2. Industry 4.0: The Industrial Internet of Things 2016by Alasdair Gilchrist (Author)
Publisher: Apress; 1st ed. edition (30 July 2016)
Language: English
ISBN-10: 1484220463
ISBN-13: 978-1484220467

3. Industry 4.0 Data Analytics31 July 2016 by Rajesh Agnihotri and Samuel New
Publisher: CreateSpace Independent Publishing Platform (31 July 2016)
Language: English
ISBN-10: 1534778284
ISBN-13: 978-1534778283

4. 3D Printing: The Next Industrial Revolution4 May 2013by Christopher Barnatt
Publisher: Createspace Independent Publishing Platform (4 May 2013)
Language: English
ISBN-10: 148418176X
ISBN-13: 978-1484181768

5. Augmented Reality: Principles and Practice by Dieter Schmalstieg and Tobias Hollerer
Publisher: Pearson Education; First edition (5 October 2016)
Language: English
ISBN-10: 9332578494
ISBN-13: 978-9332578494

LIST OF EXPERIMENTS / CASE STUDIES

Case Study & Group Work:

- Identification of areas where Smart Manufacturing can flourish
- Business Goals achieved through Smart Manufacturing
- Compilation of Results & Presentation

SAVITRIBAI PHULE PUNE UNIVERSITY

Board of Studies in Civil Engineering

Structure and Syllabus for B.E. Civil 2015 Course (w. e. f. June, 2018)

SAVITRIBAI PHULE PUNE UNIVERSITY

Board of Studies in Civil Engineering

Structure for B.E. Civil 2015 Course (w. e. f. June 2018)

	Semester-I										
Subject code	**Subject**	**Teaching Scheme Hrs/Week**			**In-Semester Assessment**	**TW**	**Pract /Or**	**End-Semester Exam**	**Total**	**Credit**	
		Lect	**Tu**	**Pr**						**Th**	**Lab**
401 001	Environmental Engineering II	3	--	2	30	--	50	70	150	3	1
401002	Transportation Engineering	3	--	2	30	50	--	70	150	3	1
401 003	Structural Design and Drawing III	4	--	2	30	--	50	70	150	4	1
401 004	Elective I	3	--	2	30	50	--	70	150	3	1
401 005	Elective II	3	--	--	30	--	--	70	100	3	--
401 006	Project (Phase-I)	--	2	--	--	50	-	--	50	--	2
Total :		16	2	8	150	150	100	350	750	16	6
										22 Credits	

	Semester-II										
Subject code	**Subject**	**Teaching Scheme Hrs/Week**			**In-Semester Assessment**	**TW**	**Or**	**End-Semester Exam**	**Total**	**Credit**	
		Lect	**Tu**	**Pr**						**Th**	**Pr**
401 007	Dams and Hydraulic Structures	3	--	2	30	--	50	70	150	3	1
401008	Quantity Surveying, Contracts and tenders	3	--	2	30	--	50	70	150	3	1
401 009	Elective III	3	--	2	30	50	--	70	150	3	1
401 010	Elective IV	3	--	2	30	50	--	70	150	3	1
401 006	Project	--	6	--	--	50	100	--	150	--	6
Total :		12	6	8	120	150	200	280	750	12	10
										22 Credits	

Following will be the list of electives.

Semester I

Elective-I 401 004	Elective-II 401 005
1. Structural Design of Bridges	1. Matrix Methods of Structural Analysis
2. Systems Approach in Civil Engineering	2. Integrated Water Resources Planning and Management
3. Advanced Concrete Technology	3. TQM & MIS in Civil Engineering
4. Architecture and Town Planning	4. Earthquake Engineering
5. Advanced Engineering Geology with Rock Mechanics	5. Advanced Geotechnical Engineering

Semester-II

Elective-III 401 009	Elective-IV 401 010
1. Advanced Structural Design 2.Statistical Analysis and Computational Methods in Civil Engineering 3. Hydropower Engineering 4. Air Pollution and control 5. Finite Element Method in Civil Engineering 6. Airport and Bridge Engineering	1. Construction Management 2. Advanced Transportation Engineering 3. Advanced foundation Engineering. 4. Coastal Engineering **5. Open Elective** a) Plumbing Engineering b) Green Building Technology c) Ferrocement Technology d) Sub sea Engineering e) Geoinformatics

Savitribai Phule Pune University, Pune

BE Civil 2015 Course

Syllabus

Semester-I

401 001 Environmental Engineering – II

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs/week	**Paper In-sem : 30 Marks (1Hr.)**
Practical: 2 Hrs/week	**Paper End-sem : 70 Marks (2.5 Hrs.)**
	Oral : 50 Marks

Unit I **(6 Hrs.)**

Sewage quantity: Collection and conveyance of sewage, sources of sewage, variations in sewage flow, Flow quantity estimation (sewage and storm water quantification), design of storm water system, Design of circular sanitary sewers. Pumping of sewage, necessity, location. Effect of change of life style on sewage quality.

Characteristics of sewage: Methods of sampling, Physical, chemical and biological characteristics, Quality requirements for disposal and recycle/reuse of sewage as per CPCB norms.

Stream sanitation: Self-purification of natural streams, river classification as per MoEF & CC, Govt. of India; Oxygen Sag Curve, Streeter - Phelps equation and terminology (without derivation and numerical). National river cleaning plan.

Unit II **(6Hrs.)**

Sewage treatment: Pollution due to improper disposal of sewage, Introduction to sewage treatment, preliminary, primary, secondary and tertiary treatment, Unit operation and Process flow diagram for sewage treatment, Theory and design of screen chamber, Grit Chamber and Primary sedimentation tank as per the Manual of CPHEEO.

Unit III **(6 Hrs.)**

Theory & design of secondary treatment units: Introduction to unit operations and processes for secondary treatment. Principles of biological treatments, role of microorganism in wastewater treatment.

Activated sludge process: Theory and design of ASP, sludge volume index, sludge bulking & control, modifications in ASP. Operational problems and maintenance in ASP.
Concept of Sequential batch reactor (SBR) .

Trickling filter: Biological principle, different T.F media & their characteristics, design of standard rate and high rate filters using NRC formula, single stage & two stage filters, recirculation, ventilation, operational problems, control measures, theory of rotating biological contactors.

Unit IV **(6 Hrs.)**

Low cost treatment methods for rural areas

Oxidation pond: Bacteria – algae symbiosis, design of oxidation pond as per the manual of CPHEEO, advantages & disadvantages of oxidation ponds.

Aerated lagoons: Principle, aeration method, advantages & disadvantages of aerated Lagoons, design of aerated lagoon.

Introduction and theory of Phytoremediation technology for wastewater treatment. Introduction and theory of root zone cleaning system.

Unit V **(6 Hrs.)**

Onsite Sanitation Treatment systems: Septic tank**,** up-flow anaerobic filter. and Package Sewage Treatment Plant**-** Working principle, advantages and disadvantages. Introduction to MBR, MBBR and FMBR.

Anaerobic digester: Principle of anaerobic digestion, stages of digestion, bio – gas production its characteristics & application, factors governing anaerobic digestion,. Dewatering of sludge by gravity thickener, sludge drying bed, decanters. Methods of sludge treatment and disposal, advantages & disadvantages. Up-flow Anaerobic Sludge Blanket (UASB) Reactor– Principle, advantages & disadvantages.

Unit VI **(6 Hrs.)**

Industrial waste water treatment: Equalization and neutralization. Application of preliminary, primary and secondary treatment for industrial wastewater as per the CPCB norms.

Sources of waste water generation from manufacturing process, characteristics of effluent, different methods of treatment & disposal of effluent for the following industries: Sugar, dairy and distillery. Discharge standards as per CPCB norms.

Recycle & reuse of treated wastewater: Gardening, sewage farming, W.C. Flushing, reuse in industry.

Term Work:

A. Compulsory Assignment:

1. Brief report on Sewer materials, choice of materials, testing of sewer pipes, sewer appurtenances.
2. Design of septic tank.

B. Experiments:

The term work shall consist of a journal giving details of at least 8 out of 12 of the following experiments conducted in Environmental Engineering laboratory, of which, **Sr.No.12 is compulsory**.

Determination of

1. Solids -Total solids, suspended solids, volatile solids, settle able solids & non settle able solids.
2. Sludge Volume Index.
3. Dissolved oxygen.
4. Bio-Chemical Oxygen Demand.
5. Chemical Oxygen Demand.
6. Electrical Conductivity.
7. Determination of Phosphates by spectrophotometer.
8. Determination of Nitrates by spectrophotometer.
9. Determination of heavy metals like Cr6+ or Zn or Ni or Cd.
10. Determination of total nitrogen by Kjeldal method.
11. Visit to domestic / Industrial wastewater treatment plant & its detailed reports.

12. **Computer aided design of Sewage Treatment Plant (STP) OR Effluent Treatment** Plant (ETP) of Sugar or Dairy Industry using suitable software (C programming or any other suitable software).

Note: - Term Work should include a detailed analysis of practical interpretation, significance and application of test results.

Text Books:

1. Environmental studies by Rajgopalan- Oxford University Press.
2. Waste Water Treatment & Disposal – Metcalf & Eddy - TMH publication.
3. Environmental Engg. - Peavy, Rowe - McGraw Hill Publication.
4. Waste Water Treatment – Rao & Dutta.

Reference Books:

5. Waste Water Engg. – B.C. Punmia & Ashok Jain - Arihant Publications.
6. Water Supply & Waste Water Engg.- B.S.N. Raju – TMH publication.
7. Sewage Disposal & Air Pollution Engg. – S. K. Garg – Khanna Publication.
8. Environmental Engg. – Davis - McGraw Hill Publication.
9. Manual on sewerage and sewage treatment – Public Health Dept., Govt. of India.
10. Standard Methods by APHA.

I.S. Codes:

I.S. 3025 (all parts).

e – Resources:

i) http://nptel.iitm.ac.in/courses-contents/IIT Kanpur and IIT Madras.
ii) http://cpcb.nic .in
iii) http://moef.nic .in

401 002 Transportation Engineering

Teaching scheme
Lectures: 3 Hrs/week
Practical: 2 Hrs/week

Examination Scheme
In-Sem Exam: 30 Marks 1 Hr.
End-Sem Exam: 70 Marks 2.5 Hrs.
Term work: 50 Marks

Unit I **(6 Hrs.)**

Highway Development & Planning:

History, Development Plans, Classification of roads, Road Patterns, road development in India - Vision 2021 & Rural Road Development Vision 2025, Current road projects in India; highway alignment and highway project report preparation (Planning surveys & Master Plans based on saturation system).

Unit II: **(6 Hrs.)**

Geometric design of highways:

Introduction; highway cross section elements; sight distance, design of horizontal alignment; design of vertical alignment; design of intersections, problems, Highway drainage, Importance of highway drainage, subsurface and surface drainage systems.

Unit III **(6 Hrs.)**

Traffic engineering & control:

Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control devices (signs, signals, islands, road markings); Accident studies, types of road intersections; parking studies; highway lighting.

Unit IV **(6 Hrs.)**

Pavement materials:

Materials used in Highway Construction and related tests - Soil subgrade and CBR Test, Stone aggregates, bituminous binders, bituminous paving mixes, viscosity based gradation of bitumen, Modified Bitumen (Cutbacks, Emulsions, Crumbed Rubber Modified Bitumen – CRMB, Polymer Modified Bitumen-PMB, Foamed Bitumen), Marshall Stability Mix Design and Test (All 5 test parameters).

Unit V **(6 Hrs.)**

Pavement Design:

Introduction; flexible pavements – Computation of design traffic (Vehicle Damage Factor VDF, Lane distribution factor LDF, Traffic growth rate); stresses in flexible pavements; design guidelines for flexible pavements as per IRC 37-2012 (steps only); rigid pavements- components and functions; factors affecting design; stresses in rigid pavements (ESWL); design guidelines for concrete pavements as per IRC 58-2015 (steps only); joints in CC pavements, problems.

Unit VI **(6 Hrs.)**

A. Pavement Construction:

Construction process of GSB, WBM, WMM; Cemented base, Introduction to bituminous works such as prime coat, tack coat, seal coat, Built-up Spray Grout (BSG), Asphaltic Concrete (AC) or Bituminous Concrete (BC), Bituminous Macadam (BM), Dense Bituminous Macadam (DBM) and premix carpet, Dry lean Concrete (DLC), Pavement Quality Concrete (PQC).

B. Modern Trends in Highway Materials, Construction & Maintenance:

Mastic Asphalt, Cold Mix Asphalt Technology, Warm Mix Asphalt Technology, Recycled/Reclaimed Asphalt Pavement (RAP) (Manual Series - 2), Concept of Super pave Mix Design (Super pave Series 2), Non-Destructive Evaluation of Pavements (Falling Weight Deflectometer FWD).

Term work:

Term work shall consist of the following:

A. Practicals:

I. Tests on Aggregate (Any Five) :

1. Aggregate Impact Value Test
2. Aggregate Crushing Strength Test
3. Los Angeles Abrasion Test
4. Shape Test (Flakiness Index and Elongation Index)
5. Specific Gravity and Water Absorption Test by basket method
6. Stripping Value Test
7. Soundness Test

II. Tests on Bitumen (Any Five):

1. Penetration Test
2. Ductility Test
3. Viscosity Test (Tar Viscometer)
4. Softening Point Test
5. Flash Point & Fire Point Test
6. Specific Gravity Test
7. Bitumen Extraction Test

III. Tests on Aggregate Bitumen Combined:

1. Marshall Stability Test

IV. Tests on Soil Subgrade:

1. California Bearing Ratio Test (CBR Test)

B. Technical visits to:

1) Road Construction and/or RAP Site
2) Hot mix Plant with detailed report

Text Books:

1. Highway engineering – S.K. Khanna, C.E.G. Justo & A. Veeraragavan, Nem Chand and Brothers, Roorkee
2. Principles of Highway Engineering and Traffic Analysis (4^{th} edition) F. L. Mannering, Scott S. Washburn, Wiley India
3. Principles and practices of Highway engineering –Dr. L.R. Kadiyali, Khanna Publishers Delhi.

Reference Books:

1. A Course in Highway Engineering – S.P. Bindra, Dhanpat Rai and Sons, Delhi.
2. Principles of Transportation Engineering – G.V. Rao Tata MacGraw Hill Publication
3. Highway Engineering – Rangawala, Charotar publishing House, Anand 388001 (Gujrat)
4. Principles of Transportation Engineering – Partha Chakraborty, Animesh Das, Prentice Hall of India Pvt. Ltd., New Delhi.
5. Highway and Bridge Engineering – B.L. Gupta, Amit Gupta Standard publishers Distributors, Delhi.

Other References:

1. National Cooperative Highway Research Program (NCHRP)
2. Federal Highway Authority (FHWA)

Codes:

1. I.S. 1201 TO 1220-1978, IS 73, IS 2386 PART I toV
2. I.R.C. 58- 2015, IRC 37-2012
3. Specifications for Road and Bridge works (MORTH) 5th Revision, New Delhi.

e – Resources:

1. www.nptel.iitm.ac.in/courses/iitkanpur
2. www.cdeep.iitb.ac.in/nptel
3. www.fhwa.dot

401 003 Structural Design and Drawing III

Teaching Scheme:	**Examination Scheme:**
Lectures: 4 Hrs / week	**In Sem: 30 and End Sem : 70 Marks**
Practical: 2 Hrs/week	**Oral: 50 Marks**
	Duration: In-Sem: 1.5 Hrs.
	End-Sem: 3 Hrs.

Unit 1 **(8 Hrs.)**

Prestressed concrete – Analysis:

Introduction, Basic concepts, materials, various Pre-tensioning and Post-tensioning systems, concept of losses, Stress calculations, and concept of cable profile.

Unit 2 **(8 Hrs.)**

Prestressed concrete – Design:

Design of post tensioned prestressed concrete simply supported rectangular and flanged sections for flexure and shear including end block.

Design of one way and two way post tensioned slabs (Single panel only).

Unit 3 **(8 Hrs.)**

Design of Flat slab:

Introduction to flat slab, Design of prestressed two way flat slab by direct design method.

Unit 4 **(8 Hrs.)**

Earth retaining structures:

Introduction, Functions and types of retaining walls, Analysis and design of RCC cantilever type of retaining wall for various types of backfill conditions.

Unit 5 **(8 Hrs.)**

Liquid retaining structures:

Introduction, types, function, codal provisions, methods of analysis, Design of circular, square, and rectangular water tanks resting on ground by working stress method, Introduction to limit state design of water tanks.

Unit 6 **(8 Hrs.)**

Introduction to vibration and earthquake analysis:

Introduction to single and multi-degree of freedom systems: free, forced, un-damped and damped vibration, Estimation of earthquake forces by seismic coefficient method, Estimation of combined effect of lateral forces and vertical loading on G+2 storied frames.

Note: Design based on above unit shall conform to latest versions of IS 456, IS 875, IS 1343, IS 3370, IS 1893, IS 13920.

Term Work:

Term work shall be based on the above syllabus. It consists of

1) Assignment on calculation of losses in prestress.
2) Assignment on stress calculation in prestressed structures.
3) Design and detailing of design of prestressed girder.
4) Design and detailing of prestressed flat slab by direct design method.
5) Design and detailing of retaining wall for various loading conditions.
6) Design and detailing of ground resting water tank.
7) Report on analysis and design of any one of the structures listed in the syllabus using software or computer program.
8) Two site visit reports, one each on RCC and Prestressed concrete structure.

Note:

(a) There should be separate design problem statement for a group of students not exceeding *four* in numbers.

(b) Minimum four full imperial sheets based on two projects on design of RCC and two projects on design of prestressed concrete structural elements.

Text Books:

1. Limit state theory and design of reinforced - Dr. V. L. Shah and Dr S. R. Karve - Structures Publications, Pune.
2. Fundamentals of Reinforced Concrete- N.C. Sinha, S.K. Roy – S. Chand & Co. Ltd
3. Advanced design of structures- Krishnaraju - Mc Graw Hill.
4. Design of Prestressed concrete structures- T. Y. Lin.
5. Prestressed Concrete- N. Krishna Raju – Tata Mc Graw Hill Publication Co.
6. Earthquake resistant design of structures- Agarwal, Shrikhande, PHI learning.

Reference Books:

7. Comprehensive RCC Design - Punmia, Jain & Jain - Laxmi Publications.
8. Design of design of reinforced Concrete structures- M. L. Gambhir –PHI.
9. Reinforced Concrete, Vol I- Dr.H J. Shah Charotar Publishing House
10. Prestressed Concrete – A Fundamental Approach- Edward Nawy – PHI..
11. Reinforced concrete design- Pillai and Menon TMH.
12. Elementary Structural Dynamics-Selvam, Dhanpatrai Publications.

I.S. Codes

1. IS: 456: Indian Standard code of practice for plain and reinforced concrete, BIS, New Delhi.
2. IS: 1343: Indian Standard code of practice for Prestressed concrete, BIS, New Delhi.
3. IS: 1893: Indian Standard Code of practice for criteria for Earthquake resistant design of structures, BIS, New Delhi.
4. IS: 3370-Indian Standard code of practice for concrete structures for storage of liquids, BIS, New Delhi.

401 004 Elective I: (1) Structural Design of Bridges

Teaching Scheme:
Lecture: 3 Hrs/week.
Practical:- 2 Hrs/week

Examination Scheme:
In-sem. Exam.: 30 Marks (1 Hr.)
End Sem. Exam.: 70 Marks (2.5 Hrs.)
Term work: 50 Marks.

Unit 1 **(6 Hrs.)**

Introduction to RC highway bridges and steel railway bridges: Types of bridges, classification, IRC codal provisions for RC highway bridges, IRS codal provisions for railway steel bridges, loading standards.

Unit 2 **(6 Hrs.)**

RC highway bridges: Slab culvert and T-beam deck slab bridges – Design of slab culvert, Deck slab: Structural configuration, Piegaud‘s method, analysis and design of deck slab.

Unit 3 **(6 Hrs.)**

RC highway bridges: T-beam deck slab bridges – Post tensioned girders: Load distribution on longitudinal and cross girders, methods of analysis, analysis and design of longitudinal and cross girders.

Unit 4 **(6 Hrs.)**

Railway steel bridges – Truss bridges: Structural configurations, loads and load combinations, analysis and design of truss elements, longitudinal and cross-girders, bracing systems.

Unit 5 **(6 Hrs.)**

Bearings: Function of bearings, types of bearings, design of steel bearings and elastomeric bearings.

Unit 6 **(6 Hrs.)**

Sub-structure: Function, loads, analysis and design of RC abutments and piers, design of well foundation.

Note: The designs should conform to the latest codal provisions.

Term Work:

a) One project on RC highway bridges which shall include - the design of deck slab, longitudinal girder, cross-girder, bearings and abutment and pier.

The detailing shall be shown in at least three full imperial sheets.

b) One project on railway steel bridges which shall include – the design of truss elements, longitudinal girder, cross-girder, and bearings.

The detailing shall be shown in at least two full imperial sheets.

c) The term work can be prepared in a group of not more than four students in a group.

d) Report of at least two site visits covering the contents of the syllabus.

e) The projects can be done using any drafting software.

Reference Books:

1. Design of Bridges, N. Krishna Raju, Oxford and IBH Publishing Company Pvt. Ltd.
2. Design of Bridge Structures, M.A. Jayaram Prentice-Hall Of India Pvt. Limited. Prestressed Concrete, N. Krishna Raju, Tata-McGraw Hill.
3. Design of Steel Structures, Ramachandra, Standard Publications New-Delhi.

401 004 Elective I (2) - Systems Approach in Civil Engineering

Teaching scheme:	**Examination scheme:**
Lectures: 3 Hrs/week	**In semester exam: 30 marks---1 Hr.**
Practical: 2 Hrs/week	**End semester exam: 70 marks—2.5 Hrs.**
	Term Work: 50 marks.

Unit 1: Introduction of systems approach **(6 Hrs)**

(A) Introduction to System approach, Operations Research and Optimization Techniques, Applications of systems approach in Civil Engineering.

(B) Introduction to Linear and Non linear programming methods (with reference to objective function, constraints), Graphical solutions to LP problems.

(C) Local & Global optima, unimodal function, convex and concave function.

Unit 2: Stochastic Programming **(6 Hrs)**

(A) Sequencing– n jobs through 2, 3 and M machines.

(B) Queuing Theory : elements of Queuing system and it's operating characteristics, waiting time and ideal time costs, Kendall's notation, classification of Queuing models, single channel Queuing theory : Model I (Single channel Poisson Arrival with exponential services times, Infinite population (M/M/1) : (FCFS/ /).

(C) Simulation : Monte Carlo Simulation.

Unit3: Linear programming (A) **(6 Hrs)**

(A) The Transportation Model and its variants.

(B) Assignment Model, and its variants.

Unit 4: Linear programming (B) **(6 Hrs)**

(A) Formulation of Linear optimization models for Civil engineering applications. The simplex method.

(B) Method of Big M, Two phase method, duality.

Unit 5: Nonlinear programming **(6 Hrs)**

(A) Single variable unconstrained optimization: Sequential Search Techniques-Dichotomous, Fibonacci, Golden section.

(B) Multivariable optimization without constraints-The gradient vector and Hessian Matrix, Gradient techniques, steepest ascent/decent technique, Newton's Method.

(C) Multivariable optimization with equality constraints - Lagrange Multiplier Technique.

Unit 6: Dynamic programming, Games Theory & Replacement Model (6 Hrs)

(A) Multi stage decision processes, Principle of optimality, recursive equation, Applications of D. P.

(B) Games Theory – 2 persons games theory, various definitions, application of games theory to construction Management.

(C) Replacement of items whose maintenance and repair cost increase with time, ignoring time value of money.

Term Work :

1. One exercise/assignment on each unit. Out of these any one exercise/assignment to be solved using Computer.
2. One exercise on formulation of a problem applicable to any field of Civil Engineering, requiring use of LP/ NLP/ DP. Formulation of objective function and constraints (No solution).

Text Books :

1. Operations Research by Premkumar Gupta and D.S.Hira, S. Chand Publications (2014).
2. Engineering Optimization: Methods and Application-- A. Ravindran, K. M. Ragsdell— Wiley India.
3. Engineering Optimization by S. S. Rao.
4. Operations Research by Hamdy A. Taha.
5. Quantitative Techniques in Management by N.D. Vohra (Mc Graw Hill) .
6. Operations Research by Pannerselvam, PHI publications.

Reference Books :

1. Topics in Management Science by Robert E. Markland(Wiley Publication).
2. An Approach to Teaching Civil Engineering System by Paul J. Ossenbruggen.
3. A System Approach to Civil Engineering Planning & Design by Thomas K. Jewell (Harper Row Publishers).

e - Resources

1. Mathematical Model for Optimization (MMO Software).
2. nptel.iitm.ac.in/courses/webcourse-contents/IISc-Bang/OPTIMISATION METHODS/New-index1.html.

401004 Elective I (3) - Advanced Concrete Technology

Teaching scheme	**Examination scheme**
Lectures: 3 Hrs/week	**In semester exam: 30 Marks-1 Hr.**
Practical: 2 Hrs/week	**End semester exam: 70 Marks—2.5 Hrs.**
	Term Work: 50 Marks

Unit I **(6 Hrs.)**

Cement and its types: general, hydration of cement, alkali aggregate reaction. Grading curves of aggregates, Manufactured sand as fine aggregate, copper slag as fine aggregate.

Concrete: properties of concrete, w/b ratio, gel space ratio, Problems on maturity concept, aggregate cement bond strength, Green concrete, Guidelines for Quality control & Quality assurance of concrete, Effect of admixtures.

Unit II **(6 Hrs.)**

Structural Light weight concrete, ultra light weight concrete, vacuum concrete, mass concrete, waste material based concrete, sulphur concrete and sulphur infiltrated concrete, Jet cement concrete (ultra rapid hardening), gap graded concrete, high strength concrete, high performance concrete ,Self curing concrete, Pervious concrete, Geo polymer concrete .

Unit III **(6 Hrs.)**

Design of high strength concrete mixes, design of light weight aggregate concrete mixes, design of fly ash cement concrete mixes, design of high density concrete mixes, Design of pump able concrete mixes, Design of self-compacting concrete.

Advanced non-destructive testing methods: ground penetration radar, probe penetration, break off maturity method, stress wave propagation method, electrical/magnetic methods, nuclear methods and infrared thermographs.

Unit IV **(6 Hrs.)**

Historical development of fibre reinforced concrete, properties of metallic fibre, polymeric fibres, carbon fibres, glass fibres, Basalt fibres and naturally occurring fibres. Interaction between fibres and matrix (uncracked and cracked matrix), basic concepts and mechanical properties: tension and bending.

Unit V **(6 Hrs.)**

Properties of hardened frc, behavior under compression, tension and flexure of steel fibres and polymeric fibres, GFRC, SFRC, SIFCON,SIMCON -development, constituent materials, casting, quality control tests and physical properties.

Unit VI **(6 Hrs.)**

Ferrocement: Properties & specifications of ferrocement materials ,analysis and design of prefabricated concrete structural elements,manufacturing process of industrial concrete elements, precast construction, erection and assembly techniques.

Termwork / Labwork :

The Termwork / Labwork will be based on completion of assignments / practicals / reports of site visits, confined to the course in that semester.

1. Write a review on any recent research article from standard peer-reviewed journal.
2. Report on at least one patent (national/international)– on any topic related to concrete technology.
3. Concrete mix design and production in lab of any one – Self compacting concrete, Fiber reinforced concrete, light-weight concrete, high strength or ultra-high strength concrete . Comparison with traditional concrete mix is to be clearly stated in the report. 4. Cost analysis (material, labour, equipment, others) of any type of concrete for lab, in-situ and RMC production.
4. Perform any two Fresh (workability tests – Slump Flow Test, T-50, J-Ring, Visual Stability Index, Column Segregation, L-Box, U-box) and Hardened (Compressive, tensile, flexural) properties tests on any high performance concrete.
5. Any one experiment on any one of the topics – NDTs; Microscopic examination of cement/concrete; Performance study of any one admixture (Mineral/Chemical) in concrete.
6. Visit reports on minimum two site visits - exploring the field and practical aspects of concrete technology.

Note:

Term Work should include a detailed analysis of practical interpretation, significance and application of test results including above contents and site visit report in form of journal.

Text books:

1. Concrete Technology --M.S. Shetty, S. Chand Publications.
2. Concrete Technology -- A R Santhakumar, Oxford University Press.
3. Concrete technology -- M. L. Gambhir, Tata Mcgraw Hill Publications.
4. Fiber Reinforced Cement Composite- P.N.Balguru & P.N.Shah.
5. Concrete: Microstructure, Properties and Materials-- P. Kumar Mehta and P. S. M. Monteiro-- Tata Mc-Graw Hill Education Pvt. Ltd.

Reference Books:

1. Handbook on Advanced concrete Technology Edited by N V Nayak,A .K.Jain, Narosa Publishing House .
2. Design of concrete mixes by Raju N Krishna, CBS Publisher.
3. Properties of concrete by A. M. Neville, Longman Publishers.
4. Concrete Technology by R.S. Varshney, Oxford and IBH.
5. Concrete technology by A M. Neville, J.J. Brooks, Pearson.
6. Ferrocement Construction Mannual-Dr. D.B.Divekar-1030, Shivaji Nagar,Model Colony, Pune.
7. Concrete Mix Design-A.P.Remideos--Himalaya Publishing House (ISBN-978-81-8318-996-5
8. Concrete, by P. Kumar Metha, Gujrat Ambuja.
9. Learning from failures----- R.N.Raikar.
10. Structural Diagnosis----- R. N. Raikar.
11. Concrete Mix Design --Prof. Gajanan Sabnis.

General Reading suggested:

1) Codes : i) IS 456 ii) IS 383 iii) IS 10262-2009 iv) IS 9103.
2) Ambuja cement booklets on concrete Vol .1 to 158.
3) ACC booklets on concrete.

401 004 Elective I (4)- Architecture and Town Planning

Teaching scheme:	**Examination scheme:**
Lectures: 3 Hours/week	**In semester exam: 30 marks-1 Hr.**
Practical: 2 Hrs/week	**End semester exam: 70 marks-2.5 Hrs.**
	Term Work: 50 marks

Unit I **(6 Hrs.)**

• Principles and elements of Architectural Composition.

• Qualities of Architecture: user friendly, contextual, ecofriendly, utility of spaces, future growth etc.

• Role of –Urban Planner and Architect‖ in planning and designing in relation with spatial organization, utility, demand of the area and supply.

Unit II: **(6 Hrs.)**

• Landscaping: importance , objectives, principles, elements, material (soft and hard).

• Urban renewal for quality of life and livability.

• Importance of sustainable architecture with case study.

Unit III: **(6 Hrs.)**

• Goals and Objectives of planning; components of planning; benefits of planning.

• Levels of planning: Regional plan, Development Plan, Town Planning Scheme.

• Neighborhood plan; Types of Development plans: Master Plan, City Development Plan, Structure Plan.

Unit IV: **(6 Hrs.)**

• Various types of civic surveys for DP: demographic, housing, land use, Water Supply & sanitation, etc.

• Planning agencies for various levels of planning. Their organization and purpose (CIDCO-MHADA-MIDC, MMRDA/ PMRDA etc).

• Traffic transportation systems: urban road, hierarchy, traffic management, Intelligent Transport Systems.

Unit V: **(6 Hrs.)**

• Legislative mechanism for preparation of DP: MRTP Act 1966.

• UDPFI guidelines (for land use, infrastructure etc.), SEZ, CRZ, Smart City Guidelines.

Unit VI : **(6 Hrs.)**

• Special townships, Land Acquisition Rehabilitation and Resettlement Act 2013.

• Application of GIS, GPS, remote sensing in planning.

Term Work: - 50 Marks

Sr. no. 1 and 2 are compulsory and any four from remaining.

1. Study and analysis of Development Plan with respect to land use, services, infrastructure, street furniture, housing etc. (group work).
2. Neighborhood- planning (group work).
3. Report on contribution of Engineers, Planners and Architects in post-independence India (individual work).
4. Report on any existing new towns and planned towns like new Mumbai, Gandhinagar, PCNTDA etc.(infrastructure, disaster management etc), (individual work).
5. Study of salient features of urban renewal schemes (group work).
6. Study of any existing town planning scheme (group work).
7. Smart City approaches (individual work).
8. Study of Special Townships: (site visit) (group work).
9. Study of urban housing and housing change (group work).

Text Books:

1. Town Planning By G K Hiraskar --Town Planning by S Rangwala.
2. Building Drawing and Built Environment- 5th Edition – Shah, Kale, Patki--Planning Legislation by Koperdekar and Diwan.
3. G. K. Bandopadhyaya, –Text Book of Town Planning‖.
4. Climate Responsive Architecture – Arvind Krishnan.
5. Introduction to Landscape Architecture by Michael Laurie.

Reference Books:

- MRTP Act 1966.
- Manual Of Tropical Housing And Building By Koenigsbeger.

- Sustainable Building Design Manual.
- UDPFI Guidelines.
- ‒The Urban Pattern: City planning and design‖ by Gallion and Eisner.
- Design of cities by Edmond bacon.
- LARR Act 2013.
- MoUD By GoI.
- Web sites of NRSA, CIDCO, MHADA, MIDC, MMRDA, PMRDA.

401004 Elective-I (5) Advanced Engineering Geology with Rock Mechanics

Teaching Scheme:
Lecture: 3 Hrs/week
Practical: 2 Hrs/week

Exam. Scheme:
In Sem: 30 Marks (1 Hr.)
End Sem: 70 Marks (2.5 Hrs.)
Termwork: 50 Marks

Unit I: (6 Hrs.)

Indian Geology, Seismic Zones and Geological Studies in Engineering Projects.

Geological Map of India with special reference to Maharashtra. Distribution and Geological characters of Major rock formations of India. Engineering characters of major rock formations of India. Engineering characters of major rock formations of India. Engineering characters of major rock formations of India. Engineering characters of major rock formations of India.

The study of Plate Tectonics and highlights of Seismic Zones of India. Importance of geological studies in engineering investigations.

Unit II (6 Hrs.)

Geohydrological characters of rock formations and Geological process of Soil formations

Geohydrological characters of major rock formations of India:

Geohydrological characters and factors controlling various characters of rocks. Introduction to morphometric analysis. Various water conservation techniques, effect of over exploitation of tube wells, bore wells and dug wells. Artificial recharge, rainwater harvesting, watershed development and necessity of geological studies. Relevant case studies highlighting success and failure of these techniques.

Geological Process of Soil formations:

Effect of climate on formation of soil. Soil profile of different states in India.

Rock weathering conditions favorable for decomposition, disintegration, residual and transported soils.

UNIT III (5 Hrs.)

Resource Engineering, Role of Geology in planning and development.

Resource Engineering:

Utility of various rock formations as construction material. Illustrative case studies.

Geological Hazards and mitigation.

Role of Geology in planning and development:

Influence of geological factors upon urban development & planning. Reclamation of abandoned grounds and mining regions, illustrative examples.

UNIT IV: (6 Hrs.)

Rock Mechanics and Geophysical techniques.

Rock Mechanics:

General principles of rock mechanics. Dependence of physical and mechanical properties of rocks on geological characters.

Analyzing and evaluating of core recovery, R.Q.D. and Joint Frequency Index.

Various Methods of Geomechanical classifications of rocks such as Terzahagi, U.S.B.M, R.M.R., R.S.R., Q- system, Deer and Miller, Bieniawaski's geomechanical classification etc.

Geophysical techniques :

Electrical Resistivity method and Seismic method of exploration. Evaluation and analyzing the data produced through electrical resistivity for the determination of thickness of overburden, locating ground water potential zones which leads for strengthening the major civil projects.

UNIT V (7 Hrs.)

Subsurface Geological Explorations for various projects; Foundation Treatments, Tail Channel Erosion.

Subsurface Explorations for Dams, Reservoir, Percolation Tanks:

The strength and water tightness of rocks found at the dam, reservoir and percolation tank site. Case studies illustrating the success and failure of major projects owing to negligence of geological studies. Earthquakes occurring in the areas of some dams and RIS theories.

Geological Foundation Treatments for various Civil Engineering Projects:

Foundation investigation during construction of projects for assessing various geological defects in rocks and suggesting appropriate remedial measures by various methods of grouting.

Erosion of Tail Channels:

Geological reasons for selection of site for spillway, causes of erosion of tail channel. Relevant Case studies.

Unit VI: **(6 Hrs.)**

Geological exploration for Tunnels and Bridges

Geological exploration for Tunnels:

Variations in methodology of investigation for different types of tunnels for different purposes, location, spacing, angles & depths of drill holes suitable for different types of tunnels.

Difficulties introduced in various geological formation and their unfavorable field characters. Standup time of rock masses and limitations of it.

Dependence of protective measures such as guniting, rock bolting, shotcreting, steel fiber shotcreting, permanent steel supports, lagging concreting & grouting above permanent steel supports on geological conditions. Illustrative case studies.

Bridges Investigation for bridge foundation, difference in objectives of investigation of bridge foundation. Bridge foundation based on nature & structure of rock. Foundation settlements. Case studies.

Practical Work / Term Work

i. Study of Geological map and seismic zone map of India **(2 Practicals)**

ii. Study of Morphometric Analysis of river, (topsheet will be made available by the college) **(1 Practical)**

iii. Study of Soil Profile, weathering index and clay geology. **(1 Practical)**

iv. Use of electrical resistivity method for determining depth of bedrock. **(1 Practical)**

v. Engineering Classification of rocks and Computation of RQD & Joint Frequency Index **(1 Practical)**

vi. Interpretation of drill hole data. Logging of drill cover, preparation of Litho logs & interpretation of drill data. Preparing geological cross sections from drill hole data & using them for designing of civil engineering structures representing following case studies.

1. Dipping sedimentary formation.
2. Faulted region.
3. Folded region.
4. Locating spillway.
5. Tunnels in Tectonic areas.
6. Tunnels and open cuts in non-tectonic areas. **(6 Practicals)**

vii. A compulsory guided tour to study geological aspects of an engineering projects & writing a report based on studies carried out during visits to civil engineering projects.

Note:

Field visits will be made to different places around study area and one study tour to important geological places.

The practical journal will be examined as term work**.**

REFERENCE BOOKS AND TEXT BOOKS:

1. Jaeger J. C., Cook N. & Zimmerman R. – Fundamentals of Rock Mechanics, Blackwell Scientific Publications.
2. Goodman R. E. – Introduction to Rock Mechanics, John Wiley & Sons.
3. Bieniawski Z. T. - Engineering Classification of jointed Rock Masses.
4. M. B. Dobbrin - Introduction to Geophysical Prospecting, McGraw Hill Inc., USA.
5. B. P. Verma - Introduction to Rock Mechanics, Khanna Pub New Delhi.
6. Keller E A - Environmental Geology, Prentice – Hall Publication.
7. Subinoy Gangopadhyay - Engineering Geology, Oxford University Press.
8. Vasudev Kanithi – Engineering Geology, Universities Press.
9. Dr. J. B. Auden Commemorative Volume – Indian Soc. Of Engineering Geology, Culcutta.
10. Seminar on Engineering and Geological Problems in Tunneling (Part 1 & 2) – Indian Society of Engineering Geology, New Delhi.

Handbooks:

a. Gupte R. B. (1980) – P. W. D. Handbook Chapter –6, Part-II ‗Engineering Geology Government of Maharashtra.

b. Tunneling India '94, ‒Central Board of Irrigation and Power‖, New Delhi.

c. Manual on Rock Mechanics, Central Board of Irrigation and Power, New Delhi, 1988.

d. Handbook of Geology in Civil engineering, Robert Fergussion, Legget, Mc- Graw hill.

I. S. Codes

a. IRC code of practice for Road Tunnels. IRC-78-2000; IS-12070; IS-1336 Part I and II.

b. I. S. 4453-1967 Code of practice for Exploration, pits, trenches, drifts & shaft.

c. I. S. 6926-1973 Code of practice for diamond drilling for site investigation river valley project.

d. I. S. 4078-1967 Code of practice for Logging and Storage of Drilling Core.

e. I. S. 5313-1969 Guide for core drilling observation.

e- Resources:

1. www.ebd.co.in/undergraduate/eng
2. www.library.iisc.ernet.in
3. www.iitb.ac.in
4. www.nptel.iitm.ac.in
5. Free online course-swayam-https//swayam.gov.in
6. Open source course management – https//moodle.org

401 005 Elective-II (1) Matrix Methods of Structural Analysis

Teaching scheme:
Lectures: 3 Hrs/week

Examination scheme:
In semester exam: 30 marks (1 Hr.)
End semester exam: 70 marks (2.5 Hrs.)

Unit I: Computational Techniques (6 Hrs)

Review of matrix algebra, computer oriented numerical methods-Gauss elimination, Gauss Jordon and Gauss Seidel. Computer algorithm and flowcharts of above methods.

Unit II: Flexibility matrix method for beams and frame (6 Hrs)

Degree of static indeterminacy, flexibility, selection of redundant, flexibility matrix, analysis of indeterminate continuous beams and simple portal frames involving not more than three unknowns.

Unit III: Stiffness matrix method for bars and trusses (6 Hrs)

a) Degree of kinematic indeterminacy (degrees of freedom), local and global coordinate systems, stiffness matrices of a axially loaded bar members, global stiffness matrix, analysis of determinate/indeterminate bars involving not more than three unknowns using member approach.
b) Stiffness matrices of a truss member with four DOF, transformation matrix, global stiffness matrix, analysis of determinate/indeterminate trusses involving not more than three unknowns using member approach.

Unit IV: Stiffness matrix method for beams (6 Hrs)

a) Structure approach: Degree of kinematic indeterminacy, problems involving not more than three unknowns.
b) Member approach: Derivation of stiffness matrix for beam member, Global stiffness matrix, problems involving not more than three unknowns.

Unit V: Stiffness matrix method for frames (6 Hrs)

a) Structure approach: Degree of kinematic indeterminacy, problems involving not more than three unknowns.
b) Member approach: Derivation of stiffness matrix for plane and space frame member, transformation matrix, global stiffness matrix, problems involving not more than three unknowns.

Unit VI: Stiffness matrix method for grid structures **(6 Hrs)**

a) Structure approach: Degree of kinematic indeterminacy, problems involving not more than three unknowns.

b) Member approach: Derivation of stiffness matrix for grid member, transformation matrix, global stiffness matrix, problems involving not more than three unknowns.

Reference Books:

[1] Matrix Methods of Structural Analysis- Wang, C. K., International Textbook Co., 1970.

[2] Matrix Analysis of Framed Structures – Gere & Weaver- CBS Publications, Delhi.

[3] Matrix & Finite Element analysis of structures – A.H. Shaikh and Madhujit Mukhopadhyay.

[4] Numerical Methods for Engineering – S.C. Chapra& R.P. Canale Tata McGraw Hill Publication.

[5] Structural Analysis – A Matrix Approach – Pandit & Gupta - Tata McGraw Hill Publication.

[6] Matrix Methods of Structural Analysis – Meghre & Deshmukh- Charotar Publishing House, Anand.

401005 Elective-II (2) Integrated Water Resources Planning & Management

Teaching Scheme: Lectures: 3 Hrs / week

Examination Scheme:
Paper In-sem. 30 Marks (1 hr),
Paper End-sem : 70 Marks (2.5 hr)

Unit1: (6 Hrs)

a) Introduction :World water resources, water resources in India, water as finite resource, variability of water in time & space, history of water resources development, water infrastructure-problems and perspectives, present institutional framework for water management.

b) Water laws: Constitutional provisions, National Water Policy, riparian rights / ground water owner ship, prior appropriation, permit systems, acquisition and use of rights, scope for privatization. EPA 1986, MWRRA act.

Unit2: Economics & Paradigm shift in water management (6 Hrs)

a) Economics of water :Water as economic good, intrinsic value, principles of water pricing & water allocation, capital cost, opportunity cost, internal rate of return, benefit cost analysis, principles of planning and financing of water resources project : Discussion on any two case studies.

b) Paradigm shift in water management:

Global and national perspectives of water crisis, water scarcity, water availability and requirements for human and nature, concepts of _blue water‘, _Green water‘, and _virtual water‘, and their roles in water management. Sustainability principles for water management, framework for planning a sustainable water future.

Unit 3: Basin scale flogy (6 Hrs)

a) Estimation of surface water, estimation of ground water draft/recharge import/export of water (inter basin water transfer, interlinking of national river), recycling and reuse and storage, control of water logging, salinity, & siltation of storages.

b) Flood & Drought management: causes of floods, structural and non-structural measures, mitigation plan, flood damage assessment, use of geoinformatics for flood management. Types of droughts, severity index, drought forecasting, damage assessment, mitigation plan, use of geoinformatics for drought management.

Unit 4: Water demand and supply based management **(6 Hrs)**

a) Consumptive & non consumptive demands, irrigation demand estimation, water utilization, irrigation efficiency, water management in irrigation sector.

b) Demand estimation in hydro/thermal/nuclear power sector, estimation & forecasting of water demands of domestic & industrial sector, navigation and recreational water demands.

Unit 5: Environmental and social aspects **(6 Hrs)**

a) Environmental management: protection of vital ecosystem, water requirements for environmental management, aquaculture, minimum flows, environmental flow, water quality management for various uses.

b) Social impact of water resources development: direct/ indirect benefits, employment generation, industrial growth, agro-industry, enhanced living standards, education & health, co-operative movement, management of rehabilitation & resettlement, interstate dispute of water sharing and tribunals, sectorial conflicts.

Unit6: Basin planning &Watershed management **(6 Hrs)**

a) Perspective plan for basin development & management, Decision support system for Integrated Water Resources Management (IWRM), use of data driven techniques like Artificial Neural Networks, Genetic programming, Model Tree in water resources planning, development & management.

b) Watershed Management:

Watershed definition, classification of watersheds, integrated approach for watershed management, role of RS & GIS in watershed management, soil and water conservation-necessity- soil erosion-causes- effects-remedial measures, contour bunding-strip cropping-bench terracing-check dams, farm ponds, percolation tank.

Text Books:

1) Water Resources Systems Engg, D. P. Loucks, Prentice Hall
2) Water Resources Systems Planning and Management, Chaturvedi, M.C. Tata McGraw Hill
3) Economics of Water Resources Planning, James L.D and Lee R.R, McGraw Hill
4) Water resources hand book; Larry W. Mays, McGraw International Edition
5) Design of Water Resources Systems, Arthur Mass, MacMillan 1962
6) Water resource system, Pramod .R. Bhave - Narosa Publication

Reference Books:

1. Economics of Water Recourses Planning, L. D. James & R.R.Leo, McGraw Hills, NY 1971.
2. Water Resources Systems Engineering, W. A. Hill & J. A. Dracup.
3. Water shed Management – B.M. Tideman
4. Watershed management –J. V. S. MURTY, new Age International Publisher.
5. Integrated Watershed Management Perspectives and Problems - Beheim, E., Rajwar, G.S., Haigh, M., Krecek, J. (Eds.) , Springer Publication.
6. Managing Water in River Basins: Hydrology, Economics and Institutions -- M. Dinesh
7. Kumar, Publisher: Oxford Universit Press
8. Water Resources Design Planning Engg. and Economic; Edward Kuiper, Butterworth & Co.
9. ANN in Hydrology; Govinda Raju & Ramachandra Rao; PHI
10. Integrated Water Resources Management in Practice: Better Water Management for Development - R. L. Lenton, Mike Muller , Publisher Earthscan.
11. Sustainability of Integrated Water Resources Management - Editors**:** Setegn, Shimelis Gebriye, Donoso**,** Maria Concepcion (Eds.) Publisher Springer International Publishing .
12. Integrated Water Resources Management in the 21st Century: Revisiting the paradigm -Pedro Martinez-Santos, Maite M. Aldaya, M. Ramón Llamas, Publisher CRC Press, Taylor & Francis Group.
13. Key Concepts in Water Resource Management: A Review and Critical Evaluation - Jonathan Lautze, publisher Routledge.
14. Water Management – Jasapal Singh, M.S.Achrya, Arun Sharma – Himanshu Publication.

e – Resources:

1. nptel.iitm.ac.in/courses /webcourse-contents / IISc-Bang/water resource management.

401 005 Elective II (3) TQM and MIS in Civil Engineering

Teaching scheme:
Lectures: 3 Hrs/week

Examination scheme:
In semester exam: 30 marks---1 Hr.
End semester exam: 70 marks—2.5 Hrs.

Unit I: Quality in Construction (6 Hrs)

a) Quality – Various definitions and interpretation. Importance of quality on a project in the context of global challenges, Factors affecting quality of construction, Reasons for poor quality & measures to overcome, Contribution of various Quality Gurus(Juran, Deming, Crossby, Ishikawa).
b) Evolution of TQM- QC, TQC, QA, QMS, TQM.

Unit II: TQM & Six Sigma (6 Hrs)

a) TQM – Necessity, advantages , 7QC tools, Quality Function Deployment(QFD).
b) Six sigma – Importance, levels.
c) Defects & it‘s classification in construction. Measures to prevent and rectify defects.

Unit III: ISO & Quality Manual (6 Hrs)

a) Study of ISO 9001 principles.
b) Quality manual – Importance, contents, documentation. Importance of check-lists in achieving quality. Typical checklist for concreting activity, formwork activity, steel reinforcement activity.
c) Corrective and Preventive actions, Conformity and NC reports.

Unit IV: Management Control & Certifications (6 Hrs)

a) Benchmarking in TQM, Kaizen in TQM.
b) Quality Circle.
c) Categories of cost of Quality.
d) CONQAS, CIDC-CQRA certifications.

Unit V: Techniques in TQM Implementation and awards (6 Hrs)

a) 5 _S‘ techniques.
b) Kaizen.
c) Failure Mode Effect Analysis (FMEA).

d) Zero Defects.
e) National & International quality awards- Rajeev Gandhi Award, Jamuna lal Bajaj Award, Golden Peacock Award, Deming Prize, Malcolm Baldrize award.

Unit VI: MIS **(6 Hrs)**

a) Introduction to Management Information systems (MIS) Overview, Definition.
b) MIS and decision support systems, Information resources, Management subsystems of MIS, MIS based on management activity whether for operational control, management control, strategic control.
c) Study of an MIS for a construction organization associated with building works.

Text Books:

1. Total Quality Management-- Dr. Gunmala Suri and Dr. Puja Chhabra Sharma—Biztantra.
2. Quality Control and Total Quality Management by P.L.Jain- Tata McGraw Hill Publ. Company.
3. Total Quality Management - Dr. S.Rajaram and Dr. M. Sivakumar—Biztantra.
4. Total Engineering Quality Management – Sunil Sharma – Macmillan India Ltd.

Reference Books:

1. Juran's Quality Handbook – Juran Publication. Importance of quality on a project in the context of global challenges. Importance of quality on a project in the context of global challenges.
2. Management –Principal, process and practices by Bhat – Oxford University Press.
3. Financial management by Shrivastava- Oxford University Press.
4. Management Information Systems – Gordon B. Davis, Margrethe H. Olson – Tata McGraw Hill Publ. Co.
5. Total Project Management – The Indian Context - P.K.Joy Macmillan India Ltd.

E- Sources:

www.nptel.ac.in , www.mobile.enterpriseappstoday.com

401 005 Elective II (4) Earthquake Engineering

Teaching scheme:
Lectures: 3 Hrs/week

Examination scheme:
In semester exam: 30 marks---1 Hr.
End semester exam: 70 marks—2.5 Hrs.

Unit I

Introduction to earthquakes: (6 Hrs.)

Geology of earth, configuration of tectonic plates in a globe, influence of Geology on earthquake, behavior of plates, their motion and effects, causes of earthquake and their Characteristics, Earthquake parameters, magnitudes, intensity, scales, classification of earthquake seismic zoning of India, seismic coefficients for different zones, .Lessons from past earthquake: - Study of damages caused due to past, earthquakes in/ outside India and remedial measures.

Unit II (6 Hrs.)

Theory of vibrations:

Vibrations - definition, causes, classifications. Single Degree of Freedom systems (SDOF) - Free, forced, damped, un-damped vibrations with basic examples. Introduction to Multi-degrees of Freedom systems (MDOF) - derivations of related equations and solutions to two degree and three degree of freedom systems.

Unit III (6 Hrs.)

Static analysis of earthquake forces:

Introduction to IS1893 (Part-I): Seismic design Philosophy, provision, Seismic coefficient method.

Unit IV (6 Hrs.)

Dynamic analysis of earthquake forces:

Response Spectra, estimation of story shear, effect of unsymmetrical geometry and masses, mass center and stiffness center, estimation of story shear for symmetrical and torsion for unsymmetrical buildings. Effect of infill masonry and shear walls.

Unit V **(6 Hrs.)**

Earthquake force calculation and analysis and design of frames

Estimation of combined effect of lateral forces and vertical loading on multi storeyed frames. Design any intermediate continuous beam of the frames for combined effect of loadings, Concept of ductile detailing, IS 13920 provisions for RC frame.

Unit VI **(6 Hrs.)**

Introduction of different control systems: Passive control: base isolation and active control: bracing system. Strengthening and Retrofitting techniques, methodology of retrofitting for walls, slabs roofs columns, foundations etc. for buildings in stones, bricks, RCC. Introduction to Disaster Management: Types of Disaster, Phases of disaster management, Disaster rescue, psychology and plan of rescue operations.

Notes:

Every design should confirm to latest versions of IS 1893, 4326, 13920, 13827, 13828, 13935

Text Books:

1. Earthquake resistance design of structure by Duggal- Oxford University Press.
2. Earthquake – Resistant Design of Building Structures-Dr. Vinod Hosur-- Wiley India.
3. Earthquake Tips NICEE, IIT, Kanpur.
4. Elements of Earthquake Engineering by Jaikrishna and Chandarsekaran.
5. Earthquake resistant design of structures- Agarwal, Shrikhande, PHI learning.

Reference Books:

1. Dynamics of structure by Clough R.W. and Penzin J. McGraw Hill Civil Engineering Series.
2. Dynamics of structure by Anil Chopra, Prentice Hall India Publication.
3. Dynamics of structure by Mario Paz, CBSPD Publication.
4. Geo-technical Earthquake Engineering by Kramer S. L. Prentice Hall India Publication.
5. Introduction to Structural Dynamics by John M. Biggs.
6. Mechanical Vibrations by V. P. Singh.
7. Relevant Latest Revisions of IS codes.

401 005 Elective II (5)- Advanced Geotechnical Engineering

Teaching scheme:	**Examination scheme:**
Lectures: 3 hours/week	**In semester exam: 30 marks---1 hour**
	End semester exam: 70 marks—2.5 hours

Unit I **(6 Hrs.)**

(a) Soil classification Identification and classification, criteria for classifying soil - classification on the basis of grain size, plasticity, symbolic & graphic presentation. Classified soils and engineering properties. (b) Soil structure & clay minerals Clay minerals, clay water relations, clay particle interaction, soil structure & fabric, granular soil fabric.

Unit II **(6 Hrs.)**

(a) Earth pressure theory Earth pressure theories for calculation of active and passive pressure, Rankines and coulombs earth pressure theories, analytical and graphical methods. (b) Design of earth retaining structures Design of gravity and cantilever retaining walls, design - cantilever sheet pile walls, anchored sheet pile walls, timbering and bracing for open cuts.

Unit III **(6 Hrs.)**

(a) Geosynthetics Geosynthetics- types, functions, properties and functional requirements. Application of geosynthetics in geoenviroment. (b) Reinforced soil Mechanism, reinforcement soil – interaction. Applications – reinforcement soil structures with vertical faces, reinforced soil embankments. Reinforcement soil beneath unpaved roads, reinforcement of soil beneath foundations. Open excavation and slope stabilization using soil nails.

Unit IV **(6 Hrs.)**

(a) Soil behavior under dynamic loads Soil behavior under static and dynamic loads. Acceptable levels of strain under static and dynamic loading. Soil properties relevant for dynamic loading and its determination.

(b) Machine foundations: Types of machine foundations, design criteria, methods of analysis – elastic half space method, linear elastic weightless spring method. Evaluation of soil parameters. Design procedure for a block foundation for cyclic loading and impact loading.

Unit V **(6 Hrs.)**

Ground Improvement In-situ ground improvement by compaction piles, dynamic loads, sand drains, grouting, deep mixing, inserting reinforcement elements, freezing soil, and vibroflotation.

Unit VI **(6 Hrs.)**

Rheology Rheological elements, basic and composite rheological models. Examples of compound models used to explain different soil phenomena; such as secondary consolidation, creep etc.

Reference Books:

1. Physical and Geotechnical properties of soils- Joseph E. Bowels, Tata Mac-Grawhill.
2. Advance Soil Mechanics – Braja Mohan Das- Tata Mc- Grawhill.
3. Geotechnical Engineering by Shashi K. Gulati & Manoj Datta – Tata Mc-Grawhill.
4. Basic and Applied Soil Mechanics- Gopal Ranjan & A.S. Rao- New Age Publication.

Codes:

1. I.S .Codes 1. IS: 1892-1979 – ―Code of Practice for Subsurface Investigation for Foundation‖.
2. 2. IS: 2131-1981 (Reaffirmed 1997), ―Method for Standard penetration Test for Soils‖.

Handbooks:

1. Bolt, Bruce A.(1999),‖Earthquakes‖, W. H. Freeman.
2. Baghi, A., (1994)‖ Design, Construction and Monitoring of Landfills.‖ John Wiley & Sons.
3. Day. R.W.(2002),‖Geotechnical Earthquake Engineering Handbook‖,McGraw Hill.

e -Resources:

1. Website www.nptel.iitm.ac.in

401006 Project Phase-I

Teaching Scheme: **Examination Scheme:**

Tutorial: 2 Hrs/week **TW: 50 Marks.**

Project phase I Term Work will be evaluated for an individual student based on the seminar presented on the work done in first semester and submission of the report. If the student fails to present the seminar and submit the report, he / she will be marked absent in project examination. The project work phase I shall be consist of any one of the following nature in Civil Engineering related subjects.

1. Experimental investigation.
2. Software development.
3. Benefits cost economic analysis.
4. Case study with own design.
5. Working model design and fabrication.
6. Case study with development of methodology using soft computing tools.

It is mandatory to present a seminar in presence of Internal and External Examiners and submit preliminary project report based on work done in first semester. The report shall contain finalization of topic, literature survey, planning schedule/ flow chart for completion of project. The report shall be typed or printed and hard/spiral bound. The project work to be taken up individually or in groups. The group shall not be of more than 4 students. References shall be mentioned at the end as per universal standards as mentioned in any international journal of professional body.

Format of project report: Sequence of pages:

i) Front Cover Page ii) Certificate iii) Acknowledgement iv) Synopsis v) Contents vi) Notations vii) List of Tables viii) List of Figures ix) List of Graphs.

Chapter 1 Introduction (This consists of: 1.1 Introduction of the Project Work; 1.2 Problem Statement, 1.3 Objectives and 1.4 Scope of the Project Works, 1.5 Research Methodology, 1.6 Limitations of study, 1.7 Expected outcome.

Chapter 2 Literature Review from minimum 10 articles (It shall include theoretical support, details regarding work done by various persons, methods established, any new approach. It should preferably highlight the development in the field of research chronologically as reflected from books, journals etc.).

Chapter 3 Planning Schedule/ Flow Chart For Completion of Project References and Bibliography (The references and bibliography shall include name of author/code/manual/book, title of paper/code/manual/book, name of the journal, month & year of publication, volume number/ISBN number, page number x-y. The references and bibliography shall be as per universal standards as mentioned in any international journal of professional body).

Report Printing details:

1. Report shall be typed on A4 size Executive Bond paper with single spacing preferably on Both sides of paper.
2. Margins: Left Margin: 37.5 mm, Right Margin: 25 mm, Top Margin: 25 mm, Bottom Margin: 25 mm.
3. Give page number at bottom margin at center.
4. Size of Letters: Chapter Number: 16 font size, Times New Roman in Capital Bold Letters, Chapter Name: 12 Font size in Capital Bold Letters, Main Titles (1.1, 2.5 etc): 16 Font size in Bold Letters Sentence case, Sub Titles (1.1.5, 4.5.1 etc): 14 Font size in Bold Letters- Sentence case. All other matter: 12 Font size sentence case.
5. No blank sheet be left in the report.
6. Figure name: 12 Font size in sentence case Bold- Below the figure.
7. Table title -12 font size in sentence case- Bold-Above the table.

Semester-II

Savitribai Phule Pune University Board of Studies in Civil Engineering B.E. Civil 2015 Course (w. e. f. June 2018)

401007 Dams and Hydraulic Structures

Teaching Scheme:
Lectures: 3 hours/week
Practical: 2 hours/week

Examination Scheme:
In-sem: 30 marks (1 Hour)
End-sem :70 marks (2.5 Hours)
Oral : 50 marks

Unit I **(4 Hrs.)**

a) Introduction to dams

Introduction, Historical development of dams, Different terms related to dams, Selection of site for dam, Factors governing selection of type of dam, Classification of dams, Classification based on purpose, Classification based on materials, Classification based on size of project, Classification based on hydraulic action, Classification based on structural action, Dams and earthquakes, Dams and social issues, Large dams verses small dams, Displacement and rehabilitation, Dams and climate change.

b) Dam Safety and Instrumentation

Introduction, Objectives of dam safety and instrumentation, Types of measurements, Instrumentation data system, Working principles and functions of instruments, Selection of Equipment‘s, Different Instruments, Piezometers, Porous tube piezometer, Pneumatic piezometer, Vibrating wire piezometer ,Settlement measurement system Vibrating wire settlement cell, Magnetic settlement system, Inclinometer, Joint meter, Pendulums, Inverted Pendulum, Hanging Pendulum, Automatic pendulum coordinator ,Vibrating wire pressure cell, Extensometer, Embedment strain gauge, Temperature gauge, distributed fiber optics temperature tool, seismograph.

UNIT 2 **(7 Hrs.)**

a) Gravity Dams

Introduction, Components of gravity dam, Conditions favoring gravity dams, Forces acting on gravity dam, Combinations of loading for design, Seismic analysis of dam, Terms related to seismic analysis, Determination of Seismic forces (Zangar‘s method) , Effect of horizontal earthquake acceleration, Effect of vertical earthquake acceleration, Stress analysis in gravity dam (Only concept, no derivations), Vertical or normal stress , Principal stresses, Shear stress, Middle third rule, Modes of failure of gravity dam, Elementary profile of gravity dam, Concept of low and high gravity dams, Various Design methods of gravity dam (Introduction only)— Details of Gravity method or 2 D method, ,Construction of gravity dams, Colgrout masonry, Roller Compacted Concrete (R.C.C.),Temperature control in mass concreting, Crack formation in gravity dam, Control of crack formation in dams, Construction joints, Keys, Water seal, Retrofitting.

b) Arch Dam and Other Dams (Introduction only)

Introduction, Concept of Arch Dam, Conditions favoring an arch dam, Classification of an arch dam, Constant angle arch dam, Constant radius arch dam, Variable radius arch dam, Arch gravity dam, Double curvature arch dam, Buttress dams, Advantages of Buttress dams, Limitations of Buttress dams, Types of buttress dams.

Unit III **(7 Hrs.)**

a) Spillway and Gates [6 Lectures]

Introduction, Location of Spillway, Different key levels and heads in spillway, Spillway Capacity, Components of spillway, Approach channel, Control structure, Discharge channel, Energy dissipation device, Tail channel, Classification of spillway, Classification based on operation, Main or service spillway, Auxiliary spillway, Emergency spillway, Classification based on gates, Gated spillway, Ungated spillway, Classification based on features, Straight drop spillway(Free overflow spillway),Saddle spillway, Side channel spillway, Overflow or ogee spillway, Chute or open channel or trough spillway, Shaft or morning glory spillway, Siphon spillway, Conduit or tunnel spillway, Stepped spillway,

Design of Ogee spillway or overflow spillway, Shape of crest, Equations for spillway profile on upstream and downstream, Energy dissipation below spillway, Classification of energy dissipation devices, Energy dissipation in stilling basin, Stilling basin, Components of stilling basin, Types of stilling basins, Indian standard stilling basins, Energy dissipation through buckets, Solid roller bucket, Slotted roller bucket, Ski jump bucket, Correlation between jump height and tail water depth.

b) Spillway Gates

Introduction of Spillway gates , Classification of spillway crest gates, Classification based on function, Classification based on movement of gates, Classification based on special features, Introduction to automatic gates, Maintenance of gates, Inspection of gates.

Unit IV **(7 Hrs.)**

a) Earth Dam

Introduction, Conditions favoring an earth dam, Limitations of earth dam, Classification of earth dam, Classification based on---materials, method of construction, height; Selection of type of earth dam, Components of an earth dam, Requirements for safe design of earth dam, Hydraulic (Seepage) Analysis, Plotting of seepage line, Case 1: Homogeneous earth dam with horizontal drainage blanket, Determination of seepage discharge using phreatic line.

Case II: Composite earth dam with casing and hearting, Properties of phreatic line, Determination of seepage discharge through earth dam using flownet, Structural stability analysis of homogeneous and zoned earth dam, Forces acting on earth dam, Method of stability analysis of an earth dam, Procedure of analysis by Swedish slip circle method, Fellenius Method of Locating Centre of Critical Slip circle, Stability analysis for foundation, Failure of earth dam, Classification of failure of earth dams, Hydraulic Failure, Seepage failure, Structural failure, Seepage control in earth dams, causes of seepage, Seepage control measures, Construction of earth dam,

b) Diversion head works

Introduction, Function of diversion headworks, Selection of site for diversion headworks, Layout of diversion headworks, Components of diversion headworks, Design of weir on permeable foundation, Criteria for safe design of weir floor, Brief introduction to Bligh and Lane‘s theory, Khosla's theory based on potential theory approach, Khosla's theory of independent variables, Design criteria of weirs on permeable foundations, Checks for stability and safety of weirs.

Unit V **(6 Hrs.)**

a) Canals

Introduction, Classification of canals, Classification based on alignment, Classification based on soil, Classification based on source of supply, Classification based on discharge, Classification based on lining, Classification based on excavation, Components of canal , Data required for canal design, Selection of canal alignment, Design of stable canal in alluvial beds, Kennedy‘s theory, Design of canal by Kennedy‘s theory, Limitations of Kennedy‘s theory, Lacey‘s regime theory, Design of canal by Lacey‘s theory, Canal lining, Need of canal lining, Requirements of lining material, Classification of canal lining, Hard surface lining including Ferrocement lining, Soft surface lining, Burried lining, Advantages of canal lining, Design of lined canal, Benefit – cost analysis for canal lining.

b) Canal Structures

Canal falls Introduction, Necessity of canal fall, Selection of site for canal fall, Classification of canal fall, Types of falls, Free fall or open fall, Notch fall, Ogee Fall, Rapid Stepped fall, Straight glacis fall, Sarda fall, Semi pressure fall, Baffle or Englis Fall, Montague fall Siphon well or cylinder fall, Pressure or closed conduit fall, Shaft or Pipe fall, Selection of type of fall, **Canal outlets-** Introduction of Canal outlet or module, **Canal escapes-** Introduction of Escapes, Significance of canal escape, **Canal regulators--**Canal regulators.

Unit VI **(5 Hrs.)**

a) C. D. Works

Introduction, Necessity of cross drainage works, Selection of site for Cross Drainage work, Data required for design of Cross Drainage work, Classification of Cross Drainage works, Drain over canal-Siphon, Super passage, Canal over drain—Aqueduct, Siphon aqueduct, Canal and drain water mixed in each other--Level crossing, Inlet and Outlet, Selection of suitable type of C. D. works, Design considerations for cross drainage works.

b) River Training Structures

Introduction, Classification of rivers, Classification based on topography, regime, alignment, source, Behaviour of rivers, River training, Objectives of river training, Classification of river training, purpose, orientation, River training structures, Embankment or Levee, Guide banks, Groynes or spurs, Artificial cut off, Pitched island, Submerged sill or dykes, Closing dykes.

Term Work (A+B+C)

A) Analysis /Design Assignments. (Compulsory)

1) Stability analysis of gravity dam
2) Design of profile of spillway and energy dissipation device below the spillway
3) Stability analysis of zoned earthen dam
4) Analysis of weirs on permeable foundations.
5) Design of unlined and lined canal.

B) Site visits and reports with photographs (compulsory)

1. Gravity dam.
2. Earth dam.
3. D. work/ Canal structure(s)/Weirs/Barrage.

C) Review of any one case study of failure of hydraulic structure from the published literature or patent related to Hydraulic structures (in a group of five students).

Note:-

Visit report should consist of Name of project, date of visit , need and practical significance of project, salient features of project, technical details of project, detailed description and figures of different components of project, special features of project, the technical, social, financial and environmental impact of project on downstream and upstream, photographs of technical details of visit, if allowed . If not allowed for technical details, the photograph near board of project or site as a proof of visit.

Reference Books :-

1. Design of Small Dams- United States Department of the Interior, Bureau of Reclamation revised reprint 1974, Oxford and IBH Publishing Co.
2. Irrigation and Water Resources Engineering- Asawa G.L- New Age International (P) Ltd. Publishers, first ed, 2005.
3. Irrigation Engineering and Hydraulic Structures- Garg S.K- Khanna Publishers N.D. 13th ed, 1998.
4. Design Textbook in Civil Engineering: Volume Six: Dams- Leliavsky, Serge – Oxford and IBH Publishing Co. Pvt. Ltd., 1981.
5. Roller Compacted Concrete Dams- MehrotraV.K- Standard Publishers Distributors, Delhi, 1st ed, 2004.
6. Irrigation, Water Resources and Water Power Engineering- Modi, P.N. - Standard Book House, New Delhi, 2nd ed, 1990.
7. Irrigation and Water Power Engineering - Punmia B.C. - Laxmi Publication.

I.S. Codes:

1. I.S. 8605 – 1977 (Reaffirmed 1998), Code of practice for construction of masonry in dams, third reprint, July 1999, B.I.S. New Delhi.
2. I.S. 6512-1984 (Reaffirmed 1998), Criteria for design of solid gravity dams, first revision, first reprint, September, 1998, B.I.S. New Delhi.
3. I.S. 457 – 1957 (Reaffirmed, 2005), Code of practice for general construction of plain and reinforced concrete for dam and other massive structures, sixth reprint, January 1987, B.I.S. New Delhi.

4. I.S. 10135 – 1985, Code of practice for drainage system for gravity dams, their foundations and abutments, first revision, B.I.S. New Delhi.
5. I.S. 14591 – 1999, Temperature control mass concrete for dams – guidelines, B.I.S.
6. I.S. 11223 – 1985 (Reaffirmed 2004), Guidelines for fixing spillway capacity, edition 1.2 (1991-09), B.I.S. New Delhi.
7. I.S. 6934 – 1998 (Reaffirmed 2003), Hydraulic design of high ogee overflow spillways – recommendations, first revision, B.I.S. New Delhi.
8. I.S. 11155- 1994, Construction of spillways and similar overflow structures – Code of practice, B.I.S. New Delhi.
9. I.S. 5186 – 1994, Design of chute and side channel spillway – criteria, first revision, B.I.S. New Delhi.
10. I.S. 10137- 1982 (Reaffirmed 2004), Guidelines for selection of spillways and energy dissipaters, B.I.S. New Delhi.
11. I.S. 4997 – 1968 (Reaffirmed 1995) Criteria for design of hydraulic jump type stilling basins with horizontal and sloping apron, sixth reprint, January, 1998, B.I.S. New Delhi.
12. I.S. 7365-1985, Criteria for hydraulic design of bucket type energy dissipaters, first revision, B.I.S. New Delhi.

01 008 Quantity Surveying, Contracts & Tenders

Teaching scheme:
Lectures: 3 Hrs/week
Practical: 2 Hrs/week

Examination scheme:
In semester exam: 30 Marks---1 Hr.
End semester exam: 70 Marks—2.5 Hrs.
Oral: 50 Marks

Unit I **(6 Hrs.)**

Introduction and Approximate Estimates:

a) **Introduction to estimates and related terms:** Definition of estimation and valuation. Significance (application) of the Course. Purpose of estimation. Type of estimates, data required for estimation as a pre requisite. Meaning of an item of work, and enlisting the items of work for different Civil Engineering projects. Units of measurement. Mode of measurement of building items/ works. Introduction to components of estimates: face sheet, abstract sheet (BOQ), measurement sheet, Rate Analysis, lead statement. Provisional sum& prime cost items, contingencies, work charge establishment, centage charges. Introduction to D. S. R.

b) **Approximate Estimates**: Meaning, purpose, methods of approximate estimation of building & other civil engineering projects like roads, irrigation/ water supply, sanitary engineering, electrical works.(Theory & Numericals).

Unit-II **(6 Hrs.)**

Taking out quantities &Detailed estimate:

a) **Detailed estimates**: Factors to be considered while Preparing Detailed Estimate, Detailed estimate of R.C.C framed structures using IS 1200, Concept of Estimation of Load Bearing Structure (PWD & Centre Line Method).

b) **Bar Bending Schedule:** Preparing Bar Bending Schedule for all RCC members of building.

Unit-III **(6 Hrs.)**

Specifications and Rate Analysis:

a) **Specifications**: Meaning & purpose, types. Drafting detailed specifications for materials, quality, workmanship, method of execution, mode of measurement and payment for major items like, excavation, stone/ brick masonry, plastering, ceramic tile flooring, R.C.C. work.

b) Rate Analysis: Meaning and factors affecting rate of an item of work, materials, sundries, labour, tools & plant, overheads & profit. Task work or out turn, factors effecting task work. Working out Rate Analysis for the items mentioned in specifications above.

Unit IV **(6 Hrs.)**

Valuation:

a) **Valuation:** Purpose of valuation. Meaning of price, cost and value. Factors affecting

‗Value‘. Types of value: only Fair Market Value, Book Value, Salvage/ Scrap Value, Distressed Value and Sentimental Value. Concept of free hold and lease hold property. Estimation versus valuation. Methods of depreciation & obsolescence, Sinking Fund, Years Purchase.

b) **Methods of Valuation of Building:** Rental Basis, Land & Building basis, Direct Comparison Method, Profit based method, Belting of Land, Development method.

Unit V **(6 Hrs.)**

Tendering and Execution of Works:

a) Tenders: Definition. Methods of inviting tenders, tender notice, tendering procedure,
Pre and post qualification of contractors, tender documents. 3 bid/ 2 bid or single bid system. Qualitative and quantitative evaluation of tenders. Comparative statement, Pre-bid conference, acceptance/ rejection of tenders. Various forms of BOT &Global Tendering, E-tendering.

b) Methods of Executing Works: PWD procedure of work execution, administrative approval, budget provision, technical sanction. Methods of execution of minor works in PWD: Piecework, Rate List, Daily Labour. Introduction to registration as a contractor in PWD.

Unit VI **(6 Hrs.)**

Contracts and Arbitration:

a) Contracts: Definition, objectives & essentials of a valid contract as per Indian Contract

Act (1872), termination of contract. Types of contracts: only lump sum, item rate, cost plus. **Conditions of contract**: General and Specific conditions. Conditions regarding EM, SD, and time as an essence of contract, conditions for addition, alteration, extra items, testing of materials, defective work, subletting, etc. Defect liability period, liquidated damages, retention money, interim payment or running account bills, advance payment, secured advance, final bill.

b) **Arbitration**: Introduction to Arbitrations as per Indian Arbitration & Conciliation Act (1996) Meaning and need of arbitration, qualities and powers of an Arbitrator.

Term Work:

The following exercises should be prepared and submitted:

1. Report on contents, use of current DSR & Drafting detailed specification for major items of works.
2. Working out quantities using C-L and PWD method for a small single storied load bearing structure up to plinth and Preparing Abstract Sheet using DSR(Regional)
3. Detailed Estimate of a single storied R.C.C framed building using D.S.R.
4. Working out quantities of steel reinforcement for a column footing, a column, a beam and a slab by preparing bar bending schedule.
5. Working out rate analysis for the items as in the specifications of Assignment No. 1.
6. Preparing Valuation of a Residential building and writing report using O-1 form.
7. Estimating quantities for any one of the following using appropriate software.
    a) A Factory Shed of Steel Frame
    b) Underground Water Tank
    c) Pipe Culvert
    d) Road / Railway Track/ Runway
8. Drafting of tender notice, Preparation of Schedule A & B and Conditions of Contract regarding time, labour payment, damages for RCC Framed Structure (Assignment No. 3) and collecting minimum of 3 tender notices of Civil Engineering Works.

Oral Examination: Based on the Term Work.

Reference Books:

1. Estimating and Costing in Civil Engineering: Theory and Practice: B.N Dutta - S. Dutta & Company, Lucknow.
2. Estimating, Costing Specifications & valuation in Civil Engineering: M. Chakraborty.
3. Estimating and Costing: R. C. Rangwala - Charotar Publ. House, Anand.
4. Theory and Practice of Valuation: Dr. RoshanNamavati, Lakhani Publications.
5. Valuation Principles and Procedures: Ashok Nain, Dewpoint Publ.
6. Laws for Engineers : Dr. Vandana Bhat and Priyanka Vyas –Published by PRO-

CARE,5/B,/Sagarika Society,Juhu Tara Road,Juhu,Santacruz(W),Mumbai-400049 procure@technolegal.org).

Handbooks:

1. Standard Contract Clauses for Domestic Bidding Contracts: Ministry of Statistics and Program Implementation, Government of India.
2. FIDIC Document: Federation International Des Ingenieurs Conseils i.e. International Federation of Consulting Civil Engineers, Geneva, Switzerland.
3. Indian Practical Civil Engineers' Handbook: P. N. Khanna, UBS Publi. Distri. Pvt. Ltd. (UBSDP).

Codes:

1. IS 1200 (Part 1 to 25): Methods of Measurement of Building & Civil Engg.Works.
2. IS 3861-1966: Method of Measurement of Areas and Cubical Contents of buildings.
3. D. S. R. (District Schedule of Rates) for current year.
4. PWD Redbooks, Vol 1 & 2.

e – Resources: nptel.iitm.ac.in

401 009 Elective III (1) Advanced Structural Design

Teaching Scheme
Lectures: 3 hours/week
Practical: 2 hours/week

Examination Scheme
Theory Examination:
In-sem : 30 marks (1 Hour)
End-sem:70 marks (2.5.Hours)
Term work: 50 Mark

Unit 1 **(6 Hrs.)**

Cold-formed light gauge steel structural members: Design of axially loaded compression members, tension members and beams (not more than two spans).

Unit 2 **(6 Hrs.)**

Frames: Uniqueness theorem, lower bound and upper bound theorems, mechanisms, analysis and design of frames (single story), design of connections.

Unit 3 **(6 Hrs.)**

Composite deck slab: Design of composite deck slab with cold form light gauge profile and shear connectors.

Unit 4 **(6 Hrs.)**

Yield line analysis and design of slabs: Yield line theory, yield lines, ultimate moment along a yield line, principle of virtual work, analysis and design of slabs of different geometry, support conditions and loading conditions.

Unit 5 **(6 Hrs.)**

Elevated water tanks: Analysis and design for gravity and earthquake loads (static analysis) for square, rectangular and circular water tanks (excluding Intze tank) supported on staging, design of staging and foundation system.

Unit 6 **(6 Hrs.)**

Shear walls: Function, types, analysis and design of cantilever type shear walls.

Note: The designs should conform to the latest codal provisions.

Term Work:

a) At least three plates showing the details of cold-formed light gauge steel sections used in compression, tension and flexural members

b) At least three plates showing the details based on yield line analysis and design of slabs

c) Sheet 1: Detailing of any one design problem from Unit 2 or Unit 3

d) Sheet 2: Detailing of any one design problem from Unit 5 or Unit 6

e) Report of two site visits covering the contents of the syllabus mentioned above.

References:

1). Design of Steel Structures, Ramachandra, Standard Publications New-Delhi

2). Structural and Stress Analysis, T.H.G. Megson, Butterworth-Heinemann

3). Design of Concrete Structures, J. N. Bandyopadhyay, PHI

4). Punmia, Reinforced Concrete Structures Vol. 1 and 2, Standard Book House NewDelhi.

5). Sinha and Roy., RCC Analysis and Design . S. Chand and Co. New-Delhi

6). Ramachandra, Design of Steel Structures Vol.-II Standard Publications New-Delhi.

7). Punmia,B. C. and Jain and Jain, Comprehensive Design of Steel Structures, Standard Book House

8) INSDAG publications

401009 Elective=III (2) Statistical Analysis and Computational Methods in Civil Engineering

Teaching Scheme	**Examination Scheme**
Lectures : 3 hours/week	**In-sem : 30 marks (1 Hour)**
Practical: 2 hours/week	**End-sem:70 marks (2.5.Hours)**
	Term work: 50 Mark

Unit I: (6 Hrs.)

Numerical methods: Bisection method, False Position method, Newton Raphson, Secant method.

Unit II: (6 Hrs.)

Numerical Integration Need and scope, trapezoidal rule, Simpsons 1/3rd rule, Simpsons 3/8th rule, Gauss Quadrature method.

Unit III: (6 Hrs.)

Optimization techniques: Introduction to optimization techniques-concepts and applications, direct solution of linear equations-Gauss elimination and Gauss Jordon method. Iterative solution of linear equations- Gauss Seidel method.

Unit IV: (6 Hrs.)

Statistical methods: Introduction, collection, classification and representation of data, measures of central value (mean, median, mode), measures of dispersion, sampling.

Unit V: (6 Hrs.)

Probability and Probability distributions including Binomial, Poisson, Normal, test of hypothesis, chi-square test.

Unit VI: (6 Hrs.)

Correlation analysis, regression analysis. Coefficient of correlation, probable error, single and multiple regression, curve fitting, Interpolation and extrapolation.

Term Work:

1. One exercise on each unit.
2. Any two problems to be solved using c, c++, excel or using softwares like SPSS, minitab, etc.
3. One exercise on formulation and solution of an optimization problem applicable to any field of Civil Engineering.

Reference Books:

1. Statistical methods – S.P.Gupta.
2. Probability and Statistics for Engineers – Richard A Johnson 3. Probability and Statistics for Science and Engineering – G Shankar Rao.
4. Numerical Methods – E Balagurusamy.
5. Numerical methods for Engineers – S. Chapra, R.P.Canale.
6. Higher Engg. Mathematics – B.S. Grewa.

401009 Elective III (3): Hydro Power Engineering

Teaching Scheme
Lectures: 3 hours/week
Practical: 2 hours/week

Examination Scheme
Theory Examination
In-sem: 30 marks (1 Hour)
End-sem:70 marks (2.5.Hours)
Term work: 50 Marks

Unit I **(6 Hrs.)**

Energy Resources – Planning and Potential:

Power resources – Conventional and Nonconventional, Need and advantages, Overview of World Energy Scenario, energy and development linkage, Environmental Impacts of energy use, Green House Effect, Trends in energy use patterns in India, Hydropower development in India, Hydropower potential basin wise and region wise, investigation in hydropower plants.

Unit II **(6 Hrs.)**

Hydropower Plants:

Hydrological Analysis, Classification of hydropower plants based on hydraulic characteristics - Run of river plants, Storage or Valley dam plants, Pumped storage plants, Classification based on head, Classification based on operating function, Classification based on plant capacity, Classification based on nature of topography, Introduction to micro hydro, advantages and disadvantages, Principle Components of hydropower plants.

Unit III **(6 Hrs.)**

Load Assessment:

Estimation of electrical load on turbines. Load factor, Plant factor, peak demand and utilization factor, installed capacity, diversity factor, firm power, secondary power, load curve, load duration curve, Prediction of load and significance, Tariffs, Hydro-Thermal Mix, Combined Efficiency of Hydro-Thermal-Nuclear Power Plants.

Unit IV **(6 Hrs.)**

Water Conductor System and Powerhouse:

Water Conductor System – Alignment, Intake Structures- Location and Types, Trash Rack. Headrace tunnel/ Canal, Penstock and pressure shaft, Types of Powerhouses, Typical layout of powerhouse, Components, Power plant equipments, Instrumentation and control.

Unit V **(6 Hrs.)**

Turbines:

Classification, Principles and design of impulse and reaction turbines, Selection of Turbine, Specific Speed, Governing of turbines, Water hammer, Hydraulic Transients and Surge tanks, Draft tubes, Cavitation.

Unit VI **(6 Hrs.)**

Economics of Hydroelectric Power:

Hydropower - Economic Value and Cost and Total Annual Cost. Economic considerations – pricing of electricity, laws and regulatory aspects, Policies, Electricity act – 2003, Investment in the power sector, Carbon credits, Participation of private sector.

Term Work:

Minimum eight assignments as per the list given below. **Assignments 1 and 10 are compulsory.**

1. Calculating the electricity bill of upper middle class family that uses various electrical appliances.
2. Determination of power output for a run of river plant with and without pondage.
3. Justification of economics of Pumped storage plants.
4. Design of Kaplan / Francis / Pelton turbine.
5. Determination of diameter of penstock using different methods.
6. Design of surge tank.
7. Design of straight conical draft tube.
8. Use of any software to calculate water hammer pressure.
9. Case study of any hydropower project.
10. Report based on visit to any micro/small/mega hydropower project

Reference Books:

1. Water Power Engineering – M. M. Dandekar and K. N. Sharma, Vikas Publishing House.
2. Water Power Engineering – R. K. Sharma and T. K. Sharma, S. Chand and Co. Ltd.
3. Handbook of Hydroelectric Engineering – P.S. Nigam
4. Modern Power System Planning – Wang.
5. Hydropower Resources in India – CBIP.

6. Hydro Power Structures – R. S. Varshney.
7. Water Power Development – E. Mosonvi, Vol. I & II.
8. Hydro-electric Engineering Practice – G. Brown, Vol. I, II & III.
9. Hydro – Electric Hand Book – Creager and Justin.
10. Water Power Engineering – P. K. Bhattacharya, Khanna Pub., Delhi.
11. Water Power Engineering – M. M. Deshmukh, Dhanpat Rai Pub.
12. Manual of ―Energy Group‖ of ‗PRAYAS‘, an NGO.

401009 Elective-III: (4) Air Pollution and Control

Teaching Scheme:
Lectures: 3 Hrs/week
Practical: 2 Hrs/week

Examination Scheme:
Paper In-sem. 30 Marks (1 hr),
Paper End-sem : 70 Marks (2.5 hrs)
TW : 50 Marks

Unit I **(6 hrs)**

Meteorological aspects: Zones of atmosphere, Scales of meteorology, Meteorological parameters, Temperature lapse rate, Plume behaviour. Gaussion diffusion model for finding ground level concentration, Plume rise, Types & quality of fuels, Formulae for effective stack height and determination of minimum stack height as per CPCB norms.

Unit II **(6 hrs)**

Ambient Air sampling and analysis: Air pollution survey, basis and statistical considerations of sampling sites, devices and methods used for sampling of gases and particulates. Stack emission monitoring for particulate and gaseous matter, isokinetic sampling. Analysis of air samples chemical and instrumental methods. Emission inventory and source apportionment studies. Ambient air quality monitoring as per the procedure laid down by CPCB. National Ambient Air Quality Standards (NAAQS) 2009.

Unit III **(6 hrs)**

Indoor air pollution: Causes of air pollution, sources and effects of indoor air pollutants, factors affecting exposure to indoor air pollution, sick building syndrome. Investigation of indoor air quality problems, changes in indoor air quality, control of indoor air pollutants and air cleaning systems. Use of various plants to control indoor air pollution. Radon and its decay products in indoor air.

Odour pollution: Theory, sources, measurement and methods of control of odour pollution.

Unit IV **(6 hrs)**

Control of air pollution: By process modification, change of raw materials, fuels, process equipment and process operation. Control of particulate matters. Working principle and design of control equipment as Settling chamber, Cyclone, Fabric filter and Electro Static Precipitator. Control of gaseous pollutants. Combustion chemistry & control of air pollution from automobiles.

Unit V **(6 hrs)**

Land use planning: As a method of control. Economics of air pollution control: Cost/benefit ratio and optimization. Legislation and regulation: Air (Prevention and Control) Pollution Act, 1981. The Environment (Protection) Act 1986. Emission standards for stationary and mobile sources.

Unit VI **(6 hrs)**

Environmental impact assessment and management: Methodology for preparing environmental impact assessment (Identifying the sources of air pollution, calculating the incremental values, prediction of impacts and mitigation measures). Role of regulatory agencies and control boards in obtaining environmental clearance for project. Public hearing. Environmental impacts of thermal power plants, sugar and cement industry. Environmental management plan. The environmental rules 1999 (sitting of industries).

Term Work:

Term work shall consist of

A. One assignment on each unit.

B. Detailed industrial visit report on Sugar/Cement/Steel//Thermal/Rubber/Dairy industry with reference to air pollution Control device(s).

Reference Books:

1. Air Pollution – H. V. N. Rao and M. N. Rao, TMH, Pub.
2. Air pollution – KVSG Murali krishna.
3. Air Pollution – Perkins.
4. Environmental Engineering – Davis, McGraw Hill- Pub.
5. Environmental Engineering – Peavy H.S and Rowe D.R, McGraw Hill- Pub.
6. Air Pollution – Stern.
7. Air Pollution Control – Martin Crawford.
8. Air Pollution Control: its origin and control, K. Wark, C.F. Warner & W.T.Davis .
9. Fundamentals of Air Pollution-Richard W. and Donald L. Academic Press.

I.S. Codes:

1. I.S. 5182 (all parts), and
2. I.S. 15442 (2004)

e – Resources:

1. http://nptel.iitm.ac.in/courses-contents/IIT Kanpur and IIT Madras.
2. http://cpcb.nic .in
3. http://moef.nic .in

401009 Elective III (5): Finite Element Method in Civil Engineering

Teaching Scheme:
Lectures: 3 hours/week
Practical: 2 hours/week

Examination Scheme:
Theory Examination:
In-sem: 30 marks (1 Hour)
End-sem:70 marks (2.5.Hours)
Term work: 50 Mark

Unit I **(6 Hrs.)**

Theory of elasticity: Strain-displacement relations, compatibility conditions in terms of strain, plane stress, plane strain and axisymmetric problems, differential equations of equilibrium, compatibility condition in terms of stresses, stress-strain relations in 2D and 3D problems.

Unit II **(6 Hrs.)**

General steps of the finite element method, Applications and advantages of FEM, concept of finite element for continuum problems, discretisation of continuum, use of polynomial displacement function, Pascal's triangle, convergence criteria.

Principle of minimum potential energy, formulation of stiffness matrix for truss element using variational principles.

Unit III **(6 Hrs.)**

Displacement function for 2D triangular (CST and LST) and rectangular elements, Use of shape functions, Area co-ordinates for CST element, Shape functions in cartesian and natural coordinate systems, shape functions for one dimensional element such as truss and beam, shape functions of 2D Lagrange and serendipity elements.

Unit IV **(6 Hrs.)**

Introduction to 3D elements such as tetrahedron and hexahedron. Iso-parametric elements in 1D, 2D and 3D analysis, Jacobian matrix, Formulation of stiffness matrix for 1D and 2D Iso-parametric elements in plane elasticity problem.

Unit V **(6 Hrs.)**

Formulation of stiffness matrix, analysis of spring assemblage, member approach for truss and beam element, node numbering, assembly of element equations, formation of overall banded matrix equation, boundary conditions and solution for primary unknowns, applications to truss and beam not involving unknowns more than three.

Unit VI **(6 Hrs.)**

Formulation of stiffness matrix using member approach for portal frame and grid elements, transformation matrix, applications to frame and grid not involving unknowns more than three.

Termwork:

The Termwork shall be based on completion of assignments as given below.

1. At least one assignment on each unit.
2. One assignment based on FEM by using coding tools for
   a) Formulation of stiffness matrix for any 1-D element
   b) Formulation of stiffness matrix for any 2-D element
3. Finite Element Method -Software applications of any one of following cases using any standard available software.
   a) Truss/ grid problem
   b) Plane stress / plane strain problem

Reference Books

1. A first course in the finite element method-Daryl L. Logon, Thomson Publication.
2. Nonlinear finite element analysis by Reddy- Oxford University Press.
3. Introduction to the Finite Element Method – Desai & Abel, CBS Publishers & Distributors, Delhi
4. Introduction to Finite Elements in Engineering – T.R. Chandrupatla & A.D. Belegundu Prentice Hall of India Pvt. Ltd.
5. Matrix, Finite Element, Computer & Structural Analysis – M. Mukhopadhyay, Oxford IBH Publishing Co. Pvt. Ltd.
6. Finite Element Analysis – Theory & Programming – C.S. Krishnmoorthy, TATA McGraw Hill Publishing Co. Ltd.
7. An Introduction to the Finite Element Method – J.N. Reddy, TATA Mc Graw Hil Publishing Co. Ltd.
8. Theory & Problems – Finite Element Analysis – Gorge R. Buchanan, Schaum's Outline series. TATA Mc Graw Hill Publishing Co. Ltd.
9. The Finite Element Method – O.C. Zien kiewicz, TATA Mc Graw Hill Publishing Co. Ltd.
10. Finite Element Analysis – S.S. Bhavikatti, New Age International (P) Ltd.

401 0010 Elective III (6): Airport & Bridge Engineering

Teaching scheme	**Examination Scheme**
Lectures: 3 hours/week	**In-Sem Exam: 30 marks 1 hour**
Practical: 2 hrs	**End-Sem Exam: 70 marks 2.5 hrs**
	Termwork: 50 marks

Unit 1: **(6 hrs)**

Introduction:

Advantages and limitations of air transportation. Aeroplane component parts and important technical terms, Organizations related to Air Transportation (ICAO, FAA, AAI) Roles and Responsibilities.

Airport planning:

Aircraft characteristics, which influence judicious and scientific planning of airports, Selection of sites, survey and drawings to be prepared for airport planning, Air Travel Demand forecasting, Airport classification by ICAO.

Unit 2: **(6 hrs.)**

Airport layout:

Characteristics of good layout, runway configuration, airport obstruction, location of terminal buildings, aprons and hangers. Zoning requirements regarding permissible heights of constructions and landing within the airport boundary, Airport landslide planning, Navigation and landing aids – ILS, Air Traffic Control (ATC).

Design of Runways and taxiways:

Runway orientation, wind coverage, use of wind rose diagram, basic runway length, corrections for elevation, temperature and gradient as per ICAO and FAA recommendation, Taxiways – Concept, types, design criteria.

Unit 3: **(6 hrs.)**

Structural Design of Runways and taxiways:

Runway pavement design criteria, aircraft loading, Design methods for flexible and rigid runways, Airport drainage.

Unit 4: **(6 hrs.)**

Heliports

Helicoptor characteristics, planning of heliports - site selection, size of landing area, orientation of landing area, Heliport marking and lighting, Vertical Takeoff and Landing (VTOL).

Unit 5: **(6 hrs.)**

Bridge engineering:

Introduction:

Classification of bridges, components of bridges, preliminary data to be collected during investigation of site for bridges, determination of discharge – empirical formula, direct methods, economical span, afflux, HFL, scour depth and clearance, locations of piers and abutments, factors influencing the choice of bridge super structure, approach roads.

Loads on bridges:

Brief specifications of different loads, forces, stresses coming on bridges, IRC load specification, requirements of traffic in the design of highway bridges.

Substructure:

Abutment, Piers, and wing walls with their types based on requirement and suitability.

Unit 6: **(6 hrs)**

Types of bridges

Various types of bridges:

Culvert: Definition, waterway of culvert and types.

Temporary bridges: Definition, materials used brief general ideas about timber, floating and pantoon bridges.

Movable Bridges: Bascule, cut boat, flying, swing, lift, transporter and transverse bridges, their requirement and suitability.

Fixed span bridges: Simple, continuous, cantilever, arch, suspension, bowstring girder type and rigid frame and cable stayed bridges, materials for super structure.

Bearing: Definition, purpose and importance. Types of bearings with their suitability.

Erection of bridge super structure and maintenance:

Introduction to different techniques of erection of bridge super structure and maintenance of bridges.

Term work:

Term work shall consist of: (Any eight)

1. Recent Trends in Airport planning and design (report expected)
2. Assignment on study and use of Windrose Type 1 and 2 diagram
3. Assignment on Runway Design for length and related corrections
4. Structural Design of Flexible or Rigid Runway
5. Selection of Bridge site, alignment and collection of design data
6. Assignment on conditional assessment of existing Bridges
7. Seminar on one topic each in Airport Engineering or Bridge Engineering
8. Report on Guest lecture in Airport Engineering or Bridge Engineering
9. Site visit to Bridge site or Airport site

Text Books:

1. Bridge engineering – S. Ponnuswamy, Tata Mc Graw – Hill publishing co. Ltd. New Delhi.
2. Airport planning and design – S.K. Khanna , M.G. Arora , S.S. Jain, Nem Chand and Brothers, Roorkee.
3. Airport Engineering - Rangawala, Charotar publishing House, Anand 388001 (Gujrat)
4. Essentials of Bridge Engineering – D. Johnson and Victor, Oxford and IBH publishing Co. Pvt. Ltd. , New Delhi.
5. Bridge engineering – Rangawala, Charotar Publishing House, Anand –388 001.
6. Principles and practice of Bridge Engineering – S.P. Bindra, Dhanpatrai and Sons, Delhi.

401 010 Elective IV (1): Construction Management

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 hours/week	**Theory Examination:**
Practical: 2 hours/week	**In-sem : 30 marks (1 Hour)**
	End-sem:70 marks (2.5.Hours)
	Term work: 50 Mark

Unit – I **(6 Hrs.)**

Overview of construction sector:

Role of construction industry in infrastructure development, components of infrastructure sector, construction industry nature, characteristics, size, structure, role in economic development, construction management – necessity, applications, project management consultants – role, types, selection and appointment process, project overruns and means to combat them, project monitoring and reporting systems, managerial correspondence and communications, generation and identification of project investment opportunities. (*At least 2 expert lectures by experts from field are to be conducted on above topics).

Unit – II **(6 Hrs.)**

Construction scheduling, work study and work measurement Construction scheduling. Construction project scheduling – purpose, factors affecting scheduling, time as a control tool, work breakdown structure, project work breakdown levels, line of balance technique, repetitive project management Work study and work measurement .

Definition, objectives, basic procedure of work study, symbols, activity charts, string diagrams, time and motion studies.

Unit – III **(6 Hrs.)**

Labour laws and financial aspects of construction projects Labour laws. Need and importance of labour laws, study of some important labour laws associated with construction sector- workmans compensation act 1923, Building and other construction workers act 1996, child labour act, interstate migrant workers act Financial aspects of construction projects. Capital investments: importance and difficulties, means of finance, working capital requirements, project cash flow projections and statements, project balance sheet, profit loss account statements.

Unit – IV **(6 Hrs.)**

Elements of risk management and value engineering. Risk management. Introduction, principles, types, origin, risk control, use of mathematical models: sensitivity analysis, break even analysis, simulation analysis, decision tree analysis, risk identification, analysis and mitigation of project risks, role of insurance in risk management. Value engineering Meaning of value, value analysis, value engineering and value management, energy resources, consumption patterns, energy cost escalation and its impact.

Unit – V **(6 Hrs.)**

Materials management and human resource management . Materials management Materials flow system, role of materials management in construction management and its linkage with other functional areas, vendor networking, buyer-seller relationships, eoq model and its variations, material codification and classification, concept of logistics and supply chain management, role of ERP in materials management – material resource information systems Human resource management. Human Resource in Construction Sector, Staffing policy and patterns, Human Resource Management Process, Human Resource Development Process, Performance Appraisal and Job Evaluation, Training and Career planning, Role of ERP in Human Resource Management – Human Resource Information System (HRIS).

Unit – VI **(6 Hrs.)**

Introduction to artificial intelligence technique. Basic terminologies and applications in civil engineering (a) Artificial neural network (b) Fuzzi logic (c) Genetic algorithm.

Term Work:

1. Site Visit to a Construction project to study following documents and preparing a report –

a. Project Cash Flow Analysis.

b. Project Balance Sheet.

c. Work Break Down Structure.

d. Materials Flow System in the Project.

2. Scheduling of a Construction Project using Line of Balance Technique.

3. Assignment on Work Study on any two Construction Trades.

4. Assignment on EOQ Model and its variation.

5. Assignment on application of AI techniques in Civil Engineering.

6. Seminar on any one topic from above syllabus.

Reference Books:

1. Projects – Planning, Analysis, Selection, Implementation and Review, Prasanna Chandra, Tata McGraw Hill Publications.
2. Construction Management and Planning – B. Sengupta and H. Guha, Tata McGraw Hill Publications.
3. Civil Engineering Project Management – C. Alan Twort and J. Gordon Rees, Elsevier Publications.
4. Total Project Management – The Indian Context – P. K. Joy, MacMillian Publications.
5. Materials Management–Gopalkrishnan & Sunderasan,Prentice Hall Publications.
6. Human Resource Management – Biswajeet Pattanayak, Prentice Hall Publishers.
7. Laws for Engineers : Dr. Vandana Bhat and PriyankaVyas –Published by PROCARE,5/B,/Sagarika Society,Juhu Tara Road,Juhu,Santacruz(W),Mumbai-400049 (procure@technolegal.org).
8. Labour and Industrial Laws – S. N. Mishra, Central Law Publications.
9. Artificial Neural Network – Veganarayanan – Prentice Hall.
10. Genetic Algorithm – David & Goldberg.
11. Fuzzi Logic & Engg Applications – Ross.
12. Principles of Construction Management by Roy Pilcher (McGraw Hill)

e-Resourses:

1. ERP Software-Builders Management Software.
2. Project mates Construction Software.

401 0010 Elective IV (2): Advanced Transportation Engineering

Teaching scheme	**Examination Scheme**
Lectures: 3 hours/week	**In-Sem Exam: 30 marks 1 hour**
Practical: 2 hrs	**End-Sem Exam: 70 marks 2.5 hrs**
	Termwork: 50 marks

Unit I **(6 hrs.)**

Transport System Planning: Transportation planning process and types of surveys. Travel demand forecasting - trip generation, modal spilt analysis, trip distribution and route assignment analysis, Transportation System Management (TSM), application in Comprehensive Mobility Plan (CMP) and DPR.

Unit II **(6 hrs.)**

Urban Transport Technology: Classification- light, medium, mass and rapid transit system, Introduction to Intelligent Transportation System (ITS) and its components, Public Transport Policy. Introduction to BRT, Mono rail, Metro rail, Bullet train and Hyperloop. Concept of Integrated Inter Model Transit System and freight transportation.

Unit III **(6 hrs.)**

A. Transport Economics & Financing: Road user cost **-** Vehicle operations cost, running cost, value of travel time, road damage cost, accident cost. Economic evaluation – Benefit cost method, Net present value method, First year rate of return method, Internal rate of return method & comparison of various methods.

B. Environmental Impact Assessment: EIA requirement of highway projects, procedure and guidelines, pollution cost and concept of congestion pricing.

Unit IV **(6 hrs.)**

Traffic Engineering: Traffic studies, basic traffic theory, traffic analysis process, level of service, intersection studies- turning movements, grade separated intersection, signal design- IRC method and Webster‘s method, parking study and analysis, bicycle and pedestrian facility design, instrumentation of traffic monitoring.

Unit V **(6 hrs.)**

Study of flexible pavement: Philosophy of design and design criteria, design of flexible pavement using IRC 37-2012, Distresses in flexible pavement, evaluation of pavement – Benkelmen beam, Falling Weight Deflectometer (FWD), Pavement Management Systems (PMS).

Unit VI **(6 hrs.)**

a) **Study of rigid pavement:** Philosophy of rigid pavement, comparison of rigid pavement over flexible pavement, types of rigid pavements, design of rigid pavement using IRC 58-2015 including design of joints, distresses in rigid pavement.

b) **Overlay types and their design as per IRC:** Types of overlays, design of overlay using IRC 81-1997.

Term work:

1. Traffic counts using Manual Methods.
2. Design of a flexible pavement using IRC: 37-2012 using IITPAVE.
3. Design of rigid pavement using IRC: 58-2015.
4. Road deflections measurement using Benkelmen Beam method.
5. Design of an overlay using IRC: 81-1997.
6. Conduct of distress surveys on a flexible pavement or a rigid pavement and determining its condition index (PCI).
7. Study of any two softwares related to transportation engineering.
8. Study of format of household survey and recording sample measurements.
9. Parking survey and analysis.

Reference Books:

1. Highway Engineering - Laurence I Hewes & Clarkson H Oglesby
2. Traffic Engineering and Transport Planning - L R Kadiyali, Khanna Publishers.
3. The Design and Performance of Road Pavements - David Croney, Paul Croney.
4. Understanding Traffic System -Michel A Taylor, William Young, PeterW Bonsall.
5. Principles of Urban Transport Systems Planning - B. G.Hutchinson.
6. Introduction to transport planning - M. J. Bruton.

7. Transportation Engineering An Introduction – C. Jotin Khisty, B. Kent Lall, Pearson Publication.
8. Transportation Engineering & Planning – C. S. Papacostas, P. D. Prevedouros, Pearson Publication.
9. Principles of Pavement Design - E.F. Yoder (John Wiley & Sons, lnc USA).
10. Fundamentals of Transportation Engineering - C. S. Papacostas.
11. Pavement analysis and Design – Huang Y H, Prentice Hall, Englewood Cliff, New Jersey.
12. Introduction to Transportation Engg. and Planning – Morlok E K, McGraw-Hill company.
13. Fundamentals of Traffic flow Theory – Drew, McGraw-Hill book Co.
14. A course in Traffic Planning and design-Saxena Subhash,Dhanpat Rai & sons,Delhi
15. Traffic analysis (New technologies new solutions)-Taylor M P ,Hargreen Pub.Co. New Delhi.

Codes:

1. IRC 37-2012
2. IRC 58-2015
3. IRC 81-1997
4. IRC 82-2015
5. IRC 115-2014

Hand Books:

Handbook of Road Technology _Lay M. G.Gorden Breach Science Pub.Newyork.

e-Resources:

1) www.nptel.iitm.ac.in/courses/iitkanpur
2) www.cdeep.iitb.ac.in/nptel

401 010 Elective IV (3): Advanced Foundation Engineering

Teaching Scheme
Lectures: 3 Hours/week
Practical: 2 Hours/week

Examination Scheme
Theory Examination:
In-sem : 30 marks (1 Hr.)
End-sem:70 marks (2.5Hrs.)
Term work: 50 Mark

Unit I **(6 Hrs.)**

IS code provision in respect of subsoil exploration for dams, canals, tunnels, off shore structure, air ports and bridges. IRC, provisions for exploration in respect of roads. Case studies of failures of foundation.

Unit II **(6 Hrs.)**

Design of pile based on cyclic load test. Study of provision made in different IS codes related to deep foundation, various types of pile. Design of Racer piles & piles subjected to lateral load. Testing and Design of piles subjected to tensile loads.

Unit III **(6 Hrs.)**

Design of under reamed pile foundation subjected to tensile loads. Design of sand drains and stone columns.

Unit IV **(6 Hrs.)**

Design of shallow foundations subjected to inclined loads. Design of Raft foundation on different types of soil. Design of combined and isolated footing based on field test including calculation of settlement. Introduction to software available for geotechnical foundation design.

Unit V **(6 Hrs.)**

Study of various provisions made as per IRC and as per IS in respect of design of well foundation. Case studies of failure of well foundation. Design of Rock fill coffer Dams.

Unit VI **(6 Hrs.)**

Stress distribution in the shaft, tunnels, underground conduits, classification, load on ditch conduits, positive and negative projecting conduits, and Imperfect ditch conduits.

Term Work:

Term work will consist of

A) Any Four of following 6 assignments.

1) Comparative study of provisions made for the extent of exploration in IS, IRC codes adapted by Indian railways, and PWD.
2) Detailed study of any two Geophysical methods of exploration.
3) Computations of Bearing capacity and Settlement of a Shallow Foundation involving inclined loads.
4) Design of Pile foundations subjected to inclined load and tensile load.
5) Design of Sand Drains.
6) Comparative study of provisions for well Foundation as per IS, IRC and code adapted by Indian railways.

B) Computer Modeling:

Design of any one type of Deep foundation using computer software.

C) Site visit and Case study:

1) One site visit to any important deep foundation and submission of report on the same giving details of design and construction.
2) Any one case study of failure of foundation from the published literature.

Reference Books:

1. Foundation Analysis and Design- Joseph E. Bowels, TATA Mc-Graw hill.
2. Design Aids in Soil Mechanics and Foundation Engineerimg-Shenbage R Kaniraj, TATA Mc-Grawhill.
3. Foundation Design & Construction (4th Ed.)- M.J.Tamlinson, ELBS publication.
4. G. A. Leonards, Foundation Engineering, McGraw-Hill, 1962.
5. R.B. Peck, W.E. Hanson and T.H. Thornburn, Foundation Engineering, 2nd Edition, John Wiley and Sons, 1974.
6. ―Principles of Foundation Engineering‖ by B.M. Das.
7. Theory and Practice of Pile Foundations Wei Dong Guo CRC Press.

I.S .Codes:

IS: 1892-1979 – ―Code of Practice for Subsurface Investigation for Foundation‖.

IS: 2131-1981 (Reaffiemed 1997), ―Method for Standard penetration Test for Soils‖.

IS: 6403-1981 – –Code of Practice for Determination of B.C. of Shallow Foundation‖. IS: 8009 (Part-1) 1976, –Code of Practice for Calculation of settlements of foundations‖.

IS: 1904-1986, –Code of Practice for Design and Construction of Foundations in Soils, general Requirements‖.

IS: 2911-1979, –Code of Practice for Design and Construction of Pile Foundation‖.

Handbooks:

1. Fang , H.Y.,(1991),‖ Foundation Engineering Handbook‖, Chapman & Hall, NY.
2. Teng .W.C.(1962), Foundation Design , Prentice Hall International.
3. Foundation Design Manual by Narayan V. Nayak, Dhanpat Rai & Sons.

401 0010 Elective IV (4): Coastal Engineering

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hours/week	**Theory Examination:**
Practical: 2 Hours/week	**In-sem: 30 marks (1 Hour)**
	End-sem: 70 marks (2.5.Hours)
	Termwork : 50 marks

Unit I **(6 Hrs.)**

Basics of Ocean Waves:

Generation ,classification, Basic understanding of wave mechanics including wave propagation,wave theories,, wave diffraction , wave refection, wave breaking. Waves of unusal character-currents, giant waves , tsunami etc.

Unit II **(6 Hrs.)**

Tides:

Tide producing forces- earth moon and earth sun system , dynamic theory of tides-; types of tides-tides and tidal current in shallow sea, storm surges, tides in rivers and estuaries ,tidal power.

Unit III **(6 Hrs.)**

Coastal Processes:

Coastal process- Erosion/accretion due to waves, bed forms, long shore transport (Littoral drift) estimate of wave induced sediment, budget. Tides, effect of Tides, stability of inlets. Effect of construction of coastal structures on stability of shoreline / beaches.

Unit IV **(6 Hrs.)**

Design of Marine Structures:

Design of Marine Structures: Seawalls, Revetments, Breakwater rubble mound, composite, floating and pneumatic types, and jetties. Offshore structures, Oil Production platform, sub marine pipelines. Model studies.

Unit V **(6 Hrs.)**

Design Technology:

Dredging Technology: Types of dredgers, design of disposal methods of dredged materials Environmental aspect of dredging , studies for feasibility of dumping ground for dredged material.

Unit-VI **(6 Hrs.)**

Coastal Management:

Pollution in Coastal zone, disposal of waste/dredged spoils, design criteria of coastal outfall inlets and system. Oil spills and contaminants, coastal zone management: activities in coastal zone, CRZ, Issues related to Integrated coastal zone management. Coastal regulation zone.

Reference Books:

1. Brunn Per ,B. U. Naik, ―Shore Protection Manual‖, NIO Goa.
2. Quinn A. D., ―Port Planning‖, Mc Grow Hill Book Co. New York.
3. Richard Silvester, ―Coastal Engineering‖, Vol-I-II, University of Western Australia.
4. Shore Protection Manual-U.S.Waterways Experiment Station Corps of Engineer.
5. Costal Engineering Research Center, Vickburg andU.S.A.1984.Coastal Protection Manual 2002.
6. Harbour and Coastal Engineering‖, Vol. I&II, Ocean and Coastal Engineering Publication, NIOT, Chennai.

Term work-

One assignment on each unit.

401 010 Elective IV: Open Elective : 5 (a): Plumbing Engineering

Teaching Scheme:
Lectures: 3 hours/week
Practical: 2 hours/week

Theory Examination Scheme:
In-sem : 30 marks (1 Hour)
End-sem :70 marks (2.5 Hours)
Term work: 50 Marks

Unit I (6Hrs.)

Introduction to plumbing engineering Definition- plumbing engineering/public health engineering, Indian plumbing industry, Roles of plumbing contractor, plumber, plumbing consultant, plumbing terminology, Principles of plumbing,

a) **Introduction to codes and standards:**
Introduction to UPC-I and ITM, Green plumbing code supplement-India (GPCS-I) and other codes applicable in plumbing, Approvals of authority having jurisdiction, General regulations, Testing and labeling, Alternative materials, workmanship and minimum standards, Prohibited fittings and practices, Local laws related to plumbing.

b) **Architectural and structural coordination**, plumbing shafts, Sunken toilet floors, Ledge walls.

Unit II (6 Hrs)

Water Supply, fixtures and fittings.

a) Water Supply**:** Types of water supply pipes Fittings and joints, Galvanized iron, Copper, Stainless steel, HDPE, MDPE, Rigid PVC, CPVC, PPR, Composite pipes, (PE-AL-PE), PEX, Joints, Jointing methods and materials, Tools etc. Water hammering, Pipe protection, Velocity, pressure, temperature limitations, Water Supply Fixture Unit (WSFU), Sizing, testing, Valves and regulators, Backflow prevention, Commissioning, Water tanks.

b) Plumbing fixtures, Water conserving fixtures, Rating system for water efficient products, (WEP-I), Water closets, Bidets, Urinals, Flushing devices, Lavatory and bath units, Kitchen sinks, Water coolers, Purifiers, Drinking water fountain, Cloth washers, Mop sinks, Dish washers, Receptors Overflows, Strainers, Standard heights. Prohibited fixtures, Floor slopes, Minimum spacing.

Unit III **(6Hrs.)**

Sanitary system and Storm water Drainage:

a) Sanitary system: Fixtures, Appliances and appurtenance, Classification of fixtures, Soil and waste and grey water, Soil fixtures, Bathroom fixtures, Accessories, Indirect waste connections, Food handling establishments, Fixtures below invert level.

b) Building Drains:

Introduction, Four systems of plumbing, One pipe and two pipe system, Air admittance valves and solvents, Comparison of systems, Vent pipe, Symphonic action, Antisyphon and vent pipes, Loop, Circuits, Types of building drainage pipes, Fittings and jointing methods, Clean outs, Drainage fixture units (DFU), Sizing, Testing, Case study

Unit IV Traps and Interceptors **(6Hrs.)**

Traps-Purpose, Fixture traps and floor traps, Prohibited traps, Trap arm, Developed length, Trap seal, Trap seal protection, Venting of traps, Trap primers, Building traps, Clarifiers, Grease interceptors, Sizing, oil and sand interceptors.

b) Vents:

Vent requirement, Parts of vent system. Parts of vent system, Materials, Sizing, Vent connections, Flood rim level, Island sink venting, Venting of interceptors, Water curtain and hydraulic jump, Termination of vent stacks, Stack venting, Yoke vent, Wet venting.

Unit V **(6Hrs.)**

a) Building Sewers:

DFU, Change in direction of flow, Hydraulic jump,Sudsing stack, Cleanouts, Pipe grading, pipes and fittings suitable for building sewers, RCC, PVC, Nu-Drain, Stoneware., Sizing, testing, Types of traps, Gully, Chambers and manholes, Materials, Venting, Sizing, Testing, Sumps, Pumps, Sewage disposal, Septic tanks.

b) Plumbing in high rise buildings:

Definition of high rise building, Multiple storage tanks, Plumbing shafts, Break pressure tanks, Water supply, Hydro pneumatic system, Pressure reducing valves, Building drainage system, Rain water system, Sizing, Testing, Case study, Introduction to centralized hot water supply, Principles of design.

Unit VI **(6 Hrs)**

Design Parameters & Case Study

Introduction, Plumbing Drawings & Layouts, Water Supply Design Consideration, Sewer Network design consideration, Storm water design consideration as per CPHEEO manuals, Case study on each.

Term work

Term work will consist of 8 assignments with necessary plans /sketches.

1. Introduction of available codes in plumbing
2. Introduction of associations in plumbing in India and outside India
3. Detailed hydraulic design for High rise structure OR G+1 Bungalow by using software.
4. Compilation of rules and regulations of local governing bodies.
5. Roles of plumbing contractor and plumbing consultants.
6. Report on Plumbing fixtures and fittings and explain any ten.
7. Report on materials for water supply and drainage.
8. Report on necessity of traps, intercepts and vents

Books:

1. ―Plumbing Engineering‖ by Deolalikar.
2. ―Plumbing, Sanitation and Domestic Engineering‖ Volume – 1to 4 by G. S. Williams, Mc Graw Hill.
3. ―Plumbing, Sanitation and Domestic Engineering, Data Sheets & Wall Charts‖ by G. S. Williams, Mc Graw Hill
4. ―Plumbing Engineering, Theory and Practice‖ by Subhsh Patil. SEEMA Publishers Mumbai
5. ―National Plumbing Codes Handbook‖, by R. Dodge Woodson.
6. ―Central Public Health and Environmental Engineering Organisation Manual (CPHEEO)‖.

Codes:

1. Uniform Plumbing Code- India (UPC-I), 2008
2. Illustrated Training Manual (ITM), 2008.

401 010 Elective IV: Open Elective: 5 (b): Green Building Technology

Teaching Scheme:
Lectures: 3 Hours/week
Practical: 2 Hours/week

Examination Scheme:
Theory Examination:
In-sem : 30 Marks (1 Hour)
End-sem:70 Marks (2.5 Hours)
Term work: 50 Marks

Unit I: (6 Hrs.)

Materials and Its Applicability, Indoor Environmental Quality, Reuse and Recycle of Construction Waste.

A) Eco Friendly/ Green Building Materials: To understand Environmental impact of building materials. Eco Friendly building materials, their composition, availability, production, physical properties etc. Application of the Eco Friendly/ Green Building materials for different components of the buildings at different level, both internally and externally.
B) Indoor environmental quality, Low VOC materials: Adhesives - Sealants, Paints- Coatings etc.
C) Construction Waste as a Resource- Resource Economics, Disposable Materials, Recovery, Recycling, Collection, Processing, Governmental Role in Waste Management, Potential for Reuse.

Unit II (6 Hrs.)

Site / Building Planning

A) Sustainable Site planning: wind / sun path, water management , material use, landscape, topography.
B) Climate Responsive Architecture: orientation, solar- wind, Building envelope.
C) Thermal comfort indices. Heat flow through building materials. Thermal properties of common building materials available in India. Thermal performance of building envelope. Air movement and buildings. Ventilation and buildings. Wind an Stack effect. Mechanical ventilation. HVAC System, Day lighting. Passive and sustainable architecture. Passive and active systems.

Unit III (6 Hrs.)

Embodied Energy, Life Cycle Assessment, Environmental Impact Assessment, Energy Audit and Energy Management.

A) Embodied energy of various construction materials. Introduction to the Concept: ‒Life Cycle assessment of materials‖.

B) EIA : Introduction to EIA., Process of EIA and its application through a case study., EIA as a strategic tool for sustainable development.

C) Energy Management.

Unit IV **(6 Hrs.)**

Appropriate Technologies / Approaches for:

A) Water conservation / efficiency.

B) Sanitation (Grey water, black water management, SWM)

C) Treatments.

D) Biogas.

E) Composting.

F) Solar energy and its applicability through panels, photovoltaic cells etc.

G) Use of ‒LED, CFL, Fresnel Lens‖ etc.

H) Wind energy and its use.

I) Orientation aspects in site planning to achieve maximum daylight and natural ventilation.

UNIT V: **(6 Hrs.)**

A) Clean Development Mechanism.

B) Kyoto Protocol.

C) Energy Conservation Building Code.

UNIT VI **(6 Hrs.)**

Rating Systems: - Leadership in Energy and Environmental Design (LEED), Green Globes, National Association for Home Builders (NAHB) – For Homes, Building Research Establishment Environmental Assessment Method (BREEAM), Green Star by Green Building Council Australia (GBCA), LEED India, Comprehensive Assessment System for Built Environment Efficiency (CASBEE), Estimada -Abu Dhabi Urban Planning Council (UPC) etc.

Term Work:

Any Eight of the following:

A) To study: Innovative Materials Developed by CBRI, SERC.

B) To study: Environmental Audit of any existing building and prepare a report.

C) To study, analyze present scenario of organic waste collection and management of any of the premise; preferably hotels.

D) To compare the benefits under different rating systems.

E) To prepare detailed plan for a hypothetical site indicating utility of solar path, wind direction, rainfall intensity etc. to make it sustainable.

F) To prepare a report on carbon credit.

G) To prepare a report on energy efficient buildings in India.

H) To study sustainable planning aspects for urban housing.

I) Study of Design of On Site Sanitation Systems for Indian conditions developed by Appasaheb Patwardhan Safai V Paryavaran Tantraniketan, Dehugaon .

J) To study the benefits given by Municipal Corporations to Green Buildings.

Reference Books and Additional Reading material:

1. Manual of Tropical housing and climate by Koenisberger.
2. Climate responsive architecture by Arvind Krishnan.
3. Manual of solar passive architecture - by Nayak J.K. R. Hazra J. Prajapati.
4. Energy Efficient Buildings in India by Milli Mujumdar.
5. Green Building Materials by Ross Spiegel and Dru Meadows.
6. Publications from - CBRI – Roorkee, - IDC – Mumbai, NID – Ahmedabad.
7. Solar Energy in Architecture and Urban Planning by Herzog Thomas.
8. Solar Heating, Design Process by Kreider Jan F.
9. Energy - Manual for college teachers (CEE publications).
10. Renewable Energy & Environment - A policy analysis for India (CEE publications).
11. Sustainable Building Design Manual-Volume I and II –TERI Publication.
12. Mechanical and Electrical Systems in Construction and Architecture-by Frank R Dagostino.

Principles of Air conditioning-By V. Paul Lang:

1. Heating, Cooling and lighting design methods for architecture. By Lechor Worbert.
2. LEED Manual.
3. Green Globes Manual.
4. Florida Green Building Coalition Manual.
5. The green building process.
6. Green building codes and standards.
7. International Green Construction Code.
8. ASHRAE 189P.
9. ANSI/GG 01, TERI, BREEAM etc.

401 010 Elective IV: Open Elective: 5 (c): Ferrocement Technology

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 hours/week	**Theory Examination:**
Practical: 2 hours/week	**In-sem : 30 marks (1 Hour)**
	End-sem:70 marks (2.5 Hours)
	Term work: 50 Mark

Unit 1 **(6 Hrs.)**

What is Ferrocement?

a) Definition, Basic concept like bond increase. Comparison with concretes like RCC, Prestressed, Asbestos cement, Fiber reinforced, Polymer concretes. Composition of ferrocement. Special types of ferrocement. Ferrocement as substitute for conventional building materials. Typical characteristics and their applications.

b) Raw materials, skills, tools and plants. Ferrocement as material of construction. Forming a ferrocement structure. Properties and specifications of raw materials. Proportioning of cement mortar. Job requirements of required skills. Tools and plants.

Unit 2 **(6 Hrs.)**

Mechanical properties and construction methods:

a) Mechanical properties and typical features affecting design. Properties under static and dynamic loading. Shrinkage and creep. Testing of ferrocement.

b) Methods of constructing ferrocement structures. Standardizing method of construction. Planning the work. Fabricating skeleton, tying meshes and mortaring. Curing. Maintenance. Protective surface treatments. Damage to ferrocement structures.

Unit 3 **(6 Hrs.)**

Strength through shape and design:

a) Strength through shape. Design of structure based on form and shape. Forms in nature, various structural forma and their behavior. Typical strengths of different materials. Comparative study of various forms.

b) Design of ferrocement structures. Design, analysis and optimization. Special design considerations for ferrocement. Typical features of ferrocement affecting design. Conventional design methods like working stress, load factor, applied to ferrocement. Design based on equivalent area method for compression, tension and flexural members. Specific surface method and crack control method, Design of structures subjected to membrane stresses. Design of shaped structures in ferrocement like stiffened plates, arch faced walls, stiffened cavity walls and hollow floors and beams, Design of forms like _T‘ _U‘ _T‘ _+‘ _L‘

Unit 4 **(6 Hrs.)**

Cost analysis and ferrocement in Building construction.

a) Cost analysis : Factors governing cost analysis. Special considerations for ferrocement structures. Cost comparison with conventional construction. Specifications for ferrocement structures. Quantity analysis of material and labour for ferrocement items. Cost and value of ferrocement construction.

b) Ferrocement in building construction. Ferrocement in foundations, walls, floors roofs. Ferrocement single wall construction. Design and construction of houses with cavity walls, hollow floors and hollow beams. Staircases and other building accessories. Earthquake resisting structures. Special characteristics of ferrocement to resist shock loading design and construction of quake proof structures.

Unit 5 **(6 Hrs.)**

Hydraulic and soil retaining structures in ferrocement :

a) Hydraulic structures. Why ferrocement? Water retaining structures, Storage tanks of various types. Structures across streams. Ferrocement in layered form used for lining, water proofing and surface coating.

b) Soil retaining structures. Types of retaining walls and their comparison with ferrocement arch faced wall. Design and method of fabrication and casting. Ferrocement counterfort retaining wall. Ferrocement containers for storing granular materials.

Unit 6 **(6 Hrs.)**

Space structures and precast products:

a) Ferrocement large size special purpose structures. Space structures like shells, pyramids, domes corrugated catenaries.

b) Precast ferrocement products : Why ferrocement for precasting? Methods of precasting. Design of precast elements. Ferrocement precast walling and flooring panels. Joints in precast ferrocement elements.

Term Work :

Minimum 02 site visits with detailed reports and one assignment based on each unit (Journal consisting of total 6 assignments + 2 visit reports).

Books Recommended:

1) Ferrocrete Technology- A Construction Manual. -- Dr. B. N. Divekar Published by the Author.

2) Ferrocement --- : B. R. Paul and R. P. Pama.Published by International Ferrocement Information Centre. A.I.T. Bangkok, Thailand.

3) Ferrocement and laminated cementitious composites --: A.E. Naaman. Publisher : Techno-press, Ann Arbor, Michigan, USA.

4) Ferrocement - Materials and applications; Publication SP 61, A C I Detroit. USA

5) State of the art report and guide for design, Construction and repairs of Ferrocement; ACI Committee Report. No. ACI 549R-88 and ACI 549.1R.88. Published by American Concrete Institute, Detroit, USA.

6) Chapter 1 titled ‗Ferrocement' by S. P. Shah and P. N. Balaguru in book ‗Concrete Technology and Design Vol. II, Editor; R. N. Swamy.

7) Proceedings of International Symposiums on ‗Ferrocement and thin reinforced composites – Ferro 1 to Ferro 10. Available with International Ferrocement Information Centre, A I T Bangkok, Thailand.

8) Ferrocement Conference Proceedings of Ferrocement Society, India--FS 2011, F.S.2013, F. S. 2015.

401 010 Elective IV: Open Elective: 5 (d): Sub Sea Engineering

Teaching Scheme
Lectures: 3 hours/week
Practical 2 hours/week

Examination Scheme
Theory Examination
In-sem: 30 marks (1 Hour)
End-sem: 70 marks (2.5.Hours)
Termwork: 50 Marks.

Unit1 **(6 Hrs.)**

Introduction to oil and gas industry: general view of oil and gas industry, technological challenges and future developments. Overview of deep water developments: introduction, deep water areas and potential, challenges, route for development Metaocean and environmental conditions: Overview of the determination of Metaocean conditions (meteorological and oceanographic) and the influence of wave, wind, tide and current on marine operations. Introduction to marine ecology and its impact on marine operations.

Unit 2 **(6 Hrs.)**

Introduction to subsea infrastructure development: Summarize the current state of the art and highlights the design challenges. Outlines the way in which water depth influences the architecture and technology of Oil and Gas infrastructure.

Flow assurance: overview of flow assurance and the fundamentals of flow management for subsea production systems, Introduction to flow assurance issues like paraffin deposition; hydrate formation and blockage; Asphaltene precipitation; emulsions; experimental methods, flow assurance assessment methods; prevention, mitigation and remediation tools for flow assurance issues; thermal management and insulation materials.

Unit 3 **(6 Hrs.)**

Subsea installation and intervention: Overview of the installation of subsea plant, risers and pipelines and the main intervention methods including AUVs, ROVs and divers.

Subsea operations and control: An overview of the principle methods of subsea control including electrical, acoustic and hydraulic systems.

Subsea processing and artificial lift: introduction the analytical and numerical models used to design subsea processing systems for sustained recovery of hydrocarbons.

Unit 4 **(6 Hrs.)**

Reliability and integrity management: Introduction to Risk Assessment, FMECA and HAZOPS, Monitoring, Intervention and Inspection Methods, Data Management Construction management of oil field, future challenges.

Unit 5 **(6 Hrs.)**

Subsea field equipment, structures and architectures: scale of operations, environmental factors, A description of each of the pieces of the subsea infrastructure, their use and interconnection including subsea trees, flow lines, umbilicals, risers, moorings and pipelines Materials and corrosion. Types of corrosion found in the oilfield with emphasis on the effects of acid gases (CO_2 and H_2S).

Unit 6 **(6 Hrs.)**

Pipelines and design: Introduction to pipeline engineering, the main pipeline design challenge in deep water. Analysis and design methods of pipelines that address stress analysis, buckling and collapse of deep water pipelines. Limit state based strength design methods. Geotechnical aspects of pipeline design and its installation.

Deepwater risers: different design options available for deep water risers, and defines the key design drivers for each. General principles of stress analysis: An introduction to the principles of stress analysis and the principles of reliability based design, finite element analysis.

Termwork:--Shall consist of one assignment per unit.

References:

1. A Primer of Offshore Operations by Petex
2. Subsea Engineering Handbook Hardcover by Yong Bai (Editor), Qiang Bai (Editor)
C. Norsok standard Common requirements Subsea structures and piping system U-cr-001 Rev. 1, January 1995.
D. Norsok codes, DNV codes : Design specifications for subsea system.

401 010 Elective IV : Open Elective : 5 (e): (Geoinformatics)

Teaching Scheme:
Lectures: 3 Hrs/week

Examination Scheme:
Paper In-sem. 30 Marks (1 Hrs),
Paper End-sem : 70 Marks (2.5 Hrs.)

Unit I (6 Hrs.)

Introduction to Remote Sensing GIS and SBPS:

Electro-magnetic radiations (EMR) - atmospheric scattering, Raleigh scattering, Mie scattering, non-selective scattering -atmospheric absorption - atmospheric windows, refraction - interaction of EMR earth_s surface - reflection - transmission - spectral signature - Reflectance characteristics of Earth_s cover type: Vegetation, water, soil

Introduction to GIS - Basic spatial concepts - Coordinate Systems - GIS and Information Systems – Definitions – History of GIS - Components of a GIS – Hardware, Software, Data, People, Methods – Proprietary and open source Software - Types of data – Spatial, Attribute data- types of attributes – scales/ levels of measurements. Introduction to SBPS, Segments and errors in GPS.

Unit II (6 Hrs.)

THERMAL REMOTE SENSING: Thermal radiation principles – Thermal interaction sensors and characters – thermal image characters – image degradation sources & correction – interpretation of thermal images – Application and Case studies.

MICROWAVE REMOTE SENSING: Introduction-Plane waves-Interference, Radar remote sensing - Radar basics- Antenna Systems -Real aperture radar - Radar frequency bands - SLAR Imaging Geometry, Resolution Concepts - Geometric Distortions, SAR – Concepts - Doppler principle & Processing. RADAR Interaction with earth surface- RADAR equation.

Unit III Unit II (6 Hrs.)

DIGITAL IMAGE PROCESSING :

Fundamentals of Image Processing, sensors model and pre processing, image enhancement, image classification, object recognition.

Unit IV **(6 Hrs.)**

OPEN SOURCE GIS:

DESKTOP GIS WITH OPEN SOURCE GIS : View Graphics – Data exchanges- portability and interoperability – Raster handling and Image analysis – vector data management –Rater and vector analysis - 2D/3D vectors with topology, 3D Voxel, 2D Raster.

OPEN SOFTWARE AND WEB MAPPING : Open Source Software : GRASS, QGIS, OSSIM, PostopesSQL and (R) Environment – WEB Mapping Architecture and components – WEB mapping servers- Thin clients in WEB mapping - WMS,WFS, WCS,WPS and other web services- Open Server standards.

Unit V **(6 Hrs.)**

MAP PROJECTION:

Concepts of sphere, ellipsoid and geoid - latitudes, longitudes and graticules –map projections– shape, distance, area and direction properties - role of aspect, development surface, secant and light source / view points – perspective and mathematical projections – Indian maps and projections – Map co-ordinate systems – UTM and UPS references – common projections and selections– projections for hemispheres and the world maps , Map projection for cadastral maps.

Unit VI **(6 Hrs.)**

FUNDAMENTALS and GEOMETRIC GEODESY:

Definitions- Classifications, Problem of Geodesy and purpose of Geodesy Historical development and Organization of Geodesy. Reference Surfaces and their relationship. Applications, Engineering, Lunar, Planetary and interferometric Synthetic aperture radar Geodesy – Local and International Spheroid.

Geomentry of ellipsoid, fundamental mathematical relationship of ellipsoid, Geodetic, Geocentric and Reduced latitudes and their relationship. Ellipsoidal Co-ordinates in terms of Reduced, Geodetic and geocentric latitude. Radius of curvature in the meridian & prime vertical and their relationship. Mean Radius of curvature in any azimuth, Length of the meridian arcs and arcs of parallel and Area of trapezium on the ellipsoid. Curves on the ellipsoid, properties of Geodesic.

Reference Books:

1. Wolfgang Torge, Geodesy, Walter De Gruyter Inc., Berlin, 2001
2. Lillesand, T.M. and Kiefer R.W. Remote Sensing and Image interpretation, John Wiley and Sons, Inc, New York, 2002.
3. Neteler M, Helena M (2008) _Open source GIS: A GRASS GIS approach_, 3rd edn, Springer, New York
4. Kang-Tsung Chang, Introduction to Geographic Information Systems, Mc-Graw Hill Publishing, 2nd Edition, 2011.
5. John, R. Jensen, Introductory Digital Image Processing, Prentice Hall, New Jersey,2005 3rd edition
6. R.W. Anson and F.J. Ormeling, Basic Cartography for students and Technicians. Vol.I, II and III, Elsevier Applied Science Publishers, 3rd Edition, 2004.

401006 Project work

Teaching Scheme:
Tutorial: 6 Hrs/week

Examination Scheme:
TW : 50 Marks.
Oral : 100 Marks.

Project Work will be evaluated for an individual student based on the presentation of the work done in a year(I Sem + II Sem) and submission of the report .The student may work in a group during project work, if any.

The project work shall consist of any one of the following nature in Civil Engineering related subjects.

1. Experimental investigation.
2. Software development.
3. Benefit : Cost economic analysis.
4. Case study with own design.
5. Working model design and fabrication.
6. Case study with development of methodology using soft computing tools.

The details of report writing and preparation of report will be similar to that of as mentioned in syllabus of Project Phase I in first semester.

Evaluation of Project work in final exam. Will be done by the pair of internal guide having minimum 3 years approved experience as teacher and external guide.

It is recommended to promote the students to present a paper based on project work in appropriate conference / journal.

Savitribai Phule Pune University

Faculty of Science &Technology

B.E. (Electronics & Telecommunication)
(2015 Pattern) Syllabus

(With effect from Academic Year 2018-19)

Savitribai PhulePune University
Final Year E&TC Engineering (2015 Course)
(With effect from Academic Year 2018-19)

Semester I												
Course Code	**Course**	**Teaching Scheme Hours / Week**			**Semester Examination Scheme of Marks**						**Credits**	
		Theory	**Tut**	**Pract**	**In-Sem**	**End-Sem**	**TW**	**PR**	**OR**	**Total**	**TH/TW**	**PR+OR**
404181	VLSI Design& Technology	3	--	--	30	70	--	--	--	100	3	--
404182	Computer Networks & Security	4	--	--	30	70	--	--	--	100	4	--
404183	Radiation & Microwave Techniques	3	--	--	30	70	--	--	--	100	3	--
404184	Elective I	3	--	--	30	70	--	--	--	100	3	--
404185	Elective II	3			30	70	--	--	--	100	3	--
404186	Lab Practice -I (CNS+ RMT)	--	--	4	--	--	50	--	50	100	--	TW 01 + OR 01
404187	Lab Practice -II (VLSI + Elective I)	--	--	4	--	--	50	50		100	--	TW01 + PR 01
404188	Project Stage I	-	2	--	--	--	-	--	50	50	--	2
	Audit Course 5	--	--	--	--	--	--	--	--	--	----	
	Total	16	2	8	150	350	100	50	100	750	16	6
Total Credits											**22**	

Elective I

1 Digital Image and Video Processing

2. Industrial Drives and Control

3. Embedded Systems & RTOS

4. Internet of Things

Elective II

1. Wavelets

2. Electronics Product Design

3. Optimization Techniques

4. Artificial Intelligence

5. Electronics in agriculture

Audit Course 5

1. Green Energy

2. Human Behaviour

Final Year E&TC Engineering (2015 Course)

(With effect from Academic Year 2018-19)

Semester II

Course Code	Course	Teaching Scheme Hours / Week			Semester Examination Scheme of Marks						Credit	
		Theory	Tut	Pract	In-Sem	End-Sem	TW	PR	OR	Total	TH/TW	PR+OR
404189	Mobile Communication	3	--	--	30	70	--	--	--	100	3	--
404190	Broadband Communication Systems	4	--	--	30	70	--	--	--	100	4	--
404191	Elective III	3	--	--	30	70	--	--	--	100	3	--
404192	Elective IV	3	--	--	30	70	--	--	--	100	3	--
404193	Lab Practice –III (MC+BCS)	--	--	4	--	--	50	50	--	100	--	TW 01 + PR 01
404194	Lab Practice –IV (Elective III)	--	--	2	--	--	--	--	50	50	--	1
404195	Project Stage II	--	6	-	--	--		150	50	200	--	TW 04 + OR 02
	Audit Course 6	--	--	--	--	--	--	--	--	--		
Total		13	6	6	120	280	200	50	100	750	13	9
										Total Credits	22	

Elective III	**Elective-IV**	**Audit Course 6**
1. Machine Learning 2. PLC s and Automation 3. Audio and Speech Processing 4. Software Defined Radio 5. Audio Video Engineering	1. Robotics 2. Biomedical Electronics 3. Wireless Sensor Networks 4. Renewable Energy Systems 5. Open Elective*	1. Team Building, Leadership and Fitness 2. Environmental issues and Disaster Management

*Any one course from the list of Elective IV of computer/IT/Electrical/Instrumentation or Institute can offer elective IV based on any industry need with prior approval from BoS(Electronics & Telecommunication). Repetition of course or topics should be avoided.

404181 VLSI Design & Technology

Credits: 03

Teaching Scheme:		**Examination Scheme:**
Lecture : 03 Hr/Week		**In-Sem : 30 Marks** **End-Sem: 70 Marks**

Course Objectives:

- To explore HDL and related design approach.
- To nurture students with CMOS circuit designs.
- To realize importance of testability in logic circuit design.
- To overview ASIC issues and understand PLD architectures with advanced features.

Course Outcomes:

On completion of the course, student will be able to

1. Write effective HDL coding for digital design.
2. Apply knowledge of real time issues in digital design.
3. Model digital circuit with HDL, simulate, synthesis and prototype in PLDs.
4. Design CMOS circuits for specified applications.
5. Analyze various issues and constraints in design of an ASIC
6. Apply knowledge of testability in design and build self test circuit.

Unit I : HDL Design **7 Hrs**

Design Flow, Language constructs, Data objects, Data types, Entity, Architecture & types of modeling, Sequential statements, Concurrent statements, Packages, Sub programs, Attributes, HDL modeling of Combinational, Sequential circuits and FSM. Simulations, Synthesis, Efficient coding styles, Hierarchical and flat designs, Partitioning for synthesis, Pipelining, Resource sharing.

Unit II : Digital design and Issues **6 Hrs**

Sequential synchronous machine design, Moore and Mealy machines, HDL code for Machines, FIFO. Metastability and solutions, Noise margin, Fan-out, Skew, Timing considerations, Hazards, Clock distribution, Clock jitter, Supply and ground bounce, Power distribution techniques, Power optimization, Interconnect routing techniques; Wire parasitic, Signal integrity issues. I/O architecture.

Unit III : PLD Architectures and applications **6 Hrs**

Design Flow. CPLD Architecture, Features, Specifications, Applications. FPGA Architecture, Features, Specifications, Applications. The Simulation and Synthesis Tools, FPGA synthesis and implementation.

Unit IV:Digital CMOS circuits **7 Hrs**

N-MOS, P-MOS and CMOS, MOSFET parasitic, Technology scaling, Channel length modulation, Hot electron effect, Velocity saturation, CMOS Inverter, Device sizing, CMOS combinational logic design, Power dissipations, Power delay product, Body Effect, Rise and fall times, Latch Up effect, transmission gates.

Unit V : Application Specific Integrated Circuit **7 Hrs**

Design Flow, Cell design specifications, Spice simulation, AC and DC analysis, Transfer Characteristics, Transient responses, Noise analysis, Lambda rules, Design rule check, Fabrication methods of circuit elements, Layout of cell, Library cell designing for NAND & NOR, Circuit Extraction, Electrical rule check, Layout Vs. Schematic, Post-layout Simulation and Parasitic extraction, Design Issues like Antenna effect, Electro migration effect, Cross talk and Drain punch through, Timing analysis.

Unit VI : VLSI Testing and Analysis **6 Hrs**

Types of fault, Need of Design for Testability (DFT), DFT Guideline, Testability, Fault models, Path sensitizing, Test pattern generation,Sequential circuit test, Built-in Self Test, JTAG & Boundary scan, TAP Controller.

Text Books:

1. Charles H. Roth, "Digital systems design using VHDL", PWS.
2. Wyane Wolf, "Modern VLSI Design (IP-Based Design)", 4E,Prentice Hall.
3. Steve Kilts "Advanced FPGA Design Architecture, Implementation and Optimization", Wiley.

Reference Books:

1. E. Weste, David Money Harris, "CMOS VLSI Design: A Circuit &System Perspective", Pearson Publication.
2. R. Jacob Baker, "CMOS Circuit Design, Layout, and Simulation", 3E, Wiley-IEEE Press
3. John F. Wakerly, "Digital Design Principles and Practices" , 3E, Prentice Hall
4. M. Morris Mano , "Digital Design", 3E , Pearson
5. CemUnsalan, Bora Tar, "Digital System Design with FPGA: Implementation Using Verilog and VHDL", McGraw-Hill

404182Computer Networks & Security

Credits: 04

Teaching Scheme:			**Examination Scheme:**	
Lecture : 04 Hrs/Week				**In-Sem: 30 Marks** **End-Sem: 70 Marks**

Course Objectives:

- To understand state-of-the-art in network protocols, architectures, and applications
- To provide students with a theoretical and practical base in computer networks issues
- To outline the basic network configurations
- To understand the transmission methods underlying LAN and WAN technologies.
- To understand security issues involved in LAN and Internet.

Course Outcomes:

On completion of the course, student will be able to

1. Understand fundamental underlying principles of computer networking
2. Describe and analyze the hardware, software, components of a network and theirinterrelations.
3. Analyze the requirements for a given organizational structure and select the most appropriatenetworking architecture and technologies
4. Have a basic knowledge of installing and configuring networking applications.
5. Specify and identify deficiencies in existing protocols, and then go onto select new and betterprotocols.
6. Have a basic knowledge of the use of cryptography and network security.
7.

Unit I : Introduction to Local Area Networks **6Hrs**

TCP/IP Protocol Suit, Media Access Control:Random Access, Controlled Access- Reservation, Channelization. Wired LAN:Ethernet Protocol, Standard Ethernet, Fast Ethernet (100 MBPS), Gigabit Ethernet, 10 Gigabit Ethernet. Wireless LAN : Introduction, IEEE 802.11 Project, Bluetooth

Unit II :Network Layer Part I **7Hrs**

Introduction to Network Layer:Network-Layer Services, Packet Switching, Network-Layer Performance, IPv4 Addresses, Forwarding Of IPPackets,Network Layer Protocols:Internet Protocol (IP), ICMPv4, Mobile IP

Unit III : Network Layer Part II **6 Hrs**

Unicast and Multicast Routing:Introduction, Routing Algorithms, Unicast Routing Protocols, Introduction, Multicasting Basics, Intra-domain Multicast Protocols, Inter-domain Multicast Protocols, IGMP. Next Generation IP:IPv6 Addressing, The Ipv6 Protocol, TheICMPv6 Protocol, Transition From IPv4 toIPv6.

Unit IV : Transport Layer **6 Hrs**

Introduction to Transport Layer:Introduction, Transport-Layer Protocols,Transport Layer Protocols:Introduction, User Datagram Protocol, Transmission Control Protocol, SCTP.

Unit V : Application Layer 7 Hrs

Introduction to Application Layer, Standard Client Server Protocols:World Wide Web and HTTP , FTP, Electronic Mail, Telenet, SSH, DNS.Network Management: Introduction, SNMP.

Unit VI : Network Security **7Hrs**

Cryptography & Network Security: Introduction Confidentiality, Other Aspects Of Security.

Internet Security:Network-Layer Security, Transport-Layer Security, Application-Layer Security, Firewalls.

Text Books:

1. Behrouz A. Forouzan, "Data Communications and Networking" MacGraw Hill, 5th edition
2. James F. Kurouse& W. Rouse, "Computer Networking: A Top down Approach", 6thEdition, Pearson Education.

Reference Books:

1. Andrew S. Tannenbaum, "Computer Networks", Pearson Education, Fourth Edition,2003
2. Wayne Tomasi, "Introduction to Data Communication and Networking", 1/e, Pearson Education
3. Natalia Olifer, Victor Olifer, "Computer Networks" Wiley Student Edition

404183 Radiation and Microwave Techniques

Credits: 03

Teaching Scheme:		**Examination Scheme:**

Lecture : 03 Hr/Week				In-Sem : 30 Marks End-Sem : 70 Marks

Course Objectives:

- To introduce fundamental theory of radiation and microwaves.
- To understand design principles of various radiating elements.
- To understand theory of passive and active components of microwave systems.
- To learn microwave measurement techniques.

Course Outcomes:

On completion of the course, student will be able to

1. Differentiate various performance parameters of radiating elements.
2. Analyze various radiating elements and arrays.
3. Apply the knowledge of waveguide fundamentals in design of transmission lines.
4. Design and set up a system consisting of various passive microwave components.
5. Analyze tube based and solid state active devices along with their applications.
6. Measure various performance parameters of microwave components.

Unit I : Fundamental Theory of Radiation and Radiating Elements 8Hrs

Fundamental equations for free space propagation, Friis transmission equation, Definition of antenna, radiation mechanism and types of antenna, performance parameters such as radiation pattern, directivity, gain, efficiency, half power beam width, bandwidth, polarization, input impedance, radiation efficiency, effective length, effective area, radiation sphere.

Unit II : Radiating elements and arrays7 Hrs

Comparison of various radiating elements such as infinitesimal dipole, small dipole, finite length dipole and half wave length dipole, analytical treatment of these elements. Planar, log periodic and YagiUda antenna. Types of arrays, two element array, N-element array, uniform amplitude uniformly spaced linear broad side and end-fire array.

Unit III : Transmission lines and Waveguides 6Hrs

General solution for TEM, TE and TM waves.Analysis of coaxial line and rectangular waveguides. Analysis of rectangular cavity resonators and their applications, Striplines: Structural details, types and applications.

Unit IV : Passive Microwave Components 6Hrs

Construction, working principle and scattering analysis of passive microwave components such as E-plane, H-plane and magic tee. Ferrite composition, characteristics and Faraday rotation principle. Construction, working principle and scattering analysis of isolator, circulator and directional coupler. Construction and operation of gyrator.

Unit V: Active Microwave Components 6Hrs

Limitations of conventional tubes, O and M type classification of microwave tubes, re-entrant cavity, velocity modulation.Construction, operation, performance analysis and applications of -Single cavity and two cavity klystron,Cylindrical wave magnetronandHelix traveling wave. Construction, working principle and applications of two terminal microwave devices such as tunnel diode, Gunn Diode, PIN Diode, Schottky Barrier Diode and Varactor.

Unit VI : Microwave Systems and Microwave Measurement Techniques 6Hrs

Microwave terrestrial and satellite communication system and industrial applications of microwaves such as microwave heating, thickness and moisture measurement, medical application such as microwave diathermy.Microwave measurement devices such as slotted line, tunable detector, VSWR meter, power meter, and their working principles. Microwave measurement techniques to measure S-parameters, frequency, power, attenuation, phase shift, VSWR, impedance.

Radiation hazards and protection.

Text Books:

1. C.A. Balanis, “Antenna Theory - Analysis and Design", John Wiley.
2. Samuel Y. Liao, “Microwave Devices and Circuits”, 3rd edition, Pearson
3. Annapurna Das and Sisir K. Das, “Microwave Engineering", Second edition, Tata McGraw Hill.

Reference Books:

1. David M. Pozar, “Microwave Engineering", Fourth edition, Wiley.
2. Ahmad Shahid Khan, “Microwave Engineering : Concepts and Fundamentals
3. K. D. Prasad, “Antenna &Wave Propagation”, SatyaPrakashan, New Delhi.
4. M. Kulkarni, “Microwave and Radar engineering”, 3rd edition, Umesh Publication
5. E.C. Jordon and E.G. Balman, “Electromagnetic Waves and Radiation Systems”, Prentice Hall India.

404184 Digital Image and Video Processing (Elective-I)

Credits: 03

Teaching Scheme:			**Examination Scheme:**	
Lecture : 03 Hr/Week				**In-Sem: 30 Marks** **End-Sem: 70 Marks**

Course Objectives:

- Understand the fundamental concepts of Digital Image Processing with basic relationship of pixels and mathematical operations on 2-D data.
- Learn design and integrate image enhancement and image restoration techniques
- Understand object segmentation and image analysis techniques
- Learn the need for effective use of resources such as storage and bandwidth and ways to provide effective use of them by data compression techniques
- Learn basic concepts of video processing

Course Outcomes:

On completion of the course, student will be able to

1. Develop and implement basic mathematical operations on digital images.
2. Analyze and solve image enhancement and image restoration problems.
3. Identify and design image processing techniques for object segmentation and recognition.
4. Represent objects and region of the image with appropriate method.
5. Apply 2-D data compression techniques for digital images.
6. Explore video signal representation and different algorithm for video processing.

Unit I : Fundamentals of Image Processing **5 Hrs**

Steps in Image processing, Human visual system, Sampling & quantization, Representing digital images, spatial and gray level resolution, Image file formats, Basic relationships between pixels, Distance Measures, Basic operations on images – image addition, subtraction, logical operations, scaling translation, rotation. Color fundamentals and models – RGB, HIS, YIQ

Unit II : Image Enhancement and Restoration **8 Hrs**

Point – Log transformation, Power law transformation, Piecewise linear transformation, Image histogram, histogram equalization, Mask processing of images, filtering operations- Image smoothing, image sharpening, frequency domains image enhancement: 2D DFT, smoothing and sharpening in frequency domein, Pseudo coloring. Image Restoration: Noise models, restoration using Inverse filtering and Wiener filtering

Unit III : Image Compression **6 Hrs**

Types of redundancy, Fidelity criteria, Compression models - Information theoretic perspective – Fundamental coding theorem, Lossless Compression: Huffman Coding- Arithmetic coding. Introduction to DCT, Lossy compression: DCT based compression, Wavelet based compression, Image compression standards JPEG and JPEG 2000.

Unit III : Image Segmentation **8 Hrs**

Pixel classification, Bi-level thresholding, Multi-level thresholding, Adaptive thresholding, Otsu's method, Edge detection – First order derivative Prewitt and Sobel, Second order derivative – LoG, DoG, Canny. Edge linking, Hough transform, Region growing and region merging. Morphological operators: Dilation, Erosion, Opening, Closing, Hit or Miss transform, Boundary detection, Thinning, Thicking, Skelton.

Unit V : Representation and Description 5 Hrs Representation – Chain codes, Polygonal approximation, Signatures, Boundary descriptors, Shape numbers, Fourier descriptors, Stastical moments, Regional descriptors – Topological, texture, Principal components for description
Unit VI : Video Processing 6 Hrs Fundamental Concepts in Video – Types of video signals, Analog video, Digital video, Color models in video, Motion Estimation; Video Filtering; Video Compression, Video coding standards MPEG.
Text Books: 1. Gonzalez and Woods, "Digital Image Processing", Pearson Education, 3rd edition 2. Iain E. G. Richardson, "H.264 and MPEG 3. Video Compression: Video Coding for Next Generation Multimedia", John Wiley and Son's Publication, 3rd Edition.
Reference Books: 1. A. K. Jain, Fundamentals of digital image processing, Prentice Hall of India, 1989. 2. Pratt William K. "Digital Image Processing", John Wiley & sons 3. A. Bovik, Handbook of Image & Video Processing, Academic Press, 2000

404184 Industrial Drives and Control (Elective-I)				
Credits: 03				
Teaching Scheme:			**Examination Scheme:**	
Lecture : 3Hours / Week				**In-Sem : 30 Marks** **End-Sem: 70 Marks**

Course Objectives:

- Describe the structure of Electric Drive systems and their role in various applications such as flexible production systems, energy conservation, renewable energy, transportation etc., making Electric Drives an enabling technology
- Study and understand the operation of electric motor drives controlled from a power electronic converter and to introduce the design concepts of controllers for closed loop operation
- Study DC, AC, special machines like stepper motor, servo motor and brushless motor and their control.

Course Outcomes:

On completion of the course, student will be able to

1. Understand the basic principles of power electronics in drives and its control, types of drives and basic requirements placed by mechanical systems on electric drives for various applications
2. Understand the operation of 1ɸ & 3ɸ converter drives for separately excited & series DC motors, dual converter drives, 2 quadrant and 4 quadrant DC chopper drives, Open-loop & closed-loop control of DC drives with transfer function, Dynamic and regenerative braking. Protection circuits for DC drives.
3. Learn speed control of induction motor drives in an energy efficient manner using power electronics. To study and understand the operation of both classical and modern induction motor drives like FOC or Vector control.
4. Learn and understand working of various types of synchronous motors and their drive systems
5. Learn stepper motors & drives, BLDC and SRM motors and drives
6. Understand modern control techniques of Fuzzy logic and ANN in motor drive application

Unit I :Motor Drive as system 5 Hrs

Electrical drive as system, Parts of Electrical drives AC / DC drives, Components, nature and classification of load torques. Four quadrant operation of a motor drive. Control of Electrical drives, steady state stability Closed loop control, Selection of motor power rating

Unit II : DC Motors and drives6Hrs

Basic characteristics of DC motors, Operating modes, Motor performance parameters, 1ɸ & 3ɸ converter drives for separately excited & series DC motors for continuous & discontinuous operations. Chopper fed DC drives, Comparison of converter fed drive & chopper fed drive. Open loop & closed loop control of dc drives with transfer function PLL control, Microprocessor based control of dc drives, Dynamic and regenerative braking of DC motors

Unit III :Induction Motors and Drives 8Hrs

Induction motor characteristics, Control strategies like stator voltage control, v/f control, rotor resistance control, Variable frequency Square wave VSI Drives, Variable frequency PWM VSI Drives, Variable frequency CSI Drives, Closed loop control of Induction motors, v/f control of three phase IM using PWM inverter, Vector Control (Field oriented Control): Basic principle of vector control, Direct vector control & indirect vector control, DQ Transformation, Braking of induction motor, soft acceleration and deceleration, various protections.

Unit IV :AC and DC synchronous Motors and drives6Hrs

Cylindrical rotor motor Drive, Salient pole motor Drive, Switched reluctance motor (SRM) drive, Synchronous Reluctance motor drive, self-controlled synchronous motor drives Permanent magnet Brushless DC motor drive, Permanent magnet AC synchronous motor drive, Variable reluctance & permanent magnet stepper motor and drive. Servo motor Drives.

Unit V :Power Electronics applications inRenewable Energy 6Hrs

Wind power system: System component, Turbine rating, Electrical load matching, fixed speed and variable speed operation, System design features, Maximum power operations and System control requirement WECS: Principle of WECS, role of power electronics in WECS, Drive selection criteria for fixed speed and variable speed WECS, Stand-alone PV systems, Grid connected PV systems. Power Electronics for Photovoltaic Power Systems Basics of Photovoltaic: The PV cell, Module and array, I-V and P-V curves, PV system component, Stand-alone PV systems, Grid connected PV systems.

Unit VI :Artificial Intelligence in Motor Drives5Hrs

Fuzzy logic principle and applications: Introduction, Fuzzy sets, Fuzzy system, Fuzzy control, Fuzzy logic based induction motor speed control. Neural network principle and applications: Introduction, Neural network in identification and control, AI Applications in electrical machines and drives, Neural network based PWM controller.

Text Books:

1. Fundamental of Electrical Drives, Gopal K. Dubey, Narosa Publishing House .
2. Power Electronics, circuits, devises and applications by Muhammad Rashid, Pearson
3. Modern Power Electronics and AC Drives, Bimal K. Bose, Pearson

Reference Books:

1. Wind & Solar Power system, Mukund Patel , CRC Press
2. Thyristor DC drives, P. C Sen, John Wiley.
3. Power Electronics, Converters, Applications and Design, N. Mohan, T. M. Undeland &W. P. Robbins, John Wiley and Sons, 3rd Edition

404184 Embedded Systems and RTOS(Elective-I)				
Credits: 03				
Teaching Scheme:			**Examination Scheme:**	
Lecture : 03Hr/Week				**In-Sem : 30 Marks** **End-Sem: 70 Marks**

Course Objectives:

- To understand and able to design an application specific systems.
- To develop implementation skill for application specific systems.
- To understand design and implementation of real time system using RTOS.
- To understand open source platform for embedded system

Course Outcomes:

On completion of the course, student will be able to

1. Understand design of embedded system
2. Use RTOS in embedded application
3. Use modern architecture for embedded system
4. Use Linux for embedded system development
5. Use open platform for embedded system development

Unit I : Embedded System Overview 6 Hrs

Embedded System Introduction, Hardware and software architectures of ES, Design metrics(technical and techno- economical), Prototyping models, Development tool chain insights(GNU), guidelines for Selection of hardware and memory architecture, embedded C programming, embedded system design challenges, standard programming practices in embedded system.

Unit II :Real time system and RTOS 7 Hrs

Real time system, types, design approaches and considerations, Usage ofSharedresourcesand related issues, Concept of RTOS, Types of RTOS, differences from GPOS (Multitasking, Inter-process communication, Timers, Device drivers, protection mechanism etc.), real time scheduling algorithms, commercial RTOS , survey of RTOS.

Unit III :µcos-II –RTOS8 Hrs

µcos-II features, kernel structure, data structure, µcos-II services as task management, time management, inter-process communication (mailbox, queue,events,pipesetc.), memory management.µcos-II porting on ARM7/Cortex (M3/M4) architecture.

Unit IV : Advanced embedded architectures (Cortex-M3/M4)8 Hrs

Introduction to ARM CORTEX series, Design Philosophy, processors series, versions, features and applications. CMSIS standard for ARM Cortex. Survey of CORTEX M3/M4 based controllers. ARM-CM3 Based Microcontroller LPC1768: Features, Architecture (Block Diagram &itsDescription), System Control, Clock & Power Control, GPIO, Pin Connect Block, interfacing with RGB LED, Seven Segment, TFT Display, MOTOR control using PWM.

Unit V : Embedded Linux 8 Hrs

Linux for embedded systems, embedded Linux development system, kernel architecture and configuration, file systems, porting Linux on ARM architecture, boot loaders, tool utilities such as Minicomp, Busybox, Redboot, Libc, Device drivers- concept, architecture, types, sample character device driver.

Unit VI :Open hardware /development systems and Case study7 Hrs

Arduino open platform (IDE), development using ATMega328p based Uno board, structure of Arduino programs, introduction to Arduino library, sample GPIO program.
Case study of implementation with control, compute and communication modules using Arduino platform.

Text Books:

1. Jean J.Labrosse, "MicroC OS II, The Real-Time Kernel", 2nd edition, CMP Books.
2. Christopher Hallinan, "Embedded Linux Primer -A Practical, Real-World Approach "2nd edition, Prentice Hall.
3. Parag H Dave, Himanshu .H.Dave," Embedded systems" Concepts, design and programming, Pearson India

Reference Books:

1. Frank Vahid and Tony Givargis, " Embedded System Design – A Unified hardware/ Software introduction " 3rd edition, Wiley
2. David Simon, "Embedded system primer"
3. Raj Kamal, "Embedded Systems – Architecture, Programming and Design" 2nd edition,
4. http://www.ti.com/lit/an/slaa207/slaa207.pdf
5. MSP430x5xx: http://www.ti.com/product/msp430f5529
6. MSP430x4xx : http://www.ti.com/product/msp430f438
7. MSP430x2xx: http://www.ti.com/product/msp430g2302-ep

404184 Internet of Things (Elective-I)

Credits: 03

Teaching Scheme:				**Examination Scheme:**
Lecture : 03 Hr/Week				**In-Sem: 30 Marks** **End-Sem: 70 Marks**

Course Objectives:

- To study fundamental concepts of IoT
- To understand roles of sensors in IoT
- To Learn different protocols used for IoT design
- To be familiar with data handling and analytics tools in IoT

Course Outcomes:

1. On completion of the course, student will be able to
2. Understand the various concepts, terminologies and architecture of IoT systems.
3. Use sensors and actuators for design of IoT.
4. Understand and apply various protocols for design of IoT systems
5. Use various techniques of data storage and analytics in IoT
6. Understand various applications of IoT

Unit I : Fundamentals of IoT **6Hrs**

Introduction, Definitions & Characteristics of IoT, IoT Architectures, Physical & Logical Design of IoT, Enabling Technologies in IoT, History of IoT, About Things in IoT, The Identifiers in IoT, About the Internet in IoT, IoT frameworks, IoT and M2M.

Unit II :Sensors Networks **7Hrs**

Definition, Types of Sensors, Types of Actuators, Examples and Working, RFID Principles and components, Wireless Sensor Networks: History and Context, The node, Connecting nodes, Networking Nodes, WSN and IoT.

Unit III :Wireless Technologies for IoT **6 Hrs** WPAN Technologies for IoT: IEEE 802.15.4, Zigbee, HART, NFC, Z-Wave, BLE, Bacnet, Modbus.
Unit IV :IP Based Protocols for IoT **6 Hrs** IPv6, 6LowPAN, RPL, REST, AMPQ, CoAP, MQTT.
Unit V :Data Handling& Analytics6Hrs Introduction, Bigdata, Types of data, Characteristics of Big data, Data handling Technologies, Flow of data, Data acquisition, Data Storage, Introduction to Hadoop. Introduction to data Analytics, Types of Data analytics, Statistical Models, Analysis of Variance, Data Dispersion, Contingence and Correlation, Regression Analysis, Precision and Error limits.
Unit VI :Applications of IoT **7Hrs** Home Automation, Smart Cities, Energy, Retail Management, Logistics, Agriculture, Health and Lifestyle, Industrial IoT, IoT design Ethics, IoT in Environmental Protection.
Text Books: 1.Hakima Chaouchi, " The Internet of Things Connecting Objects to the Web" ISBN : 978-1-84821-140-7, Wiley Publications 2. Olivier Hersent, David Boswarthick, and Omar Elloumi, "The Internet of Things: Key Applications and Protocols", WileyPublications 3. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.
References 1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications 2. by Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press 3. http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html 4. https://onlinecourses.nptel.ac.in/noc17_cs22/course

404185 Wavelets (Elective-II)

Credits: 03				
Teaching Scheme:			**Examination Scheme:**	
Lecture : 03 Hr/Week				**In-Sem: 30 Marks** **End-Sem: 70 Marks**

Course Objectives:

- Learn and understand basic linear algebra
- Understand the need of time frequency resolution
- Understand the basics of Discrete Wavelet transform and various wavelets available
- Learn the signal analysis using multi-resolution analysis
- Study the applications of Wavelets in compression, enhancement, noise removal etc.

Course Outcomes:

1. On completion of the course, student will be able to
2. Explore and learn the basics of linear algebra.
3. Identify the need of Wavelet transform and its properties.
4. Analyze the 1-D and 2-D signal using discrete wavelet transform.
5. Analyze the signal using Multi resolution analysis
6. Use wavelet transform in different applications like data compression, denoising, enhancement etc.

Unit I : Fundamentals of Linear Algebra6 Hrs

Vector spaces, Orthogonality, Ortho-normality, Projection, Functions and function spaces. Orthogonal basis functions. Fourier series orthogonality of complex exponential bases, mathematical preliminaries for continuous and discrete Fourier transformer. Limitations of Fourier domain signal processing, Towards wavelet signal processing, signal representation with continuous and discrete Short Time Fourier Transform.

Unit II : Introduction to Wavelet 6 Hrs

Concept of time-frequency resolution, Resolution problem associated with STFT, Heisenberg's uncertainty principle and time frequency tiling, why wavelet transform? The origin of wavelets, Properties of Wavelet Transform, Wavelet and other wavelet like transformer, different communities and family of wavelets, different families of wavelets within wavelet communities, Continuous and discrete wavelet transform

Unit III : Discrete Wavelet Transform 8 Hrs

Haar scaling function and function spaces, translation and scaling of φ(t), function spaces V0 Finer Haar Scaling Functions, concept of nested vectopr spaces, Haar wavelet function, scaled and translated Haar wavelet functions, orthogonality of φ (t) and γ (t). Normalization of Haar bases at different scales, daubechies wavelets, plotting of Daubechies wavelets. 1-D and 2-D decomposition (analysis) of signals using Wavelet.

Unit IV : Multi-resolution Analysis 6 Hrs

Signal decomposition and its relation with filter banks, frequencies response, signal reconstruction course to fine scale, upsampling and filtering, QMF conditions, concepts of multi-Resolution analysis and multi-rate signal processing, Perfect matching filters, Vanishing moments of wavelet function and filter properties, introduction to wavelet lifting.

Unit V : Wavelet Transform in Data Compression 6 Hrs

Transform coding, image compression using DWT, Embedded tree image coding, comparison of JPEG and JPEG 2000, Audio masking, MPEG Coding for audio, Wavelet based audio coding, video coding using Multi-resolution technique (introduction).

Unit VI : Applications of Wavelet Transform 4 Hrs

Waveletdenoising, speckle removal, Edge detection and object isolation Image fusion, wavelet watermark, image enhancement. Communication application scaling functions as signaling pulses, Discrete Wavelet Multitone modulation.

Text Books:

1. K.P Soman, K I Ramchandran, N G Resmi, “Insights into Wavelets from theory to Practice”, Third edition, PHI publication.

2. Raghuveer M Rao, Ajit S. Bopardikar, “Wavelet Transforms, Introduction to Theory and Applications”, Seventh Indian Reprint 2005, Pearson Education.

Reference Books:

1. Jaideva C. Goswami, Andrew K. Chan, “Fundamentals of Wavelets”, Wiley Student Edition

2. V. M. Gadre, A. S. Abhyankar, “Multiresolution and Multirate Signal Processing, Introduction, Principles and Applications”, MGH Publication

404185 Electronic Product Design (Elective-II)

Teaching Scheme: Lectures: 3 Hrs./ Week		**Examination Scheme:** In Sem: 30 Marks End Sem: 70Marks

Course Objectives:

- To understand the stages of product (hardware/ software) design anddevelopment.
- To learn the different considerations of analog, digital and mixed circuitdesign.
- To be acquainted with methods of PCB design and different tools used for PCBDesign.
- To understand the importance of testing in product design cycle.`
- To understand the processes and importance ofdocumentation.

Course Outcomes:

After Successfully completing the course students will be able to

- Understand various stages of hardware, software and PCBdesign.
- Importance of product test &testspecifications.
- Special design considerations and importance ofdocumentation.

Unit I: Introduction to Electronic Product Design 6 Hrs

Man machine dialog and Industrial design, user-centered design, five element of successful design, cognition, ergonomics. Packaging and factors, design for manufacture, assembly and disassembly, wiring, temperature, vibration and shock. Safety, noise, energy coupling, grounding, filtering and shielding.

Unit II: Hardware Design & testing methods 6 Hrs

Design process. Identifying the requirements, formulating specifications, design specifications, Specifications verses requirements, System partitioning, Functional design, architectural design, Functional model verses architectural model. Prototyping. Performance and Efficiency measures. Formulating a test plan, writing specifications, Test procedure and test cases, Egoless design, design reviews. Module debug and test: black box test, white box test, grey box test.

Unit III: Software Design and Testing methods 6 Hrs

Types of Software. Waterfall model of software development. Models, metrics andsoftware limitations. Risk abatement and failure preventions. Software bugs and testing. Good programming practice. User interface .Embedded, Real time software.

Unit IV: PCB design 6 Hrs

Fundamental Definitions, Standards. Routing Topology Configurations, Layer Stack up assignment, Grounding Methodologies, Aspect Ratio, Image Planes, Functional Partitioning, Critical frequencies, Bypassing and decoupling. Design techniques for ESD Protection,Guard Band implementation.

Unit V: Product Debugging and Testing 6 Hrs

Steps of Debugging, Techniques for troubleshooting, characterization, Electromechanical components, passive components, active components, active devices, operational amplifier, Analog-Digital Conversion, Digital Components, Inspection and test of components, Simulation, Prototyping and testing, Integration, validation and verification. EMI & EMC issues.

Unit VI : Documentation 6 Hrs

Definition, need, and types of documentation. Records, Accountability, and Liability. Audience. Preparation, Presentation, and Preservation of documents. Methods of documentation, Visual techniques, Layout of documentation, Bill of material.

Text Books:

1. Kim Fowler," Electronic Instrument Design" Oxford universitypress.
2. Robert J. Herrick, "Printed Circuit board design Techniques for EMC Compliance", Second edition, IEEE press.

Reference Books:

1. James K. Peckol, "Embedded Systems – A Contemporary Design Tool", Wiley publication
2. J C Whitakar," The Electronics Handbook", CRCpress.

404185 Artificial Intelligence (Elective II)

Credits: 03

Teaching Scheme:	Examination Scheme:
Lecture : 03 hr/week	In-Sem : 30 Marks End-Sem: 70 Marks

Course Objectives:

- To learn various types of algorithms useful in Artificial Intelligence (AI).
- To convey the ideas in AI research and programming language related to emergingtechnology.
- To understand the concepts of machine learning, pattern recognition, and natural language processing.
- To understand the numerous applications and huge possibilities in the field of AI that gobeyond the normal human imagination.

Course Outcomes:

On completion of the course, student will be able to

1. Design and implement key components of intelligent agents and expert systems.
2. To apply knowledge representation techniques and problem solving strategies to common AI applications.
3. Applyand integrate various artificial intelligence techniques in intelligent system development as well as understand the importance of maintaining intelligent systems.
4. Build rule-based and other knowledge-intensive problem solvers.

Unit I :Foundation 6Hrs

Intelligent Agents, Agents and environments, Good behavior, The nature of environments, structure of agents, Problem Solving, problem solving agents, example problems, Searching for solutions, uniformed search strategies, avoiding repeated states, searching with partial information.

Unit II :Searching 6Hrs Search and exploration, Informed search strategies, heuristic function, local search algorithms and optimistic problems, local search in continuous spaces, online search agents and unknown environments, Constraint satisfaction problems (CSP), Backtracking search and Local search for CSP, Structure of problems, Games: Optimal decisions in games, Alpha- Beta Pruning, imperfect real-time decision, games that include an element of chance.
Unit III :Knowledge Representation 6Hrs First order logic, representation revisited, Syntax and semantics for first order logic, Using first order logic, Knowledge engineering in first order logic, Inference in First order logic, prepositional versus first order logic, unification and lifting, forward chaining, backward chaining, Resolution, Knowledge representation, Uncertainty and methods,Bayesian Probability and Belief network, probabilistic Reasoning,Bayesian networks, inferences in Bayesian networks,Temporalmodels,Hidden Markov models.
Unit IV :Learning 6Hrs Learning from observations: forms of learning, Inductive learning, Learning decision trees, Ensemble learning, Knowledge in learning, Logical formulation of learning, Explanation based learning, Learning using relevant information, Inductive logic programming, Statistical learning methods, Learning with complete data, Learning with hidden variable, EM algorithm, Instance based learning, Neural networks - Reinforcement learning, Passive reinforcement learning, Active reinforcement learning, Generalization in reinforcement learning.
Unit V :Pattern Recognition and Expert System6 Hrs Basic steps of pattern recognition system, Feature Extraction- Principal Component Analysis,Linear Discriminant Analysis, Classification, Object Recognition- Template Matching theory, Prototype Matching Theory, Speech Recognition, Pattern Mining- Apriori Algorithm,
Unit VI :Natural Language Understanding6Hrs Why NL, Formal grammar for a fragment of English, Syntactic analysis, Augmented grammars, Semantic interpretation, Ambiguity and disambiguation, Discourse understanding, Grammar induction, Probabilistic language processing, Probabilistic language models
Text Books: 1. Stuart Russell, Peter Norvig, “Artificial Intelligence”, A Modern Approach, Pearson Education/Prentice Hall of India. 2. Elaine Rich and Kevin Knight, “Artificial Intelligence”, Tata McGraw-Hill. Reference Books

404185 Optimization Techniques (Elective II)				
Credits: 03				
Teaching Scheme:			**Examination Scheme:**	
Lecture : 03hr/week				**In-Sem : 30 Marks** **End-Sem: 70 Marks**

Course Objectives:

- To understand the need and origin of the optimization methods.
- To get a broad picture of thevarious applications of optimization methods used in engineering
- To define an optimizationproblem and its various components.

Course Outcomes:

Upon completion of the course, students will be able to:

1. Describe clearly a problem, identify its parts and analyze the individual functions.
2. Perform mathematical translation of the verbal formulation of an optimizationproblem.
3. Design algorithms, the repetitive use of which will lead reliably to finding an approximate solution
4. Discover, study and solve optimization problems.
5. Investigate, study, develop, organize and promote innovative solutions for various applications.

Unit I : Introduction to Optimization **6Hrs**

Introduction: Historical Development, Engineering Applications of Optimization, Statement of an Optimization Problem, Classification of Optimization Problems, Optimization Techniques, Engineering Optimization Literature, Mathematical Background.

Unit II :Classical Optimization Techniques **7Hrs**

Single-Variable Optimization, Multivariable Optimization with No Constraints, Multivariable Optimization with Equality Constraints, Multivariable Optimization with Inequality Constraints, Convex Programming Problem.

Unit III : Linear Programming **6 Hrs**

Introduction, Applications of Linear Programming, Standard Form of a Linear Programming Problem, Geometry of Linear Programming Problems, Definitions and Theorems, Solution of a System of Linear Simultaneous Equations, Pivotal Reduction of a General System of Equations, Motivation of the Simplex Method, Simplex Method,Revised Simplex Method, Duality in Linear Programming, Decomposition Principle, Sensitivity or Post optimality Analysis,Transportation Problem.

Unit IV : Nonlinear Programming -I **7Hrs**

Unimodal Function, Elimination Methods:Unrestricted Search, Unrestricted Search, Dichotomous Search, Interval Halving Method, Fibonacci Method

Interpolation Methods:Quadratic Interpolation Method, Cubic Interpolation Method, Direct Root Methods, Practical Considerations,

Unit V :Nonlinear Programming-II7Hrs

Introduction to Unconstrained Optimization techniques, Direct Search Methods: Random Search Methods,Grid Search Method, Univariate Method, Pattern Directions, Powell's Method, Simplex Method. Indirect Search Methods: Gradient of a Function, Steepest Descent (Cauchy) Method, Conjugate Gradient (Fletcher–Reeves) Method, Newton's Method, Davidon–Fletcher–Powell Method, Test Functions.

Unit VI : Modern Methods of Optimization6 Hrs

Genetic algorithms, Simulated annealing, Particle Swarm Optimization, Ant Colony Optimization, Optimization of Fuzzy systems, Neural Network based optimization

Text Books:

1.Singiresu S Rao, "Engineering optimization Theory and Practice", New Age International, 2009

2.Kalynamoy Deb, "Optimization for Engineering Design, Algorithms and Examples",PHI

Reference Books:

1. Hadley, G. "Linear programming", Narosa Publishing House, New Delhi.

2.Ashok D Belegundu, Tirupathi R Chandrupatla, "Optimization concepts and Application inEngineering", Pearson Education.

3. KantiSwarup, P.K.Gupta and Man Mohan, Operations Research, Sultan Chand and Sons.

4. J. S. Arora, Introduction to Optimum Design, McGraw-Hill Book Company.

5. David Lay, Steven L Lay, "Linear Algebra and its Applications", Pearson Education.

6. Papalambros& Wilde, Principles of Optimal Design, Cambridge University Press, 2008

404185 Electronics in Agriculture (Elective II)				
Credits: 03				
Teaching Scheme:			**Examination Scheme:**	
Lecture : 03 Hr/Week				**In-Sem : 30 Marks** **End-Sem: 70 Marks**

Course Objectives:

- To inculcate the ability to recognize environmental problems and to provide solutions to agricultural sector.
- An over view of technology of advanced topics like DAS, SCADA and Virtual Instrumentation.
- The ability to select the essential elements and practices needed to develop and implement the Engineering Automation for Agricultural sector.

Course Outcomes:

After successfully completing the course students will be able to

1. Understand Role of computers & virtual instrumentation.
2. Provide communication solution for interpreting environmental parameters with Electronics systems.
3. Describe Instrument technology used in agriculture.
4. Apply knowledge of Electronics in Agriculture.
5. Understand Greenhouse Technology & Role of Electronics Governance.

Unit I: Review of computers & Virtual instrumentation **6 Hrs**

Data loggers, Data acquisitions systems (DAS), Supervisory control and data acquisition (SCADA), Basics of PLC, Functional block diagram of computer control system, alarms, interrupts.Virtual Instrumentation: Historical Perspective, advantages, Block diagram and architecture of virtual instrument, data flow techniques, graphical programming in data flow, comparison with conventional programming.

Unit II:Communication Systems **6Hrs**

Use of field buses, functions, international standards, field bus advantages and disadvantages, Instrumentation network: sensor networks, Open networks-advantages and limitations, HART Network, Foundation field bus network.Profibus PA: Basics, architecture, model, network design.Foundation field bus segments: General consideration, network design.

Unit III:Instrument technology for agriculture **6Hrs**

Instrument for measurement of pH, Electrical conductivity, gas analysis, humidity, leaf area, chlorophyll content, and soil moisture & temperature.

Unit IV:Precision Farming **6Hrs**

An introduction to precision farming. GIS/GPS positioning system for precision farming, Yield monitoring and mapping, soil sampling and analysis. Computers and Geographic information systems. Precision farming- Issues and conditions. Role of electronics in farm machinery for precision farming.

Unit V:Electronics in Agriculture **6 Hrs** Instrument for crop monitoring – moisture measurement – capacitive, infrared reflectance and resistance. Monitoring soil and weather – measurement of soil properties and meteorological parameters – irrigation control systems. Instruments for crop establishment monitoring. Crop spraying – selective crop spraying – flow control. Yield monitoring. Technology for precision farming. Instruments for protected cultivation – green house environment control – transducers and control system. Instruments and systems for crop handling processing and storage. ,
Unit VI:Applications & Electronics Governance **6Hrs** Greenhouse: History of modeling and control of Greenhouse, Identification of control and manipulation variables for Greenhouse. Crop Preservation : Importance of Preservation of various commodities and parts of plants, Drying process for preservation, Variable identification for drying process, Electronic control system for grape drying process.Agriculture& Electronics Governance: Governance products & services in agriculture sector, Role of Electronics Governance in Agricultural sector.
Text Books: 1. Curtis Johnson, "Process Control Instrumentation Technology"; 8th Edition, Pearson Education 2.Stuart A. Boyer, SCADA supervisory control and data acquisition, ISA Publication
Reference Books: 1. De Mess M. N. Fundamental of Geographic Information System. John Willy & sons, NewYork, Datta S.K.1987. 2. K. Krishna Swamy, "Process Control"; New Age International Publishers 3. Kuhar, John. E. 1977. The precision farming guide for agriculturalist. 4. Lori J. Dhabalt, USManual of Soil & Water conservation Engineering. Oxford & IBH Co. Sigma &Jagmohan, 1976.

404186 Lab Practice I				
Credits:02				
Teaching Scheme:			**Examination Scheme:**	
Practical : 04 Hrs/week				**Oral : 50 Marks** **Term-work :50 Marks**

Computer Networks & Security

List of the Experiments(Minimum 8 experiments are to be performed).

1. Implementation of LAN using suitable multiuser Windows operating System anddemonstrating client-server and peer to peer mode of configuration.
2. Installation and configuration of Web server, FTP Server.
3. Study of DNS, SMTP & POP3 Determine the local host address, Ping to a host using its NetBIOS name Add IP addresses/host name mappings to the local host file Configure DNS service on Windows 2000 server Use Domain Name Service to resolve hostnames into IP addresses. Interact with an Email server using SMTP and POP3 protocols commands.
4. Installation and configuration of Telnet server for Telnet communication.
5. Installation and configuration of Proxy server.
6. Installation and configuration of DHCP server.
7. Study of IP Addresses subnetting and CIDR
8. Study of Network Protocol Analyzer tool/software.
9. Study of network monitoring tool/software.
10. Simulating LAN or WAN using suitable network simulator.
11. Write a program to simulate leaky bucket/token bucket.
12. Echo Client and Server Program Using TCP or UDP or both in C/Java
13. Write a program for Encryption and Decryption
14. Study of HTTPS, IPSec and SSH using Wireshark.

Radiation & Microwave Techniques

List of Experiments[Minimum 08]

Group A [Any 2]

1. To measure and compare radiation pattern, return loss, impedance, gain, beam width of dipole antenna and folded dipole antenna at microwave frequency

OR

1. To measure radiation pattern and gain of horn or parabolic antenna at microwave frequency
2. Design, simulate and compare performance of microwave dipole antennas of length 2λ, λ, λ/2 and λ/4.
3. Design, simulate and compare the performance of two element broad side and end fire uniform amplitude and uniformly spaced linear array.

Group B[Any 6]

4. To measure and plot mode characteristics of reflex klystron.
5. To measure VI characteristics of Gunn Diode and study of PIN modulator.
6. To measure and verify port characteristics of microwave tees (E, H, E-H or magic planes).
7. To measure and verify port characteristics of directional coupler and calculate coupling factor, insertion loss and directivity.
8. To measure and verify port characteristics of isolator and circulator and calculate insertion loss and isolation in dB.
9. To measure wavelength of the microwave using microwave test bench and verify with its theoretical calculations.
10. To plot standing wave pattern and measure SWR for open, short and matched termination at microwave frequency using slotted section with probe carriage.
11. Study the network analyzer and carry out the measurements of s-parameters.

404186Laboratory Practice II

Credits: 02

Teaching Scheme:	**Examination Scheme:**
Practical : 04 hr/week	**Practical : 50 Marks** **Termwork : 50 Marks**

Digital Image and Video Processing

List of Practicals

(Perform any 8 practical on appropriate software)

1. Perform basic operations on images.
2. Perform conversion between color spaces.
3. Perform histogram equalization.
4. Perform image filtering in spatial domain.
5. Perform image filtering in frequency domain.
6. Perform image restoration.
7. Perform image compression using DCT / Wavelet transform.
8. Perform edge detection using various masks.
9. Perform global and adaptive thresholding.
10. Apply morphological operators on an image.
11. Obtain boundary / regional descriptors of an image.
12. Extraction of frames from video, improve the quality and convert them back to compressed video.

Industrial Drives and Control

(Minimum 8 experiments are to be performed):
1. DC motor control using semi/full 1-Φ /3-Φ converter. (Open loop and closed loop)
2. 4-Quadrant chopper fed reversible DC drive
3. Dual converter fed DC Drive (Single phase/ Three phase)
4. Induction motor speed control using VFD
5. Speed Control of Universal Motor.
6. Stepper motor drive.
7. BLDC Motor drive.
8. Three phase brushless generator for wind energy applications.
9. Simulation of closed loop controlled DC motor drive using PSIM/Matlab/MathCad/ open source software

10 Simulation of closed loop controlled AC motor drive using PSIM / Matlab/MathCad/ open source software

Embedded Systems & RTOS

Minimum 08 experiments

Any 02 Lab exercise from Sr.No 2,3,4

Any 01 Lab exercise from Sr.No 05,06

List of Practicals:

1. Porting of ucos-II on ARM7/Cortex controller.
2. Implementation/Verification of multitasking (minimum 03 tasks) with ucos-II on ARM7/Cortex controller.
3. Implementation of semaphore with ucos –II service ARM7/Cortex controller for resource management and synchronization.
4. Implementation of interprocess communication with ucos-II mailbox and message queue service on ARM7/Cortex controller.
5. Programming with exploring onchip ADC of Cortex /MSP430 based microcontroller.
6. Programming on motor control with exploring onchip PWM of Cortex based microcontroller.
7. Exercise on Porting of Linux on ARM board (ARM9 preferably)
8. Programming for device driver with Embedded Linux.
9. Programming with Arduino development for GPIO on Arduino Uno board.

Case study of any compute/communication/control application on Arduino Uno board

Internet of Things

A Project based Learning approach will be followed for this course hence the experiments will be small projects to be built by the students.

Suggested List of the Experimental Projects(Minimum 6 are to be performed):

1. Study& Survey of various development boards for IoT.

2. Study & Survey of various IoT platforms.

3. Interfacing sensors and actuatorswithAurdino .

4. Build a cloud-ready temperature sensor with the Arduino Uno and the anyIoT Platform: This project shows the building of a temperature sensor.

5. Interfacing Sensors and actuators with Raspberry Pi 2.

6. IoT based Stepper Motor Control with Raspberry Pi: The combination of Raspberry Pi and IoT is an exciting one. Raspberry Pi has many general purpose I/O pins and has the ability to control different actuators like stepper motors. In this project, an internet control of stepper motor using

Raspberry Pi computer is developed. The connectivity is divided into server side software and client side software.

7.IoT based Web Controlled Home Automation using Raspberry Pi.

8. A Simple IoT Project with the ESP8266 WiFi module: Here is a simple project with ESP8266 wi-fimodule.This project collects the temperature and is displayed on the network.

9. Implement a RFID Based IoT Project

404188 Project Phase-I

Credits: 02

Teaching Scheme:		Examination Scheme:
Tutorial: 2 Hrs/week		OR :50Marks

Note:

1. Term work assessment is based on the project topic. It consists of Literature Survey and basic project work. The abstract of the project should be submitted before Term workassessment.
2. The report consists of the Literature Survey, basic project work and the size of the report should be maximum of 40pages.
3. The examination is conducted by two examiners (internal and external) appointed by the university. The examiners appointed must have minimum 5 years of experience with UG qualification or 2 years with PG qualification.
4. The assessment is based on Innovative Idea, Depth of understanding, Applications, Individual contributions, presentation, and the grade given by the internal guide based on the work carried out in a semester.
5. A log book of Work carried out during the semester will be maintained with monthly review remarks by the guide and HoD.
6. A certified copy of report is required to be presented to external examiner at the time of final examination.

Audit Course 5 (1):Green Energy

About the course

This course provides an introduction to energy systems and renewable energy resources, with a scientific examination of the energy field and an emphasis on alternate energy sources and their technology and application. The students will explore society's present needs and future energy demands, examine conventional energy sources and systems, including fossil fuels and nuclear energy, and then focus on alternate, renewable energy sources such as solar, biomass (conversions), wind power, geothermal, and hydro. Energy conservation methods will be emphasized

Course Objectives:

- To understand the conventional and non conventional energy sources
- To understand different renewable energy sources and their generation
- To understand the various applications & benefits of renewable energy sources
- To enable student to understand project management, energy audit and Installation

Course Outcomes:
After the successful completion of this course, the student is expected to have/be able to:
1. List and generally explain the main sources of energy and their primary applications in the India, and the world.
2. Describe the challenges and problems associated with the use of various energy sources, including fossil fuels, with regard to future supply and the environment.
3. Discuss remedies/potential solutions to the supply and environmental issues associated with fossil fuels and other energy resources.
4. List and describe the primary renewable energy resources and technologies.
5. Describe/illustrate basic electrical concepts and system components.
6. Convert units of energy—to quantify energy demands and make comparisons among energy uses, resources, and technologies.
7. Collect and organize information on renewable energy technologies as a basis for further analysis and evaluation.

Unit 1: Introduction of conventional & renewable energy sources:
Environment aspects, Energy Efficient materials, Pollution Control techniques, Energy conservation, Energy Audits

Unit II: Details of renewable energy sources & various systems
Solar, Wind, Hydro, Bio-power, Waste to Power

Unit III: Various applications & benefits
Renewable power projects for smart cities & rural electrification, Power conversion techniques, Off-grid/Stand-alone systems, Grid connected systems, Design of Grid-tied & off-grid Solar PV systems, Design of Grid-tied & off-grid Wind systems, Design of Grid-tied & off-grid Hybrid systems, Storage technologies

Unit IV: Project management
Installation & commissioning techniques & standards, Remote monitoring & control techniques, Performance optimization & control, Practical's / Hands-on exposure, Maintenance & Service of plants, Government policies

Guidelines for Conduction (Any one or more of following but not limited to)
• Guest Lectures
• Group Activities
• Assignments
• Taking up small project for short duration

Guidelines for Assessment (Any one or more of following but not limited to)
• Practical Test
• Presentation
• Paper / (Theory assessment test)
• Report

Sources/ References:
1. Boyle, Godfrey. 2004. Renewable Energy (2nd edition). Oxford University Press, 450 pages (ISBN: 0-19- 926178-4).
2. Boyle, Godfrey, Bob Everett, and Janet Ramage (eds.) 2004. Energy Systems and Sustainability: Power for a Sustainable Future. Oxford University Press, 619 pages (ISBN: 0-19-926179-2)
3. Ashok Desai V, *Non-Conventional Energy,* Wiley Eastern Ltd, 1990.
4. Mittal K.M, *Non-Conventional Energy Systems*, Wheeler Publishing Co. Ltd, 1997.
5. Ramesh R, Kurnar K.U, *Renewable Energy Technologies,* Narosa Publishing House, New Delhi, 1997.
6. Renewable Energy Resources by John Twidell and Tony Weir.

Audit Course 5 (2) :Human Behavior

About the Course:

Human behavior is the responses of individuals or groups of humans to internal and external stimuli. It refers to the array of every physical action and observable emotion associated with individuals, as well as the human race. Social behavior is a subset of human behavior and includes the study of considerable influence of social interaction and culture. Additional influences include ethics, encircling, authority, rapport, hypnosis, persuasion and coercion.

The behavior of humans falls within a range with some behavior being common, some unusual, some acceptable, and some beyond acceptable limits. The acceptability of behavior depends heavily upon social norms and is regulated by various means of social control. Human behavior is experienced throughout an individual's entire lifetime. It includes the way they act based on different factors such as genetics, social norms, core faith, and attitude. An attitude is an expression of favor or disfavor toward a person, place, thing, or event.

Course Objectives:

- To develop understanding of Behavioral Aspects.
- To identify and develop Attitude and Core Faith values
- To expose students to Family Relations, time and career management
- To enable student to understand Creative Thinking and Problem solving
- To enable students to understand Humanistic Education.

Course Outcomes:

On completion of the course, society will observe –

1. Change in awareness levels, knowledge and understanding of student
2. Change in attitudes / behavior of students with regards to their education improved teamwork, institutional leadership and other life skills
3. Improvement in social health and attitude.

Unit 1:

Why Human Relations are so important? Understanding Behavior, Human Relations, and Performance, Personality, Stress, Learning, and Perception, Attitudes, Self-Concept, Natural acceptance of human values, and Ethics, Dealing with Conflict, Leading and Trust.

Unit 2:

Time and Career Management, Interpersonal Communication, Organizational Structure and Communication, Team Dynamics and Leadership, Teams and Creative Problem Solving and Decision Making

Unit 3:

Understanding Harmony in the Family and Society, Harmony in Human Relationship, Understanding the meaning of *Vishwas*; Difference between intention and competence, Understanding the meaning of *Samman*; Difference between respect and differentiation. Understanding the harmony in the society: *Samadhan, Samridhi, Abhay, Sahasttva*as comprehensive Human Goals.

Unit 4:

Justice in Humankind, Nurturing and Exploitation, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics.

Reference Books:

1. “Human Relations in Organizations Applications and Skill Building” RobartLussier, eighth edition, McGraw-Hill (2014).

2. Atkinson and Hilgard’s, “Introduction to psychology” Nolen-Hoeksema, S., Fredrickson, B. L., Loftus, G. R., & Lutz, C., Cengage Learning EME.

3. “A Foundation Course in Human Values and Professional Ethics” R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi and Teacher's Manual, R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi

4. A Nagraj, 1998, JeevanVidyaekParichay, Divya Path Sansthan, Amarkantak.

5. A.N. Tripathy, 2003, Human Values, New Age International Publishers.

Semester-II

404189 Mobile Communication		
Credits: 03		
Teaching Scheme:		**Examination Scheme:**
Lectures: 3Hrs/ Week		**In-Sem : 30 Marks** **End-Sem : 70 Marks**

Course Objectives

- To understand switching techniques for voice and data traffic.
- To nurture students with knowledge of traffic engineering to design networks.
- To realize importance of cellular concepts and its propagation mechanism.
- To understand architecture of GSM system.
- To overview 4G LTE and 5G technologies.

Course Outcomes

On completion of the course, student will be able to

1. Apply the concepts of switching technique and traffic engineering to design multistage networks.
2. Explore the architecture of GSM.
3. Differentiate thoroughly the generations of mobile technologies.

Unit I - Switching techniques for Voice and Data **8Hrs**

Switching techniques for Voice: Manual Switching System, Electronic Switching System and Time Division Switching. Single Stage networks, Gradings, Two stage and Three stage networks. Synchronization, **Control of switching systems:** Call processing Functions, Common Control, Reliability, Availability and Security.

Switching techniques for Data: Circuit switching, Message Switching and packet Switching in perceptive with mobile communication.

Unit II - Traffic Engineering and Signalling **8Hrs**

Telecommunication Traffic: Unit of Traffic, Traffic measurement, A mathematical model, Lost- call systems: Theory, traffic performance, loss systems in tandem, traffic tables. Queuing systems: Erlang Distribution, probability of delay, Finite queue capacity, Systems with a single server, Queues in tandem, delay tables and application of delay formulae.

Signaling: Customer line signaling. FDM carrier systems, PCM signaling, Inter-register signaling, Common channel signaling, CCITT signaling system and Digital customer line signaling.

Unit III - Cellular Concept **8Hrs**

Introduction to cellular telephone system, Cellular concept : Expansion of mobile system capacity through frequency reuse, Cell geometry, Selection of cluster size, Cell splitting and sectoring, Coverage and capacity in cellular system and Handoff strategies.

Propagation Mechanism: Free space and two ray propagation model, Basic propagation mechanism. Hata outdoor propagation model. **Small Scale Fading and Multipath:** Types of Small scale fading, Small scale multipath propagation, Impulse response model of multipath channel and Small scale multipath measurements.

Unit IV - GSM Fundamentals **8Hrs**

Introduction, Architecture of GSM, characteristics of GSM standards, services, Radio transmission parameters in GSM System, Applications.

Unit V - GSM Channels and Services	**8Hrs**
Traffic and Logical Channels in GSM, GSM time hierarchy, GSM burst structure, Description of call setup procedure, Handover mechanism in GSM, Security in GSM. **Data transmission in GSM:** Data Services, SMS, HSCSD, GPRS, EDGE. **Multiple Access Techniques**-TDMA, CDMA and OFDMA.	
Unit VI - Evolution of Mobile Technologies	**6Hrs**
Evolution of Mobile Generation and its comparison(GSM & CDMA) **Overview of LTE :** LTE basics , LTE frame structure, LTE Design parameters with Standardization and Architecture of LTE. **Overview of 5 G Networks :** Comparison of 4G and 5G technology, Opportunities and requirements in 5G network, Open Wireless Architecture of 5G network and Disruptive technologies for 5G.	

Text Books

1. Thiagarajan Vishwanathan, "Telecommunication Switching Systems and Networks"; PHIPublications
2. Theodore Rappaport, "Wireless Communications Principles and Practice" Second Edition, Pearson Education

Reference Books

1. Fei Hu, "Opportunities in 5G Networks : A research& development perspective", CRC Press
2. J. E. Flood , "Telecommunications Switching, Traffic and Networks", Pearson Education
3. Krzysztof Wesolowski, "Mobile Communication Systems", Wiley Student Edition
4. John C. Bellamy, "Digital Telephony", Third Edition; Wiley Publications
5. Mischa Schwartz, "Mobile Wireless Communications", Cambridge University Press
6. AdityaJagannatham,"Principles of Modern Wireless Communication Systems"

404190 Broadband Communication Systems

Credits: 04

Teaching Scheme:	**Examination Scheme:**
Lecture : 04 hr/week	**In-Sem : 30 Marks** **End-Sem : 70 Marks**

Course Objectives:

- To comprehend the three primary components of a fiber optic communication system.
- To understand the system design issues and the role of WDM components in advanced light wave systems.
- To understand the basics of orbital mechanics and the look angles from ground stations to the satellite.
- To apply subject understanding in Link Design.

Course Outcomes:

After successfully completing the course students will be able to:

1. Perform Link power budget and Rise Time Budget by proper selection of components and check its viability.
2. Perform Satellite Link design for Up Link and Down Link.

UNIT I: Light wave System Components	**8Hrs**
Key Elements of optical fiber system, Optical fibers as a communication channel: Optical fiber modes and configurations, Mode theory for Circular waveguides, Single mode fibers, Graded index fiber structure, Signal degradation in optical fibers. Optical sources: Basic concepts and characteristics of LEDs and LASERs. Photo detectors: Basic concepts, Common photo detectors.	
UNIT II: Light wave Systems	**6 Hrs**
System architectures, Point to point links: System considerations, Design guidelines: Optical power budget, Rise time budget, Long - Haul systems.	
UNIT III: Multichannel Systems	**6 Hrs**
Overview of WDM, WDM Components: 2 x 2 Fiber coupler, Optical isolators and circulators, Multiplexers and De-multiplexers, Fiber Bragg Grating, FBG applications for multiplexing and de-multiplexing function, Diffraction gratings, Overview of optical amplifiers: SOA, EDFA and RFA in brief.	
UNIT IV: Orbital Mechanics and Launchers	**8 Hrs**
History of Satellite communication, Orbital mechanics, Look angle determination, Orbital perturbations, Orbital determination, Launchers and launch vehicles, Orbital effects in communication system performance.	
UNIT V: Satellite sub systems	**6 Hrs**
Satellite Subsystems, Attitude and Control Systems (AOCS), Telemetry, Tracking, Command and monitoring, Power systems, Communication subsystems, Satellite antennas, Equipment reliability and space qualification.	
UNIT VI: Satellite communication link design	**8Hrs**
Introduction, Basic transmission theory, System noise temperature and G/T Ratio, Design of downlinks, SatelHrsite systems using small earth stations, Uplink design, Design of specified C/N: Combining C/N and C/I values in satellite links system design examples.	
Text Books: 1. Gerd Keiser, "Optical fiber Communications", Tata McGraw Hill, 4th edition. 2. Timothy Pratt, Charles Bostian, Jeremy Allnutt, "Satellite Communications", John Wiley & Sons.	
Reference Books: 1. Govind P. Agrawal, "Fiber -Optic Communication Systems", Wiley, 3rd edition. 2. Dennis Roody, "Satellite Communications", McGraw Hill	

404191 Machine Learning (Elective III)

Credits: 03

Teaching Scheme:		**Examination Scheme:**
Lecture : 03 Hr/week		**In-Sem : 30 Marks** **End-Sem: 70 Marks**

Course Objectives:

- Explore supervised and unsupervised learning paradigms of machine learning used forregression and classification.
- To design and analyze various machine learning algorithms using neural networks
- To explore Deep learning technique and various feature extraction strategies.

Course Outcomes:

On completion of the course, student will be able to

1. To compare and contrast pros and cons of various machine learning techniques and to get an in sight of when to apply a particular machine learning approach.
2. To mathematically analyze various machine learning approaches and paradigms.
3. To implement convolution neural networks in recognition applications.

Unit I :Introduction to Machine Learning **4Hrs**

Why Machine learning. Types of machine learning, basic concepts in machine learning like parametric and non-parametricmodeling, linear and nonlinear regression, overfitting and dimensionality reduction. Decision trees, Feature reduction.

Unit II : Models for Regression and Classification **8Hrs**

Linear Models for Regression :Least SquaresandNearestNeighbors ,Linear Basis Function Models,The Bias-Variance Decomposition,Bayesian Linear Regression,Bayesian Model ComparisonLinear Models for Classification : Discriminant Functions .Probabilistic Discriminative Models Multivariate Data,ParameterEstimation,MultivariateClassification,Multivariate RegressionKernal Methods : Support Vector machines and Relevance Vector Machines

Unit III :Clustering **6Hrs**

Dimensionality Reduction : Principal Components Analysis,Factor Analysis,Multidimensional Scaling,Linear Discriminant Analysis Clustering : k-Means Clustering,Mixtures of Gaussians.

Unit IV : Artificial Neural Networks I 6Hrs

Biological neuron, Artificial neuron model, concept of bias and threshold, Activation functions, McCulloch-Pits Neuron Model, learning paradigms,concept of error energy, gradient descent algorithm and application of linear neuron for linear regression,: Learning mechanisms: Hebbian, Delta Rule, Perceptron and its limitations.

Unit V : Artificial Neural Networks II **6 Hrs**

Multilayer perceptron (MLP) and back propagation algorithm, Application of MLP for classification, Self-Organizing Feature Maps,Learning vector quantization Radial Basis Function networks.

Unit VI : Deep Learning and Convolution Neural Networks **6Hrs**

Improvement of the Deep Neural Network:Vanishing Gradient, Overfitting, Computational Load,ReLU Function, Dropout Architecture of ConvNet, Convolution Layer, Pooling Layer, Applications of CNN’s.

Text Books:

1. Christopher Bishop, “Pattern Recognition and Machine Learning”, Springer, 2007.
2. LaureneFausett ,” Fundamentals of Neural Networks: Architectures, Algorithms And Applications, Pearson Education, Inc, 2008.

Reference Books:

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, “The Elementsof Statistical Learning”, Springer 2009.
3. Phil Kim, “MATLAB Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence”,a Press 2017.
4. EthemAlpaydın “Introduction to Machine Learning” Second Edition The MIT Press 2010.
5. SimonHaykin,” Neural Networks : A comprehensive foundation, Prentice Hall International Inc. 1999.

404191 PLC & Automation (Elective III)

Credits: 03

Teaching Scheme:			**Examination Scheme:**	
Lecture : 03hr/week				**In-Sem : 30 Marks** **End-Sem: 70 Marks**

Course Objectives:

- Student will get the ability to recognize industrial control problems suitable for PLC control
- The learners will get an over view of technology of advanced topics such as SCADA, DCS Systems, DigitalController, CNC Machines.
- Student will gain the ability to select the essential elements and practices needed to develop and implement the Engineering Automation using PLC approach.

Course Outcomes:

On successful completion of the course, students able to:

1. Understand PLC architecture
2. Develop PLC ladder programs for simple industrial applications
3. Design Automation systems for industrial applications
4. Implement the Engineering Automation using PLC approach.

Unit I: Process Control & Automation 6Hrs

Process control principles, Servomechanisms, Control System Evaluation, Analog control, Digital control, Types of Automation; Architecture of Industrial Automation Systems, Advantages and limitations of Automation, Effects of modern developments in automation on global competitiveness.

Unit II: Transmitters and Signal Conditioning 6Hrs

Need of transmitters, Standardization of signals, Current, Voltage and Pneumatic signal standards, 2-Wire & 3-Wire transmitters, Analog and Digital signal conditioning for RTD, Thermocouple, DPT etc , Smart and Intelligent transmitters.

Unit III: Controllers and Actuators 6Hrs

PID Controller, Cascade PID control, Microprocessor Based control, PAC (Programmable automation controller), Mechanical switches, Solid state switches,Electrical actuators: Solenoids, Relays and Contactors, AC Motor, VFD, energy conservation schemes through VFD, DC Motor, BLDC Motor, Stepper Motor, Servo Motor, Pneumatic and hydraulic actuators.

Unit – IV Introduction to PLC 6Hrs

PLC: Characteristics, Operation, function, Types of PLC, Architecture Of PLC, Applications of PLC, PC v/s PLC, PLC programming, Ladder diagram: of logic gates, multiplexer, Ladder diagram for different logical conditions or logical equations or truth table. Timers: types of timer, Characteristics, Function of timer in PLC, Classification of a PLC timer, Ladder diagram using timer, PLC counter, Ladder diagram using counter.

Unit – V Industrial Automation 6 Hrs

Basic Concept, History and Hierarchy of DCS, Functions of each level, Advantages and Disadvantages, Architecture of SCADA , MTU- functions of MTU, RTU- Functions of RTU, Working of SCADA, Comparison, suitability of PLC, DCS and SCADA, Applications: Thermal power plant, Irrigation and Cement factory.

Unit VI: Automation and CNC (Computer Numeric Control) Machines **7 Hrs**

Introduction of CNC Machines: Basics and need of CNC machines, NC, CNC and DNC (Direct NC) systems, Structure of NC systems, Applications of CNC machines in manufacturing, Advantages of CNC machines. Industrial Communication:Devicenet, Interbus , Device network: Foundation Fieldbus -H 1, HART, CAN, PROFIBUS-PA, Control network: ControlNet, FF-HSE, PROFIBUS-DP, Ethernet, TCP/IP. Panel Engineering for Automation

Text Books:

1. Curtis Johnson, “Process Control Instrumentation Technology”; 8th Edition, Pearson Education.
2. MadhuchhandaMitra, SamarjitSen Gupta, “Programmable Logic controllers and Industrial Automation”; Penram International Publishing India Pvt. Ltd.

Reference Books:

1. Stuart A. Boyer, SCADA supervisory control and data acquisition, ISA Publication.
2. John W. Webb, Ronold A Reis, “Programmable Logic Controllers, Principles and Applications”; 5th Edition, Prentice Hall of India Pvt. Ltd.
3. Kilian, “Modern control technology: components & systems, Delmar 2nd edition.
4. Bela G Liptak, Process software and digital networks, 3rd edition, 2002.
5. Pollack. Herman, W & Robinson., T. “Computer Numerical Control”, Prentice Hall. NJ. Pabla, B.S. &Adithan, M. “CNC Machines”, New Age Publishers, New Delhi

404191Audio and Speech Processing (Elective III)

Credits: 03

Teaching Scheme				**Examination Scheme**
Lecture : 03 hr/week				**In-Sem: 30 Marks** **End-Sem: 70 Marks**

Course Objectives:

- To understand basics of speech production and perception mechanism.
- To understand classification of speech sounds based on acoustic and articulatory phonetics.
- To understand the motivation of short-term analysis of speech and audio.
- To understand various audio and speech coding techniques.
- To perform the analysis of speech signal using LPC.
- To extract the information of the speech or audio signals in terms of cepstral features.
- To provide a foundation for developing applications in the field of speech and audio processing.

Course Outcomes:

On completion of the course, student will be able to

1. Design and implement algorithms for processing speech and audio signals considering the properties of acoustic signals and human hearing.
2. Analyze speech signal to extract the characteristic of vocal tract (formants) and vocal cords (pitch).
3. Analyze speech signal for extracting LPC and MFCC Parameters of speech signal.
4. Apply the knowledge of speech and audio signal analysis to build speech processing applications like speech coding, speech recognition, speech enhancement and speaker recognition/verification.

Unit I : Fundamentals of speech production 6 Hrs

Anatomy and physiology of speech production, Human speech production mechanism, LTI model for speech production, Nature of speech signal, linear time varying model, articulators, articulatory phonetics, manner of articulation, place of articulation, acoustic phonetics, spectrogram, classification of speech sounds: vowels, semivowels, nasal diphthongs, stops, affricates, fricative, vowel triangle.

Unit II : Human auditory system and speech perception 6 Hrs

Anatomy and physiology of the ear, outer ear, middle ear and inner ear. Human auditory system, simplified model of cochlea. Sound perception, Auditory psychophysics, thresholds, just noticeable differences (JNDs), Sound pressure level and loudness. Sound intensity and Decibel sound levels. Pitch perception, masking, Concept of critical band and introduction to auditory system as a filter bank, Uniform, non-uniform filter bank, mel scale and bark scale. Speech perception: vowel perception. Coarticulation effects. Consonant perception, perception of manner of articulation feature. Perception of place of articulation.

Unit III: Time and frequency domain methods for speech and audio signal analysis. 6Hrs

Time-dependent speech processing. Short-time energy, short time average magnitude, Short time average zero crossing rate. Speech Vs. silence discrimination using energy and zero crossing rate. Short-time autocorrelation function, short-time average magnitude difference function. Pitch period estimation using autocorrelation method. Audio feature extraction, Spectral centroid, spectral spread, spectral entropy, spectral flux, spectral roll-off. Spectrogram: narrow band and wide band spectrogram.

Unit IV : Linear prediction and cepstral analysis 6Hrs

Basic principles of linear predictive analysis. Autocorrelation method, covariance method. Solution of LPC equations: Durbin's recursive solution, lattice formulations and solutions. Frequency domain interpretation of LP analysis. Applications of LPC parameters as pitch detection and formant analysis

Homomorphic processing of speech signal, application of cepstral analysis for vocal tract vocal cord parameter estimation (formants and pitch). Computation of MFCC.

Unit V : Speech and Audio coding 6Hrs

Time domain waveform coding: linear PCM, companded PCM, DPCM, DM, ADM.

Spectral coders: Filter bank analysis, sub-band coders, Adaptive transform coders (ATC), Harmonic coding. Linear predictive coders (LPC), Non-LP source voice coders: phase vocoders, channel vocoders, excitation for vocoders, Homomorphic (Cepstral) vocoders. Speech coding standards and applications.

Unit VI : Digital speech processing for man-machine communication 6Hrs

Automatic speech recognition (isolated word recognition, automatic telephone number dialing system etc. using statistical signal modeling e.g. GMM, GMM-HMM), Linear and dynamic time warping, text to speech synthesis, speaker recognition and verification, speech enhancement, Introduction to Musical instrument classification, Musical Information retrieval.

Text Books:

1. L. R. Rabiner and S.W. Schafer, "Digital processing of speech signals" Pearson Publication.
2. Douglas O'Shaughnessy, "Speech Communications: Human and Machine:, 2^{nd} Edition Universities Press.

Reference Books:

1. Thomas F. Quateri , “Discrete-Time Speech Signal Processing: Principles and Practice” Pearson Publication.
2. ShailaApte, “Speech and audio processing”, Wiley India Publication
3. Ben Gold and Nelson Morgan, “Speech and Audio Signal Processing: Processing and Perception of Speech and Music”, Wiley India.
4. L. R. Rabiner , B. H. Juang and B. Yegnanarayana “Fundamentals of speech recognition”. PearsonPublication

404191 Software Defined Radio (Elective III)

Credits: 03

Teaching Scheme:			**Examination Scheme:**	
Lecture : 03Hr/Week				**In-Sem: 30 Marks** **End-Sem: 70 Marks**

Course Objectives:

- To understand “Modern Radio Communication System “ that can be reconfigured
- To understand GNU Radio
- To understand how SDR platform provides easy access to wireless network system
- To understand how unlike simulation in Communication Projects, SDR allows easy
- access to both PHY and MAC layer
- To understand the concept of Cognitive Radio and Spectrum sharing

Course Outcomes:

On completion of the course, student will be able to

1. Compare SDR with traditional Hardware Radio HDR.
2. Implement modern wireless system based on OFDM, MIMO & Smart Antenna.
3. Build experiment with real wireless waveform and applications, accessing both PHY and MAC, Compare SDR versus MATLAB and Hardware Radio
4. Work on open projects and explore their capability to build their own communication System.

Unit I : Introduction to SDR and RF Implementation **6Hrs**

Introduction to SDR, Need of SDR, Principles of SDR , Basic Principle and difference in Analog radio and SDR , SDR characteristics, required hardware specifications, Software/Hardware platform, GNU radio -What is GNU radio, GNU Radio Architecture, Hardware Block of GNU,GNU software , MATLAB in SDR , Radio Frequency Implementation issues, Purpose of RF front End, Dynamic Range ,RF receiver Front End topologies, Flexibility of RF chain with software radio, Duplexer ,Diplexer ,RF filter ,LNA ,Image reject filters , IF filters , RF Mixers Local Oscillator , AGC, Transmitter Architecture and their issues, Sampling theorem in ADC, Noise and distortion in RF chain, Pre-distortion

Unit II :SDR Architecture **7Hrs**

Architecture of SDR-Open Architecture, Software Communication Architecture, Transmitter Receiver Homodyne/heterodyne architecture, RF front End, ADC, DAC, DAC/ADC Noise Budget, ADC and DAC Distortion, Role of FPGA/CPU/GPU in SDR, Applications of FPGA in SDR, Design Principles using FPGA, Trade –offs in using DSP, FPGA and ASIC, Power Management Issues in DSP, ASIC, FPGA

Unit III : Multi Rate Signal Processing **6Hrs**

Sample timing algorithms, Frequency offset estimation and correction, Channel Estimation, Basics of Multi Rate, Multi Rate DSP, Multi Rate Algorithm, DSP techniques in SDR, OFDM in SDR

Unit IV : Smart/MIMO Antennas using Software Radio **6Hrs**

Smart Antenna Architecture, Vector Channel Modeling , Benefits of Smart Antenna Phased Antenna Array Theory, Adaptive Arrays, DOA Arrays, Applying Software Radio Principles to Antenna Systems, Beam forming for systems-Multiple Fixed Beam Antenna Array, Fully Adaptive Array , Relative Benefits and Trade-offs OF Switched Beam and Adaptive Array, Smart Antenna Algorithms , Hardware Implementation of Smart Antennas, MIMO -frequency, time, sample Synchronization, Space time block coding-Space Time Filtering, Space Time Trellis Coding .

Case Study : Principles of MIMO-OFDM

Unit : Cognitive Radio **6Hrs**

Cognitive Radio Architecture, Dynamic Access Spectrum, Spectrum Efficiency, Spectrum Efficiency gain in SDR and CR ,Spectrum Usage, SDR as a platform for CR, OFDM as PHY layer ,OFDM Modulator, OFDM Demodulator, OFDM Bandwidth, Benefits of OFDM in CR, Spectrum Sensing in CR, CR Network

Unit VI : Applications of SDR **7Hrs**

Applicationof SDR in Advance Communication System-Case Study, Challenges and Issues, Implementation, Parameter Estimation –Environment, Location, other factors, Vertical Handoff, Network Interoperability.

Case Study : 1)CR for Public Safety –PSCR , Modes of PSCR, Architecture of PSCR
2)Beagle board based SDR 3)Embedded PCSR using GNU radio

Text Books:

1. Jeffrey. H. Reed ,Software Radio : A Modern Approach to Radio Engineering, Pearson LPE
2. Markus Dillinge, KambizMadani, Nancy Alonistioti, Software Defined Radio :Architectures , Systems and Functions ,Wiley

Reference Books:

1. Tony .J. Rouphael, RF and DSP for SDR, Elsevier Newness Press ,2008
2. Dr.TajStruman,Evaluation of SDR –Main Document
3. SDR –Handbook, 8th Edition , PENTEK
4. Bruce a. Fette, Cognitive Radio Technology, Newness, Elsevier

404191 Audio Video Engineering (Elective III)

Credits: 03

Teaching Scheme:		**Examination Scheme:**	
Lecture : 03Hr/Week			**In-Sem : 30 Marks** **End-Sem : 70 Marks**

Course Objectives:

- After learning AVE course, students will get benefit to learn and understand the working of real life video system and the different elements of video system plus the encoding/decoding techniques.
- The learners will be groomed up to understand different channel allocations, difference between various systems present in this world, their transmission and reception techniques.
- Students will get insight on functioning of individual blocks, different standards of compression techniques and they will be acquainted with different types of analog, digital TV and HDTV systems.
- The students will get overview of fundamentals of Audio systems and basics of Acoustics

Course Outcomes:

On successful completion of the course, students able to:

1. Apply the fundamentals of Analog Television and Colour Television standards.
2. Explainthe fundamentals of Digital Television, DTV standards and parameters.
3. Study and understand various HDTV standards and Digital TV broadcasting systems and acquainted with different types of analog, digital TV and HDTV systems.
4. Understandacoustic fundamentals and various acoustic systems.

Unit I: Fundamentals of Colour Television **8Hrs**

The basic Television system and scanning principles, Composite video signal and television standards, Color TV systems, fundamentals, mixing of colours, colour perception, chromaticity diagram. NTSC, PAL, SECAM systems, colour TV transmitter, (high level, low level), colour TV receivers.

Unit II: Digital TV and Display Devices **6Hrs**

Introduction to Digital TV, Digital TV signals and parameters, Digital TV Transmitters, MAC signals, advanced MAC signal transmission, Digital TV receivers, Basic principles of Digital Video compression techniques, MPEG Standards. Digital TV recording techniques, Display devices: OLED, LCD, TFT, Plasma, Camcoder, Digicam.

Unit III: HDTV **6Hrs**

HDTV standards and systems, HDTV transmitter and receiver/encoder, Digital TV satellite Systems, video on demand, CCTV, CATV, direct to home TV, set top box with recording facility, conditional access system (CAS), 3D TV systems, HD video cameras, Digital broadcasting, case study (Cricket match, Marathon, Football match).

Unit IV: Advanced TV Systems **6Hrs**

IP Audio and Video, IPTV systems, Mobile TV, Video transmission in 3G/4G mobile System, Digital Video Recorders, Wi-Fi Audio / Video Transmitter and Receivers.

Unit V: Fundamentals of Audio-Video Recording **8Hrs**

Methods of sound recording & reproduction, optical recording, CD recording, audio standards. Digital Sound Recording, CD/ DVD player, MP3 player, Blue Ray DVD Players, MP3 Player.

Unit VI: Fundamentals of Acoustics 6Hrs

Studio acoustics & reverberation, P.A. system for auditorium, acoustic chambers, Cordless microphone system, special types of speakers & microphones, Digital Radio Receiver Satellite radio reception.

Text Books

1. Television and video Engineering, A. M. Dhake, TMH Publication.
2. R. R. Gulati, "Monochrome and colour television"

Reference Books

1. Television Engineering -Audio and Video Systems, D. S. Bormane, P.B. Mane& R RItkarkar, Wiley publication.
2. S. P. Bali, "Color TV Theory and Practice".
3. Bernard Grobb, Charles E, "Basic TV and Video Systems".
4. Video Demisified, Kelth jack, Penram International Publication.
5. Audio Video Systems, R.G. Gupta, TMH Publication

404192 ROBOTICS (Elective-IV)

Credits: 03

Teaching Scheme:	**Examination Scheme:**
Lecture : 03Hr/Week	**In-Sem : 30 Marks** **End-Sem: 70 Marks**

Course Objectives:

- To understand the history, concept development and key components of robotics technologies.
- To understand basic mathematics manipulations of spatial coordinate representation and transformation.
- Able to solve basic robot forward and inverse kinematic problems
- To understand and able to solve basic robotic dynamics, path planning and control problems

Course Outcomes:

On completion of the course, student will be able to

1. Familiar with the history, concept development and key components of robotics technologies.
2. Implement basic mathematics manipulations of spatial coordinate representation and transformation.
3. Solve basic robot forward and inverse kinematic problems
4. Understand and able to solve basic robotic dynamics, path planning and control problems

Unit I :Basic concepts in robotics 6Hrs

Definition ; anatomyof robot, basic structure of robot, Specifications and Classification of robot, Safety Measures in robotics ,Industrial Applications of Robots.

Unit II :Robot drivers,Sensors and Vision 6Hrs

Drives for robots: Electric, hydraulic and pneumatic.

Sensors: Internal-External,Contact-noncontact, position, velocity,force, torque, proximity and range.

Vision: Introduction to techniques, Image acquisition and processing

Unit III : End Effectors and Actuators **6Hrs**

Different types of grippers- Mechanical,Magnetics,vacuum,Adhesive, Gripper force Analysis&Gripper Design , overview of actuators, Power and torque, Acceleration and velocitySpecifications and characteristics of Stepper motors, AC motors, DC motors and servomotors.

Unit IV : Robot Kinematics and Dynamics **8Hrs**

Direct and inverse kinematics for industrial robots for position and orientation, Redundancy, Manipulator, direct and inverse velocity. Lagrangian formulation , Link inertia tensor and manipulator inertia tensor, Newton –Eller formulation for RP and RP manipulators, Trajectory planning, interpolation, static force and moment transformation, solvability, stiffness

Unit V:Programming methods **6Hrs**

Robot language classification, Robot language structure, elements and its functions. Simple programs on Sensing distance and direction., Line Following Algorithms, Feedback Systems Other topics on advance robotic techniques

Unit VI : Developing and building a robot **6Hrs**

Models of flexible links and joints, Robotic arm – Components and structure, Types of joints and workspace, Design models for mechanic arms and lifting systems

Case Study: 1. Robots in material handling and assembly.
2. Human Robot Interaction

Text Books:

1. Introduction to Robotics By S.K.Saha , Tata McGraw Hill
2. Robotics Control ,Sensing ,Vision and Intelligence by K.S. Fu, R.C .Gonzalez, C.S.G.Lee , Tata McGraw Hill

Reference Books:

1. J. Hirchhorn: Kinematics and Dynamics of Machinery, McGraw Hill book co.
2. Robert J. Schilling , Fundamentals of Robotics- Analysis and Control, Prentics Hall india.
3. Robotics Technology and Flexible Automation by S.R.Deb, S. Deb, Tata McGraw Hill
4. Robot Motion and Control (Recent Developments) by M.Thoma& M. Morari

404194 Biomedical Electronics (Elective-IV)

Credits: 03

Teaching Scheme:	**Examination Scheme:**
Lecture : 03 hr/week	**In-Sem : 30 Marks** **End-Sem : 70 Marks**

Course Objectives:

- To study Human Physiological Systems from Engineering Perspectives
- To understand the basic signals in the field of biomedical.
- To study origins and characteristics of some of the most commonly used biomedical signals, including ECG, EEG, PCG, Pulse.
- To understand Sources and characteristics of noise and artifacts in bio signals.
- To understand use of bio signals in diagnosis, patient monitoring and physiological investigation

Course Outcomes:

After successfully completing the course students will be able to:

1. Model a biomedical system.
2. Understand various methods of acquiring bio signals.Understand various sources of bio

3. signal distortions and its remedial techniques.
4. Get an Overview of major Devices currently used in Medical field
5. The students will have an understanding of analyzing bio-signal and classifying them

Unit I: Introduction to Biomedical System 6Hrs

Biomedical Instrumentation System, Cell structure, Bio-Cell potential , Concept of Bio-electrodes, Types of Bio-electrodes to measure Bio-signal, Transducers and Sensors to measure Bio signal EEG,ECG,EMG, Respiration, Body temperature, SPO2, and Pulse. Artifacts in Bio signal Acquisition: Noise, Power line, Baseline, Skin Impedance and Motion Artifacts, Techniques to reduce the artifacts.

Unit II: Cardiovascular System 6Hrs

Introduction to Heart**,** Physiology and anatomy of Heart, Lead Configurations to acquire ECG, ECG preamplifiers, ECG recorder, Heart Sounds and Murmurs, Phonocardiography

Unit III:Nervous System 6Hrs

Nerve Cell and nerve potential, Neural Communication, Brain structure, 10-20 electrode placement for EEG , Types of Montage configuration, Types of EEG signals and its significance, EEG machine, EEG applications for Epilepsy and Sleep apnea**.**

Unit IV: Medical Instrumentation 8Hrs

Design of Instrumentation system for ECG acquisition, Isolation Amplifier, Right Leg drive Mechanism, Noise removal techniques using Active Filters, Wiener Filters, Adaptive Filters: Basic Concept, Principle noise cancellation model, removal of periodic events, using adaptive cancellation, adaptive cancellation of maternal ECG from fetal ECG of Interest. Grounding and shielding Concepts

Unit: Analysis of Electrical Activity of Heart 6Hrs

ECG Signal Processing: Removal of Base line and Power line Interference, Muscle noise Filtering, Highlight ECG feature points, QRS detection, ECG classification for normal and abnormal state using Multilayer Perceptron. Use of Multiscale analysis for ECG parameter estimation.

Unit VI:Medical Devices 4Hrs

Introduction To Blood Pressure Measurement (noninvasive), Life saving Devices Pacemakers and Defibrillators, Bedside Monitors, Central Monitoring system, Stress Test System, X Ray, CT scan , Dental instruments

Text Books:

1. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", 4th Edition, Prentice Hall, 2000.
2. R. Rangayan, "Biomedical Signal Analysis", Wiley 2002.
3. R.S.Khandpur, "Handbook of Biomedical Instrumentation", Tata McGraw Hill, New Delhi, 2003, Edition-II.

Reference Books:

1. John L Semmlow, "Bio-signal and Biomedical Image Processing", Marcel Dekker
2. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", 4thEdition, Prentice Hall, 2000.

404194 Wireless Sensor Networks (Elective-IV)				
Credits: 03				
Teaching Scheme:			**Examination Scheme:**	
Lecture : 03 hr/week				**In-Sem : 30 Marks** **End-Sem: 70 Marks**

Course Objectives:

- To learn basic concepts of Wireless sensor networks
- To be familiar with architecture and protocols used in Wireless sensor networks
- To provide knowledge of deployment and security issued of Wireless sensor networks

Course Outcomes:

On completion of the course, student will be able to

1. Explain various concepts and terminologies used in WSN
2. Describe importance and use of radio communication and link management in WSN
3. Explain various wireless standards and protocols associated with WSN
4. Recognize importance of localization and routing techniques used in WSN
5. Understand techniques of data aggregation and importance of security in WSN
6. Examine the issues involved in design and deployment of WSN

Unit1 : Introduction **6 Hrs**

What are Wireless Sensor Networks, Wireless Sensor Node, Anatomy of a Sensor Node, architecture of WSN , Performance metrics in WSNs, types of WSN

Unit 2: Radio Communication And Link Management **7 Hrs**

Radio Waves and Modulation/Demodulation, Properties of Wireless Communications, Medium Access Protocols, Wireless Links Introduction, Properties of Wireless Links, Error Control, Naming and Addressing, Topology Control

Unit 3: Wireless Standards And Protocol Stack **7 Hrs**

WSN Standards- IEEE802.15.4 Low rate WPAN, Zigbee, WirelessHART, ISA 100.11a, 6LoWPAN,IEEE802.15.3, Wibree,BLE, Zwave, ANT, Insteon, Wavenis, Protocol stack of WSNs, Cross Layer Protocol Stack

Unit 4: Localization And Routing **7 Hrs**

Localization : Localization Challenges and Properties, Deployment Schemes, Proximity Schemes. Ranging Schemes, Range-Based Localization, Range-Free Localization,
Routing Basics, Routing Metrics, Routing Protocols, Full-Network Broadcast, Location-Based Routing, Directed Diffusion, Collection Tree Protocol, Zigbee, Multi-Hop Communications

Unit 5: Data Aggregation And Security **7 Hrs**

Clustering Techniques, In-Network Processing and Data Aggregation, Compressive Sampling, Security Issues in Wireless Sensor Networks, Attacks, Defensive Measures, Securityrequirements and threat model,

Unit 6: Designing And Deploying WSN Applications **6 Hrs**

Designing and Deploying WSN Applications,Early WSN Deployments, General Problems, General Testing and Validation, Requirements Analysis, The Top-Down Design Process, Bottom-Up Implementation Process.

Text Books
1.Kazem Sohraby, Daniel Minoli and TaiebZnati, “ Wireless Sensor Networks Technology, Protocols, and Applications“, John Wiley & Sons, 2007. 2.Holger Karl and Andreas Willig, “Protocols and Architectures for Wireless Sensor Networks”, John Wiley & Sons, Ltd, 2005.
Reference Books
1. HossamFahmy, “Wireless Senor Networks: Concepts, Application, experimentation and analysis”, Springer Publication 2. Anna Forster, “Introduction to Wireless Sensor Networks”, IEEE Press, Wiley Publication 3.Anna Hac, “Wireless Sensor Network Designs”, John Wiley & Sons Ltd,

404194 Renewable Energy Systems (Elective-IV)

Credits: 03

Teaching Scheme:			Examination Scheme:	
Lecture : 03hr/week				**In-Sem : 30 Marks** **End-Sem : 70 Marks**

Course Objectives:

- To study energy generation, different energy sources and their utilization and impact on environment
- To gain knowledge of solar radiation and its applications
- To understand the wind energy and its nature
- To analyze the performance of solar collectors and wind turbines
- To learn fuel cell and its efficiency

Course Outcomes:

On successful completion of the course, students able to:

1. Interpret energy reserves of India and potential of different energy sources.
2. Measure the solar radiation parameters and performance of different solar collectors.
3. Calculate different parameters of wind turbine rotor.
4. Implicit the importance and applications of geothermal and ocean energy.
5. Demonstrate knowledge in field of fuel cell and potential for power generation.

Unit I : Energy Resources and Utilization: 6Hrs

Conservation and forms of energy, energy reserves in India, nuclear power, hydroelectric power potential, India's power scene, impact on environment, renewable energy sources, energy parameters, cogeneration, rational energy use of energy, energy efficiency and conservation, new technologies, distributed energy systems and dispersed generation.

Unit II :Solar Energy 8Hrs

Solar constant, spectral distribution of extraterrestrial radiation, terrestrial solar radiation, solar radiation geometry, computation of COSθ, sunrise, sunset, day length, LAT, Empirical equation, solar radiation measurement, Solar Thermal energy collectors, design parameters,laws of thermal radiation, radiation heat transfer between real bodies, radiation optics, transmitivity, heat losses and coefficient, Solar Thermal energy storage.

Unit III : Solar photovoltaic systems& Solar Applications 8Hrs

Solar photovoltaic systems: Photovoltaics, Different types of PV Cells, Mono-poly crystalline and amorphous Silicon solar cells. Design of PV array. Efficiency and cost of PV systems

Solar Applications: Solar water heating, solar distillation, solar ponds, solar pumping system, solar cooker, solar green house.

Unit IV : Wind energy 8Hrs

Classification, types of rotors, terminology, operation of wind turbines, wind energy extraction, wind characteristics, wind speed, energy estimation, power density duration curve, density function, field data analysis, direction and wind speed, variation of wind speed, wind scale, energy pattern factor in wind power studies, land for wind energy, design of wind turbine rotor, regulating system, wind power generation curve, horizontal axis wind turbine generator, modes of wind power generation, advantages and disadvantages, wind energy farms.

Unit V: Ocean and Geothermal Energy	**6Hrs**
Ocean Energy: Tidal Energy, Tidal characteristics, Tidal Energy estimation, Development of a tidal power scheme,Wave energy- characteristics-energy and power from the waves. **Geothermal energy:**Structure of earth's interior, sites, field, gradient, resources, power generation, geothermal resources in India, utilization, global status of electricity generation from geothermal resources, advantages of geothermal energy	
Unit VI : Fuel Cells	**6Hrs**
Principle of operation of an acidic Fuel Cell, Technical parameter, Fuel Processor, methanol fuel cell, fuel cell types, Advantages of fuel cell power plants, comparison between acidic and alkaline hydrogen-oxygen fuel cells, state of art fuel cells, energy output of a fuel cell, efficiency and EMF of a fuel cell, Gibbs-Helmholtz equation, operating characteristics of fuel cells.	
Text Books: 1. D.P. Kothari, K.C. Singal and RakeshRanjan, "Renewable Energy Sources and Emerging Technologies", Prentice Hall of India, New Delhi, 2009. 2. S.P. Sukhatme, "Solar Energy: Principles of Thermal Collection and Storage", TMH, New Delhi, 2008	
Reference Books: 1. Chetan Singh Solanki, "Renewable Energy Technologies", Prentice Hall of India, New Delhi, 2009 2. G. D. Rai, "Non- conventional Energy Sources", Khanna publishers, New Delhi, 2011. 3. MaltiGoel, "Energy Souces and Global Warming", allied publishers Pvt Ltd. New Delhi, 2005.	

404193 Laboratory Practice III

Credits: 02

Teaching Scheme:				**Examination Scheme:**
Practical : 02 Hr/week				**TW : 50 Marks** **PR : 50 Marks**

Mobile Communication:

List of Practicals: (Any Eight)

1. Perform an experiment to explain PSTN TST switch.
2. Write a program to elaborate Lost call system/ delay system used in the analysis of voice/data traffic.
3. Write a program to measure bit error rate in presence of AWGN model.
4. Write a program to simulate speech coding and decoding technique used in mobile Communication.
5. Set up and carry out experiment on AT commands for call operation.
6. Write a program to simulate experiment on GMSK modulation.
7. Write a program to measure bit error rate in presence of Hata/ Multipath propagation model.
8. Set up and carry out experiment to explain VoIP call routing process.
9. Visit to Mobile Telephone Switching Office (MTSO).
10. Perform an experiment / Simulate to elaborate the operation of Multiple access techniques such as TDMA/CDMA/OFDMA.

Broadband Communication System:

List of the Experiments:

- **Minimum 8 experiments are to be performed excluding tutorials.**
- **Tutorials are mandatory. (Expt. 5 and 12)**

1. Estimation of Numerical aperture of fiber.
2. Plot the characteristics of various sources and detectors.
3. Measure attenuation of MMSI and SMSI fiber and comment on the result based on attenuation due to increase in length as well as loss due to bend.
4. Set up a digital link and analyze.
5. Tutorial on Power budget and time budget analysis of optical fiber system.
6. Establishing a direct communication link between Uplink Transmitter and Downlink Receiver using tone signal.
7. To set up an Active Satellite link and demonstrate Link Fail Operation.
8. To establish an AUDIO-VIDEO satellite link between Transmitter and Receiver.
9. To communicate VOICE signal through satellite link.
10. To transmit and receive three separate signals (Audio, Video, Tone) simultaneously through satellite Link.
11. To transmit and receive PC data through satellite link.
12. Tutorial on satellite link design
13. Students, as a part of their term work, should visit satellite earth station and submit a report of visit. (Optional).

404194 Laboratory Practice IV (Elective III)

Credits: 01				
Teaching Scheme:			**Examination Scheme:**	
Practical : 02 Hr/week				**Oral : 50 Marks**

Machine Learning

List of Practical's:

(Use appropriate Software available in the Institute)

1. Implement simple logic network using MP neuron model
2. Implement a simple linear regressor with a single neuron model
3. Implement and test MLP trained with back-propagation algorithm
4. Implement and test RBF network
5. Implement SOFM for character recognition.
6. Implement SVM classifier for classification of data into two classes. Student can use datasets such as flower classification etc.
7. Implement and test Multiclass SVM classifier.
8. Implement and test CNN for object recognition.

PLC & Automation

List of Experiments (Minimum 8 experiments are to be performed).

1. Control the speed of servo motor using analog voltage 0-10V.
2. Rotate the servo motor according to X, Y co-ordinates.
3. Temperature detection using RTD & control the temperature of water at desired set point.
4. Control the flow of water using analog control valve.
5. Control the speed of AC 3ɸ motor using VFD.
6. Design simulation of 3 cylinder piston pump using pneumatic kit & PLC.
7. Detect the angle of shaft using Encoder & PLC.
8. Control the speed of 3ɸ AC motor from Mobile/HMI with PLC.
9. Interfacing of RFID with PLC & show the corresponding user data on SCADA to access the control.
10. Interface PLC with RTU & SCADA at remote location.
11. Exchange the data between two PLC's using Ethernet.
12. Interfacing of PLC to VFD over profibus& exchange the data

Audio and Speech Processing

List of Experiments (Minimum 8 experiments are to be performed):

NOTE: To perform the experiments software like MATLAB, SCILAB or any appropriate open source software can be used. For analysis of speech signals tools like PRAAT, Audacity can be used. Open source software is encouraged.

1. Record speech signal (isolated words, continuous speech) and analyze the speech signal using speech analysis tool (e.g. PRAAT). Observe spectrogram, pitch, formants, intensity etc.
2. Write a program to compute short time Energy and ZCR for different frame rates and comment on the result.
3. Write a program to classify voiced, unvoiced and silence frames using frame level energy and zero crossing rate
4. Write a program to compute narrow band and wide band spectrogram. Comment on the time and frequency resolution of wide band and narrow band spectrogram.
5. Write a program for extracting pitch period for a voiced part of the speech signal using autocorrelation method and average magnitude difference function (AMDF).
6. Write a program to design a Mel filter bank and using this filter bank write a program to extract MFCC features.
7. Write a program to perform the cepstral analysis of speech signal and detect the pitch from the voiced part using cepstrum analysis.
8. Write a program to find LPC coefficients using Levinson Durbin algorithm.
9. Write a program to enhance the noisy speech signal using spectral subtraction method.
10. Write a program to extract frequency domain audio features like SC, SF and Spectral roll off.

Software Defined Radio

List of the Experiments(Minimum 8 experiments are to be performed):

1. Introduction to GNU Radio
2. Introduction to Software Defined Radio Systems
3. Implementation of AM using SDR
4. Implementation of FM using SDR with application such as transfer of files
5. Implementation of M-PSK transmitter using SDR
6. Implementation of M-PSK receiver using SDR
7. Implementation of M-QAM transmitter using SDR
8. Implementation of M-QAM receiver using SDR
9. Implementation of Transmission of files on Wireless media using SDR
10. Implementation of OFDM using SDR
11. Implementation of Cognitive radio using SDR

Audio Video Engineering

List of Experiments (Minimum 8 experiments are to be performed).

1. Voltage and waveform analysis for color TV.
2. Study of direct to home TV and set top box.
3. Study Wi-Fi TV system
4. Study of Digital TV pattern generator.
5. Study of HDTV
6. Study of Digital TV.
7. Simulation of Video, Audio and Image compressing techniques (Software Assignments)
8. Study of Audio system: CD players and MP3 player.
9. Study of PA system with chord less microphone
10. Directivity pattern of Microphones / Loud speakers
11. Visit to TV transmitter/ Digital TV Studio/ All India Radio / TV Manufacturing factory

404195 Project Phase-II		
Credits:06		
Teaching Scheme:		**Examination Scheme:**
Tutorial: 6 Hrs/Week		**TW: 150 Mark** **OR: 50 Marks**

1. GroupSize

The student will carry the project work individually or by a group of students. Optimum group size is in 3 students. However, if project complexity demands a maximum group size of 4 students, the committee should be convinced about such complexity and scope of thework.

2. Selection and approval of topic

Topic should be related to real life application in the field of Electronics and Telecommunication

OR

Investigation of the latest development in a specific field of Electronics or Communication or Signal Processing

OR

The investigation of practical problem in manufacture and / or testing of electronics or communication equipment

OR

The Microprocessor / Microcontroller based applications project ispreferable.

OR

Software development project related to VHDL, Communication, Instrumentation, Signal Processing and Agriculture Engineering with the justification for techniques used / implemented is accepted.

OR

Interdisciplinary projects should be encouraged. The examination will be conducted independently in respective departments.

3. Note:

The group should maintain a logbook of activities. It should have entries related to the work done,problems faced, solution evolved etc., duly signed by internal and external guides.

Project report must be submitted in the prescribed format only. No variation in the format will be accepted. One guide will be assigned at the most 3 project groups.

Audit Course 6 (1)
Team Building, Leadership and Fitness

About the course

Team building allows students to work together in social situations just as they would in the classroom, their daily lives, or down the road in the workplace. Team building challenges students to solve problems and execute working with others. It shows them how to be accountable. It allows team members to stay motivated and energized to work on the project together. They work on jobs and tasks cohesively, rather than working alone without interaction. By working together, members of the team can "work together, stay together, and achieve together" .Trust and communication issues can also be noticed from team building exercises. Team building is known to improve performance in teams; members will remain motivated and can easily overcome indifferences to see the strengths in all team members.

Leadership is about the art of motivating, influencing and directing people so that they work together to achieve the goals of a team or broader organization. It's important for students to experience leadership opportunities during their schooling, to learn the art of building relationships within teams, defining identities and achieving tasks effectively. It also provides an opportunity to learn to identify and display effective communication and interpersonal skills. Leadership begins with identifying and understanding our values. Our values are our fundamental beliefs – those principles we consider to be worthwhile and desirable. Fitness does not only refer to being physically fit, but also refers to a person's mental state as well. If a person is physically fit, but mentally unwell or troubled, he or she will not be able to function optimally. Mental fitness can only be achieved if your body is functioning well. You can help relax your own mind and eliminate stresses by exercising regularly and eating right. People who are physically fit are also healthier, are able to maintain their most optimum weight and are least prone to cardiac and other health problems. In order to maintain a relaxed state of mind, a person should be physically active. A person who is fit both physically and mentally strong enough to face the ups and downs of life, and is not affected by drastic changes if they take place.

Course Objectives:

- To develop understanding of team skills and dynamics
- To identify and develop personal skills to become a more effective team member
- To introduce to the students the social change model of leadership
- To expose students to the leadership skills and imbibe within them that the fact that Leadership is a process, not a characteristic associated with an individual or role.
- To enable student to understand principles of fitness training and exercise
- To enable students to understand human posture, nutritional values and mental fitness

Course Outcomes:

On completion of the course, society will observe –

1. Change in awareness levels, knowledge and understanding of today's youth
2. Change in attitudes / behavior of students with regards to their improved teamwork, institutional leadership and other life skills
3. Increase in the body's fitness levels and also reduced health problems
4. Improvement in social health and attitude.

Unit 1: Team Building

Types of Teams, Characteristics of a Team, Stages of Team Development (Forming ,Storming, Norming, Adjourning) , Systematic Approach to Team Work , High Performing Team (Characteristics , Maintenance , Causes of low performance Why Teams Fail , People,Communication , Resources , Objectives)

Unit II: Leadership Defining Leadership , Personal Leadership Profile, Leadership in the Context of Community, Leadership Theory, Leadership Concepts, Foundations of Group Behavior: The Meaning of Group, Group behavior & Group Dynamics, Types of Groups, The Five -Stage Model of Group Development Managing Organizational Change, Leadership Styles leading to Authenticity, Learning and Development, Positive Responses to Aggressive Behavior, Professionalism, Team Building
Unit III: Educational Leadership Key challenges for educational leaders, Characteristics, Capabilities of authentic leader, values and ethics in decision making, Continuous professional Development suitable for 21st century pedagogy, Emotional intelligence for educational leaders. Need of Educational research for educational leadership
Unit IV: Fitness for Engineers Fundamentals of Exercise Science: Skeletal, muscular, cardiovascular, nervous system, nutrition, flexibility, special population and injuries, Basics of fitness, Weight management and supplementation
Guidelines for Conduction (Any one or more of following but not limited to) • Guest Lectures • Group Activities • Assignment • Taking up assisted Health challenge for short duration (ex. Yoga and Pranayam, Weight management , stability in mental health) **Guidelines for Assessment** (Any one or more of following but not limited to) • Practical Test • Presentation • Paper / (Theory assessment test) •• Report
Sources/ References: 1. Organizational Behavior by Fred Luthans 2. Organizational Behavior by M N Mishra 3. Leadership Development Activities, John Adair, 2nd Edition Jaico Publication 4. Leadership Games, Stephen S Kogan, 5. Mastering Leadership, 2nd Edition, Michael Williams, Viva Books 6. Sculpt and Shape: The Pilates Way by YasminKarachiwala 7. Total Fitness: The LeenaMogre Way by LeenaMogre 8. Don’t Lose Your Mind, Lose Your Weight: RutujaDiwekar 9. Yog Its Philosophy and Practice English by Swami Ramdevji

Audit Course 6 (2)
Environmental Issues And Disaster Management

About the Course:

The importance of environmental science and environmental studies cannot be disputed. The need for sustainable development is a key to the future of mankind. Continuing problems of pollution, loss of forget, solid waste disposal, degradation of environment, issues like economic productivity and national security, Global warming, the depletion of ozone layer and loss of biodiversity have made everyone aware of environmental issues.

It is clear that no citizen of the earth can afford to be ignorant of environment issues. Environmental management has captured the attention of health care managers. Managing environmental hazards has become very important. In spite of the deteriorating status of the environment, study of environment has so far not received adequate attention in our academic programmes.

Course objective :

- To develop understanding of Environment Issues and Biodiversity
- To introduce to the students the environment, Disaster Management
- To enable students to understand ecosystem and preservation of environment
- To understand Disaster Management and handling them

Course Outcomes :

On completion of course students will be able:

1. To learn the different environmental issues and disasters.
2. To deal with problems associated with environment and effectively handle the disasters.

Unit 1: Environmental Pollution

A) Definition, Cause, effects and control measures of :-

Air pollution,Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste Management, urban and industrial wastes.

Role of an individual in prevention of pollution. Pollution case studies.

B) Social Issues and the Environment:

Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns.

Unit 2 : Ecosystems, Biodiversity and its conservation

A) Concept of an ecosystem.

Structure and function of an ecosystem, Producers, consumers and decomposers, • Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids.

Structure and function of the following ecosystem :

a. Forest ecosystem

b. Grassland ecosystem

c. Desert ecosystem

d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity at global, National and local levels, India as a mega-diversity nation

Hot-sports of biodiversity, Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.

Unit 3 : Disaster Management a) Causes – Natural disaster and Manmade disaster b) Speed of onset – Sudden and Slow **Natural Disasters** These types of disaster naturally occur in proximity to, and pose a threat to, people, structures or economic assets. Examples are Storm, Flood, Earthquake, Tsunamis **Manmade Disasters** Accidents: Road, Rail, Air, Sea, Building collapse. Industrial Mishaps: Gas leak, Explosion, Safety. Fire: Building, Coal, Oil. Forest Fire (In tropical counters, forest fires are often manmade) Speed of onset 1 Sudden onset: little or no warning, minimal time to prepare. For example, an earthquake, tsunami, cyclone, volcano, etc. 2 Slow onset: adverse event slow to develop; first the situation develops; the second level is an emergency; the third level is a disaster. For example, drought, civil strife, etc.
Unit 4: Case Studies • Environmental ethics: Awareness, Issues and possible solutions. • Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. • Wasteland reclamation. • Consumerism and waste products. • Environment Protection Act. • Air and Water (Prevention and Control of Pollution) Act • Wildlife Protection Act and Forest Conservation Act • Issues involved in enforcement of environmental legislation. • Role of an individual in prevention of pollution and case studies.
References: 1. Disaster Management: Disaster Manager's Handbook by W. Nick Carter, Asian Development Bank. 2. An Introduction To Disaster Management EBook By S. Vidyanathan - Publisher: IKON 3. Textbook for environmental studies ,ErachBharucha For UGC.

SAVITRIBAI PHULE PUNE UNIVERSITY

FACULTY OF ENGINEERING

SYLLABUS FOR
B.E. ELECTRICAL ENGINEERING
(2015 course)

WITH EFFECT FROM YEAR 2018-2019

Savitribai Phule Pune University

FACULTY OF ENGINEERING

B.E. Electrical Engineering (2015 Course)
(w.e.f. 2018-2019)

SEMESTER-I

Sr No	Subject Code	Subject Title	Teaching Scheme (Hrs/Week)			Examination Scheme (Marks)					Total Marks	Credit	
			TH	PR	TU	PP In Sem	PP End Sem	TW	PR	OR		TH / TU	PR + OR
1	403141	Power System Operation and Control	03	02	--	30	70	25	--	25	150	03	01
2	403142	PLC and SCADA Applications	04	02	--	30	70	25	50	--	175	04	01
3	403143	Elective I	03	02	--	30	70	25	--	--	125	03	01
4	403144	Elective II	03	--	--	30	70	--	--	--	100	03	--
5	403145	Control System II	03	02	--	30	70	25	--	25	150	03	01
6	403146	Project I	--	--	02	--	--	--	--	50	50	02	--
	403152	Audit Course V											
		TOTAL	16	08	02	150	350	100	50	100	750	18	04

SEMESTER-II

Sr No	Subject Code	Subject Title	Teaching Scheme (Hrs/Week)			Examination Scheme (Marks)					Total Marks	Credit	
			TH	PR	TU	PP In Sem	PP End Sem	TW	PR	OR		TH / TU	PR + OR
1	403147	Switchgear and Protection	03	02	--	30	70	50	--	25	175	03	01
2	403148	Power Electronic Controlled Drives	04	02	--	30	70	25	50	--	175	04	01
3	403149	Elective III	03	02	--	30	70	25	--	25	150	03	01
4	403150	Elective IV	03	--	--	30	70	--	--	--	100	03	--
5	403151	Project II	--	--	06	--	--	50	--	100	150	06	--
	403153	Audit Course VI											
TOTAL			13	06	06	120	280	150	50	150	750	19	03

TH	**Theory lectures hours/week**	**TW**	**Term work**
PR	**Practical hours/week**	**OR**	**Oral**
TU	**Tutorial hours/week**	**PP**	**Paper- In semester and End Semester**

Elective I (403143)	**Elective II (403144)**
A) Fundamentals of Microcontroller MSP430 and its Applications [Open Elective] **B) Power Quality** **C) Renewable Energy Systems** **D) Digital Signal Processing**	**A) Restructuring and Deregulation** **B) Electromagnetic Fields** **C) EHVAC Transmission** **D) Electric and Hybrid Vehicles** **E) Special Purpose Machines**
Elective III (403149)	**Elective IV (403150)**
A) High Voltage Engineering **B) HVDC and FACTS** **C) Digital Control System** **D) Intelligent Systems and Applications in Electrical Engineering** **E) Analog Electronics and Sensing Technology [Open Elective]**	**A) Smart Grid** **B) Robotics and Automation** **C) Illumination Engineering** **D) VLSI Design[Open Elective]**

Audit Course

- Audit Course: Optional for 1st and 2nd term of BE Electrical Engineering
- 'Audit Courses' means a Course in which the student shall be awarded Pass or Fail only. It is left to the discretion of the respective affiliated institute to offer such courses to the students. Evaluation of audit course will be done at institute level itself.
- Teaching-learning process for these subjects is decided by concern faculty/industry experts appointed by the affiliated Engineering College based on the syllabus and guidelines given.
- Marks obtained by student for audit course will not be taken into consideration of SGPA or CGPA.

Audit Course V 403152	**(A) Hydro Energy Systems** **(B) Foreign Language – German**
Audit Course VI 403153	**Energy Storage Systems**

403141: Power System Operation and Control

Teaching Scheme		Credits	Examination Scheme [150 Marks]	
Theory	: 03 Hr/Week	03	In Sem :	30 Marks
Practical	: 02 Hr/Week	01	End Sem :	70 Marks
			Oral :	25 Marks
			Term work :	25 Marks

Prerequisite:
Basics of Power System

Course Objective: The course aims:-

- To develop ability to analyze and use various methods to improve stability of power systems
- To understand the need for generation and control of reactive power
- To impart knowledge about various advanced controllers such as FACTs controllers with its evolution, principle of operation, circuit diagram and applications
- To illustrate the automatic frequency and voltage control strategies for single and two area case and analyze the effects, knowing the necessity of generation control.
- To understand formulation of unit commitment and economic load dispatch tasks and solve it using optimization techniques
- To illustrate various ways of interchange of power between interconnected utilities and discuss planning, reliability aspects at all stages of power system.

Course Outcome: Upon successful completion of this course, the students will be able to :-

1. Identify and analyze the dynamics of power system and suggest means to improve stability of system.
2. Comprehend the effect of reactive power on Power system and suggest the suitable means of reactive power management.
3. Selection of appropriate FACTs devices
4. Analyze the generation-load balance in real time operation and its effect on frequency and develop automatic control strategies with mathematical relations.
5. Formulate objective functions for optimization tasks such as unit commitment and economic load dispatch and get solution using computational techniques.
6. Evaluate reliability indices of Power system

Unit 01 : Power System Stability (06 Hrs)

Introduction to stability, dynamics of synchronous machine, swing equation, power angle equation and curve, types of power system stability (concepts of steady state, transient, dynamic stability), equal area criterion, applications of equal area criterion (sudden change in mechanical input, effect of clearing time on stability, critical clearing angle, short circuit at one end of line, short circuit away from line ends and reclosure), solution of swing equation by point by point method, methods to improve steady state and transient stability, numerical based on equal area criteria.

Unit 02 : Reactive Power management (06 Hrs)

Necessity of reactive power control, reactive power generation by a synchronous machine, effect of excitation, loading capability curve of a generator, compensation in power system: series and shunt compensation using capacitors and reactors, Problems with Series Compensation, synchronous condenser.

Unit 03 : FACTs Technology (06 Hrs)

Problems of AC transmission system, evolution of FACTs technology, Working principle, circuit diagram, VI characteristics, applications, advantages and limitations of SVC, TCSC, STATCOM and UPFC.

Unit 04 : Automatic Generation and Control (AGC) (06 Hrs)

Concept of AGC, complete block diagram representation of load-frequency control of an isolated power system, steady state and dynamic response, control area concept, two area load frequency control. Schematic and block diagram of alternator voltage regulator scheme.

Unit 05 : Economic Load Dispatch and Unit Commitment (06 Hrs)

A. Economic load dispatch: Introduction, revision of cost curve of thermal and hydropower plant, plant scheduling method, equal incremental cost method, method of Lagrange multiplier (neglecting transmission losses), B_{mn} coefficient, economic scheduling of thermal plant considering effect of transmission losses, penalty factor, procedure of load dispatch at state level load dispatch center, Regional Load Dispatch Center, numerical on penalty factor, exact coordination equation.

B. Unit commitment: Concept of unit commitment, constraints on unit commitment – spinning reserve, thermal and hydro constraints, methods of unit commitment – priority list and dynamic programming, Numerical on priority list method.

Unit 06 : Energy Control and Planning and Reliability of Power Systems (06 Hrs)

A. **Energy Control:** Interchange of power between interconnected utilities, economy interchange evaluation, interchange evaluation with unit commitment, types of interchange, capacity and diversity interchange, energy banking, emergency power interchange, inadvertent power exchange, power pools.

B. **Planning and Reliability of Power Systems:** Need of short term planning and long term planning in generation, transmission, distribution expansion. Definition of reliability of power system, Hierarchical levels for reliability study, Reliability evaluation of generation system, loss of load probability (LOLP), loss of load expectation (LOLE), Expected Energy Not Supplied (EENS), generation model, load model, risk model, composite system reliability evaluation, Distribution system reliability evaluation for radial and parallel system, customer oriented and energy based reliability indices.

Guidelines for Instructor's Manual

Practical Sessions:-

Instructor's Manual should contain following things related to every experiment-

- Specify prerequisite and objective(s) of experiment.
- List out equipment required to perform the experiment with their ratings (for hardware experiments).
- Include circuit diagram with specifications (for hardware experiments).
- Related theory of the experiment must be included.
- The circuit diagram of the experiment should be drawn at the beginning.
- For simulation experiments using MATLAB, the Simulink diagram with proper details must be included in write up. For programming, take printout of program and result.
- Conclusion based on calculations, result and graph (if any) should be written. Provide space for same.

Guidelines for Student's Lab Journal

- Students should write the journal in own hand writing particularly results, diagram, conclusion, question answers etc.
- Circuit / Connection diagram or construction diagram must be drawn either manually using or using software on graph paper.
- Hand writing and figures must be neat and clean.

Guidelines for Laboratory / TW Assessment

- Continuous assessment is to be carried out. The experiment performed in a particular week must be checked in the next turn in next week.
- After assessment, teacher should put the remark by writing word "Complete" and not simply "C". Put the signature along with date at the end of experiment and in the index.

List of Experiments

[Perform experiment 1 or 2 and any seven from 3 to 11 using any simulation software]

1. To determine Steady state Stability of synchronous motor (performance).
2. To determine Steady state stability of medium transmission line (performance).
3. To plot swing curve by Point by Point method for transient stability analysis.
4. To apply equal area criteria for analysis stability under sudden rise in mechanical power input.
5. To apply equal area criteria for stability analysis under fault condition.
6. To study reactive power compensation using any device.
7. To study Lagrange multiplier technique for economic load dispatch.
8. To develop and execute dynamic programming method for unit commitment.
9. To study load frequency control using approximate and exact model.
10. To study load frequency control with integral control.
11. To study the two area load frequency control.

Industrial Visit:

Industrial visit is mandatory to Load Dispatch Center / Power Station Control Room.

Text Books:

[T1] I. J. Nagrath, D. P. Kothari, "Modern Power System Analysis", 4th Edition, Tata McGraw Hill Publishing Co. Ltd. (Edition 2)

[T2] Hadi Saadat, "Power System Analysis", Tata McGraw Hill

[T3] P. S. R. Murthy, "Power System Operation and Control", Tata McGraw Hill Publishing Co. Ltd.

[T4] P. S. R. Murthy, "Operation and Control in Power System", B. S. Publication.

[T5] R. Mohan Mathur, Rajiv K. Varma, "Thyristor based FACTs controller for Electrical transmission system", John Wiley and Sons Inc.

[T6] Abhijit Chakrabarti, Sunita Halder, "Power System Analysis Operation and Control", Prentice Hall of India.

[T7] Narain G. Hingorani and Laszlo Gyugyi, "Understanding FACTS", IEEE Press.

Reference Books:

[R1] Allen J. Wood, Bruce F. Wollenberg, "Power Generation, Operation, and Control", Wiley India Edition.

[R2] "Electrical Power System Handbook", IEEE Press.

[R3] Narain G. Hingorani, Laszlo Gyugyi, "Understanding FACTs Concepts and Technology of Flexible AC Transmission Systems," IEEE Press.

[R4] Olle I. Elgerd, "Electrical Energy System Theory", 2nd Edition, Tata McGraw Hill. Publishing Co. Ltd.

[R5] Prabha Kundur, "Power System Stability and Control", Tata McGraw Hill.

Websites:

1. http://www.mahasldc.in/
2. http://cercind.gov.in/
3. http://www.srldc.org/
4. https://nrldc.in/
5. http://www.mercindia.org.in/
6. http://www.erldc.org/
7. http://nptel.ac.in/courses/108101040/ (PSOC webcourse)
8. http://www.powergridindia.com/

Unit	Text Books	Reference Books
1	T1, T2, T6	R1, R2, R5
2	T3	R5
3	T5,T7	R3
4	T1	R1
5	T2,T4	R1, R4, websites
6	T1	R1

403142: PLC and SCADA Applications

Teaching Scheme		Credits	Examination Scheme [175 Marks]	
Theory	: 04 Hr/Week	04	In Sem	: 30 Marks
Practical	: 02 Hr/Week	01	End Sem	: 70 Marks
			PR	: 50 Marks
			Term work	: 25 Marks

Prerequisite:
Logic gates operations, Boolean algebra, Relay logic

Course Objective: The course aims:-

- To understand the generic architecture and constituent components of a Programmable Logic Controller.
- To develop architecture of SCADA explaining each unit in detail.
- To develop a software program using modern engineering tools and technique for PLC and SCADA.
- To apply knowledge gained about PLCs and SCADA systems to real-life industrial applications.

Course Outcome: Upon successful completion of this course, the students will be able to :-

1. Develop block diagram of PLC and explain the working.
2. Classify input and output interfacing devices with PLC.
3. Develop architecture of SCADA and explain the importance of SCADA in critical infrastructure.
4. Execute, debug and test the programs developed for digital and analog operations.
5. Describe various SCADA protocols along with their architecture.
6. Observe development of various industrial applications using PLC and SCADA.

Unit 01 : Introduction to PLC (08 Hrs)

Role of automation in Industries, benefits of automation, Necessity of PLC, History and evolution of PLC, Definition as per NEEMA (National Electrical Engineering Manufacturers' Association), types – fixed/modular/dedicated, Overall PLC system, PLC Input and output modules (along with Interfaces), CPU, programmers and monitors, power supplies, selection criterion, advantages and disadvantages, specifications, comparison of various PLCs manufactured by Allen Bradley, Siemens, ABB, Mitsubishi, GE, Fanuc and Schneider.

Unit 02 : Interfacing of PLC with I/O devices (08 Hrs)

Input ON/OFF switching devices, Input analog devices, Output ON/OFF devices, Output analog devices Sensors-temperature, pressure, flow, level Actuators-Electrical, pneumatic, hydraulic Encoders-Incremental, Absolute Transducers, Limit switches, proximity sensors Control Elements- Mechanical, Electrical, Fluid valves

Unit 03 : Programming of PLC (09 Hrs)

Programming languages for PLC, Ladder diagram fundamentals, Rules for proper construction of ladder diagram Timer and counter- types along with timing diagrams, Reset instruction, latch instruction MCR (master control relay) and control zones Developing ladder logic for Sequencing of motors, ON OFF Tank level control, ON OFF temperature control, elevator, bottle filling plant, car parking, traffic light controller.

Unit 04 : Advance function and Applications of PLC (08 Hrs)

Analog PLC operation and PLC analog signal processing, PID principles, Typical continuous process control curves, simple closed loop systems, closed loop system using Proportional, Integral and Derivative (PID), PID modules, PID tuning, tuning methods including "Adjust and observe" method.

Motors Controls: AC Motor starter, AC motor overload protection, DC motor controller, Variable speed (Variable Frequency) AC motor Drive.

PLC Applications in developing systems- Tank level controller using analog signals, temperature controller using RTD, speed control of electric motor.

Unit 05 : SCADA Systems (08 Hrs)

Introduction, definitions and history of Supervisory Control and Data Acquisition, typical SCADA system Architecture, important definitions HMI, MTU, RTU, communication means, Desirable Properties of SCADA system, advantages, disadvantages and applications of SCADA.

SCADA generations (First generation - Monolithic, Second generation - Distributed, Third generation – Networked Architecture), SCADA systems in operation and control of interconnected power system, Functions and features of SCADA systems, Automatic substation control, Energy management systems (EMS), System operating states, SCADA system in critical infrastructure: Petroleum Refining Process, Conventional electric power generation, Water Purification System, Chemical Plant.

Unit 06 : SCADA Protocols (07 Hrs)

Open systems interconnection (OSI) Model, TCP/IP protocol, Modbus model, DNP3 protocol, IEC61850 layered architecture, Control and Information Protocol (CIP), Device Net, Control Net, Ether Net/IP, Flexible Function Block process (FFB), Process Field bus (Profibus).

Guidelines for Instructor's Manual

- Specify objective(s) of the experiment.
- Include ladder diagram.
- Related theory of the experiment must be included.
- Include step by step procedure to perform the experiment.
- Tabular representation of results taken from the experiment/observation table must be included wherever applicable.
- Provide space to write conclusion.

Guidelines for Student's Lab Journal

➢ Students are expected to write the journal in the following sequence:
- Aim –
- Ladder diagram –
- Theory –
- Conclusion.

➢ Students are expected to draw the ladder diagrams on 1mm graph paper.
➢ They should attach print out or draw SCADA HMI.
➢ Students should write conclusion.
➢ Students should get the assignment and lab write up checked within 1 week after performing the experiment.

Guidelines for Laboratory conduction

- Give the safety instructions to students.
- Allow 4-5 students per group for performing the experiment.
- Explain theory related to the experiment to be conducted.
- Introduce PLC and SCADA in detail with specifications to students.
- Explain the ladder diagram of the experiment.
- Ladder diagram should be completed by the students.
- Perform the experiment in the presence of instructor.
- Verify the results obtained.

List of Experiments:

Minimum 11 experiments should be conducted. 6 experiments should be on PLC and 5 experiments should be on SCADA.

a) Experiments No. 1 to 5 are compulsory.
b) Any 1 experiment should be conducted from experiment number 6 to 9.
c) Experiments No. 10 to 13 are compulsory.
d) Any 1 experiment should be conducted from experiment number 14 to 17.

1. Interfacing of lamp and button with PLC for ON and OFF operation. Verify all logic gates.
2. Set / Reset operation: one push button for ON and other push button for OFF operation.
3. Delayed operation of lamp by using push button.
4. UP/DOWN counter with RESET instruction.
5. Combination of counter and timer for lamp ON/OFF operation.
6. DOL starter and star delta starter operation by using PLC.
7. PLC based thermal ON/OFF control.
8. Interfacing of Encoder with PLC
9. PLC based speed, position, flow, level, pressure measurement system.
10. PLC interfaced with SCADA and status read/command transfer operation.
11. Parameter reading of PLC in SCADA.
12. Alarm annunciation using SCADA.
13. Reporting and trending in SCADA system.
14. Tank level control by using SCADA.
15. Temperature monitoring by using SCADA.
16. Speed control of Machine by using SCADA.
17. Pressure control by using SCADA.

Industrial Visit: Compulsory visit to SCADA and PLC based automation industry.

Text Books:

[T1] John W. Webb, Ronald A. Reis, “Programmable Logic Controllers: Principles and Application”, PHI Learning, New Delhi, 5th Edition
[T2] John R. Hackworth, Frederick D., Hackworth Jr., “Programmable Logic Controllers Programming Methods and Applications”, PHI Publishers
[T3] Ronald L. Kurtz, “Securing SCADA System”, Wiley Publishing
[T4] Stuart A Boyer, “SCADA supervisory control and data acquisition”, ISA, 4th Revised edition
[T5] Sunil S. Rao, “Switchgear and Protection”, Khanna Publication
[T6] Curtis Johnson, “Process Control Instrumentation Technology”, Prentice Hall of India
[T7] Gary Dunning, “Introduction to Programmable Logic Controllers”, Thomson, 2nd Edition

Reference Books:

[R1] Gordan Clark, Deem Reynders, "Practical Modern SCADA Protocols", ELSEVIER

[R2] Batten G. L., "Programmable Controllers", McGraw Hill Inc., Second Edition

[R3] Bennett Stuart, "Real Time Computer Control", Prentice Hall, 1988

[R4] Krishna Kant, "Computer Based Industrial Control", PHI

[R5] P. K. Srivstava, "Programmable Logic Controllers with Applications", BPB Publications

Unit	Text Books	Reference Books
1	T1	R2
2	T1, T2, T6	R3, R4
3	T1, T7	R5
4	T1, T2, T6	R2, R5
5	T3, T4, T5	R1
6	T3	R1

Elective I : 403143 (A) : Fundamentals of Microcontroller MSP430 and its Applications [Open Elective]

Teaching Scheme	Credits	Examination Scheme [125 Marks]		
Theory :03 Hr/Week	03	In Sem	:	30 Marks
Practical :02 Hr/Week	01	End Sem	:	70 Marks
		Term work	:	25 Marks

Prerequisite:

Basic knowledge of Number system.
Knowledge of basic logic components.
Programming skills in C Language.

Course Objective: The course aims to:-

- Provide understanding of architecture of MSP430 microcontroller
- Develop ability to write and interpret C language programs for MSP430
- Use advance features in PWM for MSP430
- Interface various devices with MSP430
- Understand use of MSP 430 for IoT applications

Course Outcome: Upon successful completion of this course, the students will be able to:-

1. Explain architecture of MSP430 microcontroller, its instructions and the addressing modes.
2. Develop and debug program in C language for specific applications.
3. Use of Code Composer Studio IDE for simulating the functionalities of MSP430 microcontroller
4. Interface microcontroller MSP430 to various sensing devices.
5. Develop IoT based application using MSP430.

Unit 01 : Overview of MSP430 (06 Hrs)

Basics of Embedded Systems, Introduction to MSP430, RISC Architecture / Functional Block Diagram of MSP430G2553, Pin Diagram, Memory Organization, CPU, On-Chip-Peripherals. Overview of MSP430G2 Launchpad and its Features.

Unit 02 : Digital I/O, Interrupts and basic of programming (06 Hrs)

GPIO programming and I/O multiplexing; Interrupts and interrupt programming, Issues associated with interrupts, Capacitive touch I/O pin interface.

Software and hardware tools for development of MSP430 based system such as assembler, compiler, IDE, Emulators, debugger, programmer.

Unit 03 : Timers, PWM Control and RTC (06 Hrs)

Watchdog timer, Timers, Measurement in Capture Mode, PWM control – Edge-Aligned PWM, Centred PWM and Sine-PWM, Real Time Clock (RTC).

Unit 04 : ADC and Operating Modes (06 Hrs)
Analog-to-Digital Conversion: General Issues, Successive Approximation. Basic Operation of ADC10, Advanced Operation of ADC10, ADC10 Successive Approximation, Digital to Analog Conversion.

Low Power aspects of MSP430: Operating Modes, low power modes, Active vs Standby current consumption, FRAM vs Flash for low power; reliability.

Unit 05 : Communication (06 Hrs)
Serial communication basics, USCI, Synchronous/Asynchronous interfaces (like UART, USB, SPI, and I2C), UART protocol, I2C protocol, SPI protocol, Implementing and programming UART, I2C, SPI interface using MSP430, Interfacing external devices.

Unit 06 : IoT Basics and Applications of MSP430 (06 Hrs)
IoT overview and architecture, Overview of wireless sensor networks and design examples. Various wireless connectivity: NFC, ZigBee and Bluetooth.

Real world application: MSP430 based Embedded Networking Application: "Implementing Wi-Fi or Bluetooth Connectivity in a Smart Electric Meter".

Guidelines for Instructor's Manual

Instructor's Manual shall have

- Brief relevant theory.
- Equipment with specifications.
- Connection diagram/ methodology.
- Format of observation table and sample results.

Guidelines for Student's Lab Journal

The Student's Lab Journal should contain following related to every experiment –

1. Theory related to the experiment.
2. Apparatus with their detailed specifications.
3. Connection diagram /circuit diagram.
4. Observation table/ simulation waveforms.
5. Sample calculations for one/two reading.
6. Result table.
7. Graph and Conclusions.
8. Few short questions related to the experiment.

Guidelines for Laboratory conduction

Lab Requirement:MSP430F2553 Launch Pad, Desktop/ Laptop with Windows7/8 operating system, System with installed circuit CCS software, Breadboard, Single strand and jumper wires, MSP430 Capacitive Touch Booster-Pack, CC3100 Wi -Fi Booster Pack.

List of Experiments

Minimum 8 experiments are to be performed from the following list:

1) Digital I/O: Learn and understand how to configureMSP-EXP430G2553 / MSP-EXP430F5529 digital I/O pins. Write a C program for configuration of GPIO ports for MSP430 (blinking LEDs, push buttons interface).

   Exercises: a) modify the code to make the green and red LEDs blink: Together and alternatively

   b) Modify the delay with which the LED blinks: Together and alternatively

   c) Modify the code to make the green LED blink: Together and alternatively

2) Timer/Interrupt: Learn and understand GPIO based Interrupt programming in MSP-EXP430G2553 / MSP-EXP430F5529. Write a C program and associated GPIO ISR using interrupt programming technique.

   Exercises:

   a) Write the code to enable a timer interrupt for the pin.
   b) Write the code to turn on interrupts globally.
   c) LED Blink using timer instead of software delay.

3) PWM: Implement Pulse Width Modulation to control the brightness of the on-board, green LED. Exercises:

   a) Observe the PWM waveform using CRO / DSO.
   b) What is the maximum resolution of PWM circuitry in MSP-EXP430G2553 / MSP-EXP430F5529?
   c) Change the above code to create a PWM signal of 75% duty cycle on PWM pin.

4) PWM (Continued): Implement Advanced Pulse Width Modulation techniques

   Exercises:

   a) Edge-Aligned and Center Aligned PWM.
   b) Sine-PWM generation.

5) ADC: Learn and understand how to configure the ADC module to control the brightness of LED.

   Exercises:

   a) Read ADC value and observe in Watch window
   b) Change PWM duty cycle based on ADC value and control brightness of LED using a pot connected to ADC pin.

6) Configure of Universal Serial Communication Interface (USCI) module ofMSP-EXP430G2553 / MSP430F5529 for UART based serial communication. The main objective of this experiment is to use UART of the MSP-EXP430G2553 / MSP430F5529 to communicate with the computer.

   Exercise:

   a) Modify the above code to transmit the set of strings to the serial terminal via UART as shown below:

      char str1[]="MSP-EXP430G2553 / MSP430F5529 MCU"

      char str2[]= "Ultra low power mixed signal processing applications"

7) Capacitive I/O interface: Understand and interface a Capacitive Booster pack with MSP430.
   Exercise:
   a) Implementing Capacitive Booster Pack Demo

8) On chip temperature Sensor and ADC interface demo: To implement the on-chip temperature sensor demo.
   Exercise:
   a) Implementing Temperature Sensor and ADC interface Demo

9) Bluetooth Interface: Transmit Data wirelessly over Bluetooth for any chosen IoT application
   Examples:
   a) Temperature Sensor
   b) Humidity Sensor
   c) Position Sensor
   d) Proximity Sensor
   e) Current Sensor
   f) Voltage Sensor
   g) Pressure Sensor
   h) Or any other sensor interfaced with MSP430.

10) Closed loop temperature/speed control system using MSP430.

Lab Manual:

1) www.ti.com/lab-maunals

Embedded System Design using MSP430 Launchpad Development Kit – Lab Manual

Text Books:

[T1] Getting Started with the MSP430 Launchpad by Adrian Fernandez, Dung Dang, Newness publication ISBN-13: 978-0124115880
[T2] MSP430 microcontroller basics 1st Edition by John H. Davies (Author), Newnes Publication ISBN- 13: 978-0750682763

Other References:

[R1] http://www.ti.com/lit/ds/symlink/msp430g2553.pdf
[R2] http://www.ti.com/lit/ug/tidu520/tidu520.pdf
[R3] http://processors.wiki.ti.com/index.php/MSP430_LaunchPad_Low_Power_Mode

Unit	Text Books	Reference Books
1	T1	R1
2	T2	R1, R3
3	T2	R1
4	T2	R1
5	T2	R1
6	-	R2

Elective I: 403143 (B) : Power Quality

Teaching Scheme			Credits	Examination Scheme [125 Marks]		
Theory	:	03 Hr/Week	03	In Sem	:	30 Marks
Practical	:	02 Hr/Week	01	End Sem	:	70 Marks
				Term work	:	25 Marks

Prerequisite:
Fundamentals of Power system and Power electronics.

Course Objective: The course aims to:-

- Develop ability to identify various power quality issues, its sources and effects on various equipments.
- Monitor and analyze various power quality problems
- Describe and selection of cost effective power quality mitigation solutions.
- Explain use of power quality standards

Course Outcome: Upon successful completion of this course, the students will be able to:-

1. Identify importance of various power quality issues.
2. Carry out power quality monitoring
3. List and explain various causes and effects of power quality problems
4. Analyze power quality parameters and carry out power quality analysis
5. Select cost effective mitigation technique for various power quality problems
6. Use IEEE 519-2014 power quality standard for harmonic compliance

Unit 01 : Basics of power quality (06 Hrs)

Introduction and importance of power quality, symptoms of poor power quality. Classification of power quality events, power quality definition as per IEEE 1159.Grounding of sensitive electronic equipments and guidelines of IEEE std 1100.Long duration RMS voltage variations, its sources, effects and solutions.

Unit 02 : Voltage Sag (06 Hrs)

Sources of voltage sags, classification of voltage sags, factors governing severity of voltage sag. Area of vulnerability, critical distance. Voltage sag characteristics. Classification of equipments based on its sensitivity to various characteristics of voltage sag. Effect of voltage sag on various equipments. Voltage tolerance curve, ITIC and SEMI F47 curve, investigation of sensitivity of equipments to voltage sags. Voltage sag mitigation techniques at equipment level, LT power entrance and medium voltage. Voltage sag indices. Study of important provisions in IEEE Std 1346.

Unit 03 : Transient Overvoltage and Flicker (06 Hrs)

Sources of transient over voltages, Impulsive and oscillatory transients. Magnification of capacitor switching transients, pre insertion reactors to control capacitor switching transients, ferroresonance, principle of over voltage protection. Devices for over voltage protection. Voltage flicker, its sources. Factors governing severity of flicker. Flicker measurement, Pst and Plt. Flicker mitigation solutions.

Unit 04 : Fundamentals of Harmonics (06 Hrs)

Waveform Distortion, Harmonics, Harmonic phase sequences. Classification of harmonics harmonic, Voltage Verses Current distortion, AC quantities under non-sinusoidal conditions, Voltage and current harmonic indices, Sources of harmonics, General and special Effects of Harmonics on Electrical Equipments, cables, switchgears, Meters and Communications.

Unit 05 : Harmonic Mitigation Techniques (06 Hrs)

System behaviour to harmonics, location of harmonic sources, Series and parallel resonance, Harmonic mitigation, passive tuned and detuned filters, design of tuned filters, Active Filter, Sizing and location of active filters, Advantages of active filters over passive filters, Hybrid filters. IEEE 519-2014 standard.

Unit 06 : Power Quality Monitoring (06 Hrs)

Objectives of Power quality monitoring. Types of power quality monitoring, Power quality monitoring equipments, Power quality analyser specification requirement as per EN50160 Standard. Selection of power quality equipments for cost effective power quality monitoring, selection of voltage and current transducers. Power quality indices. IEEE 1159 standard and important provision related with power quality monitoring. Computer Tools for analysis of power quality.

Guidelines for Instructor's Manual

Instructor's Manual shall have

- Brief relevant theory.
- Equipment with specifications.
- Connection diagram/ methodology.
- Format of observation table and sample results.

Guidelines for Student's Lab Journal

The Student's Lab Journal should contain following related to every experiment –

9. Theory related to the experiment.
10. Apparatus with their detailed specifications.
11. Connection diagram /circuit diagram.
12. Observation table/ simulation waveforms.
13. Sample calculations for one/two reading.
14. Result table.
15. Graph and Conclusions.
16. Few short questions related to the experiment.

Guidelines for Laboratory conduction

- Read and understand power quality analyzer manual completely.
- Make sure that connections of power analyzer are done as per manual.
- Follow safety protocols while doing power quality audit.

List of Experiments

Minimum 8 experiments are to be performed from the following list:

Compulsory experiments:

1. Study of power quality analyzer and measurement of voltage, current, power and power factor using it.
2. Measurement of harmonic distortion of various Equipments such as UPS /AC/DC drive
3. Harmonic compliance of institute as per IEEE 519-2014 standard and sizing of active filter.
4. Power quality audit of institute or department.

Any 4 experiments from following list:

1. Harmonic analysis of transformer for various conditions (no load, inrush, full load etc.)
2. Analysis of performance of induction motor/transformer operated with sinusoidal supply and under distorted supply conditions supplied by 3 phase inverter.
3. Measurement of voltage sag magnitude and duration by using digital storage oscilloscope/ power quality analyzer.
4. Design of 7% detuned Passive Filter
5. Simulation study of transient and/or flicker measurement.
6. Simulation studies of harmonic generation sources such as VFD, SVC, STATCOM and FACTS devices and harmonic measurement (THD) by using professional software like MATLAB.
7. Harmonic load flow analysis by using professional software such as ETAP, PSCAD, ATP etc.

Text Books:

[T1] R. C. Dugan, Mark F. McGranghan, Surya Santoso, H. Wayne Beaty, "Electrical Power System Quality", 2nd Edition, McGraw Hill Publication.

[T2] M. H. J. Bollen, "Understanding Power Quality Problems, Voltage Sag and Interruptions", New York: IEEE Press, 2000, Series on Power Engineering.

[T3] C.Sankaran "Power quality", CRC Press

[T4] Arrillaga, M. R. Watson, S. Chan, "Power System Quality Assessment", John Wiley and Sons.

Reference Books:

[R1] Enriques Acha, Manuel Madrigal, "Power System Harmonics: Computer Modeling and Analysis", John Wiley and Sons Ltd.

[R2] Ewald F. Fuchs, Mohammad A. S. Masoum, "Power Quality in Power Systems and Electrical Machines" Elsevier Publication.

[R3] G. J. Heydt, "Electric Power Quality", Stars in Circle Publications

[R4] EN50160and IEEE 1100, 1346,519 and 1159 standards

[R5] Arrillaga, M. R. Watson, "Power System Harmonics", John Wiley and Sons

Unit	Text Books	Reference Books
1	T1,T2, T3	R3, R4
2	T1,T2,T3	R2, R3, R4
3	T1,T2,T3	R2, R3
4	T1,T3,T4	R1, R4, R5
5	T1,T3,T4	R1, R4, R5
6	T1,T3	R1, R4

403143 (C) : Renewable Energy Systems

Teaching Scheme		Credits	Examination Scheme [125 Marks]		
Theory	: 03 Hr/Week	03	In Sem	:	30 Marks
Practical	: 02 Hr/Week	01	End Sem	:	70 Marks
			Term work	:	25 Marks

Prerequisite: Knowledge of basic renewable technologies like solar, wind, biogas, fuel cell, Knowledge of conventional grid

Course Objective: The course aims:-

- To develop fundamental understanding about Solar Thermal and Solar Photovoltaic systems.
- To provide knowledge about development of Wind Power plant and various operational as well as performance parameter/characteristics.
- To explain the contribution of Biomass Energy System in power generation.
- To describe different Storage systems, Integration and Economics of Renewable Energy System.

Course Outcome: Upon successful completion of this course, the students will be able to :-

1. Describe various renewable energy sources such as Solar Photovoltaic, Biomass, Wind, Fuel cell and Solar thermal.
2. Explain different renewable energy sources as an alternate for conventional power sources in any application of energy.
3. Identify and locate the use of renewable energy sources as per the requirement of the location.
4. Analyze, assess and design renewable energy systems such as solar and wind sources.
5. Compare the various storage sources for electrical energy.
6. Describe the standards for renewable energy source integration and evaluate economics related to these sources.

Unit 01 : Solar Thermal (06 Hrs)

Solar radiation at the Earth's surface, solar constant, spectral distribution, Extra-terrestrial radiation, solar terrestrial radiation, solar radiation geometry, Introduction to the concept of monthly average daily and hourly global and diffuse radiation, beam and diffuse radiation under cloudless skies, solar radiation on tilted surfaces: a) beam radiation, b) diffuse radiation, c) reflected radiation, d) flux on tilted surface.

Instruments for measuring solar radiation, Basics of flat plate collector, concepts of solar water heating system and space heating system, solar dryer, introduction to Concentrating Solar Power (CSP) plants using technologies like a) parabolic troughs b) linear Fresnel reflector c) paraboloid dish

Unit 02 : Solar PV (06 Hrs)

Introduction to various solar PV technologies, Single c-Si, Poly c-Si, thin film PV Cell, Module and Array, factors influencing the electrical design of the solar system: a) Sun Intensity b) Sun Angle c) Shadow Effect d) Temperature Effect e) Effect of Climate f) Electrical Load Matching g) Sun Tracking; Peak Power Point Operation, Electrical characteristics of Silicon PV Cells and Modules, PV System Components, Efficiency of PV system.

Design of typical solar PV system with and without battery backup for applications such as homes, commercial complex, agriculture etc.

Unit 03 : Wind Energy System (06 Hrs)

Types of wind turbine, Site selection, Power Contained in Wind, Aerodynamics of Wind Energy, Efficiency Limit for Wind Energy Conversion, Maximum Energy obtained for a Thrust-operated converter (Efficiency limit), Introduction to the Design of Wind Turbine Rotor, Power-Speed Characteristics, Wind Turbine Control Systems: a) Pitch Angle Control b) Stall Control c) Power Electronics Control d) Yaw Control; Control Strategy, Introduction to Offshore Wind Energy System and its comparison with on grid Wind Energy System

Unit 04 : Biomass Energy System (06 Hrs)

Biomass Classification, Biomass Resources and their Energy Potential, Biomass Conversion Technologies: Anaerobic Digestion, Ethanol Fermentation, Biomass Gasification: Gasifiers, Fluidized Bed Gasifier, Biogas Technologies and their factor affecting Biogas Production, Biogas Plants: Floating and Fixed Dome type, Introduction to other bio-reactors such as CSTR and UASB, designing of biogas plant. Power Generation from Municipal Solid Waste (MSW), Land Fill Gas, Liquid Waste. Introduction to organic fertilizers from digest state.

Unit 05 : Fuel cell and Storage Systems (06 Hrs)

a) Fuel Cells: Introduction to Fuel Cell Technology; type of fuel cells, Operating principles of Fuel Cell, Fuel and Oxidant Consumption, Fuel Cell System Characteristics, application and limits.

b) Energy Storage systems: Hydrogen storage: Hydrogen production, relevant properties, Hydrogen as an Engine Fuel, methods of Hydrogen storage.

Batteries: Introduction to Batteries, Elements of Electro Chemical Cell, Battery classification, Battery Parameters, Factors affecting battery performance.

Grid scale storage, various options available (pumped storage, SMES, compressed air storage, fly wheels, etc.), requirements, future trends, Introduction to the concepts of round trip efficiency and cost of storage.

Unit 06 : Integration and Economics of Renewable Energy Systems (06 Hrs)

a) Integration of RES with grid, standards., Introduction to hybrid systems

b) Economics of RES: Simple payback, Internal Rate of Return (IRR), time value, Net present value (NPV), Life cycle costing, Effect of fuel cost Escalation, Annualized and levelized cost of energy

Guidelines for Instructor's Manual

Manual must have assignment related to theory of each experiment.

Guidelines for Student's Lab Journal

A separate notebook/file is required for experiments. Top of the page must have experiment number, title of experiment, date of experiment. It is to be followed by observations, calculations and results. The laboratory notebook must be checked by the staff in-charge of the experiment. Journal must have observations and conclusions written neatly. The experiments must be assessed by the proper authority before submission.

Guidelines for Laboratory conduction

Minimum 08 experiments should be conducted from the list given below:

List of Experiments

1. To identify and measure the parameters of a Solar PV Module with Series and/or Parallel combination.
2. To plot I-V and P-V characteristics with series and parallel combination of Solar PV Modules for different Insolation and temperature effects.
3. To evaluate effect of Shading and Tilt Angle on I-V and PV characteristics of Solar Module.
4. To estimate effect of sun tracking on energy generation by Solar PV Module.
5. To estimate efficiency of standalone Solar PV Module.
6. To evaluate performance of Solar flat plate collector.
7. To plot characteristics of lead-acid battery for various source and load condition.
8. To analyze effect of blade angles on performance of wind turbine.
9. To evaluate performance of horizontal axis wind turbine.
10. To evaluate performance evolution of vertical axis wind turbine.
11. To study synchronization of wind electric generator.
12. Wind generation analysis using Matlab for variable wind speeds.
13. To evaluate efficiency of DFIG System (Hardware setup only).

Industrial Visit: Field visit to Renewable Energy Sources locations or Manufacturing Industry

Text Books:

[T1] S.P. Sukhatme, "Solar Energy," Tata McGraw Hill

[T2] Mukund R. Patel, "Wind and Power Solar System", CRC Press

[T3] Chetan Singh Solanki, "Solar Photovoltaics-Fundamentals, Technologies and Applications", PHI Second Edition

[T4] H. P. Garg, J. Prakash, "Solar Energy-Fundamentals and Applications", Tata McGraw hill Publishing Co.ltd., First Revised Edition

[T5] Tony Burton, Nick Jenkins, David Sharpe, "Wind Energy Hand Book-Second Edition", John Wiley & Sons, Ltd., Publication

[T6] Godfrey Boyle, "Renewable Energy", Third edition, Oxford University Press

[T7] S. Rao, Dr. B. B. Parulekar, "Energy Technology – Non Conventional, Renewable and Conventional", Khanna Publication

Reference Books:

[R1] D. P. Kothari, K. C. Singal, Rakesh Rajan, "Renewable Energy Sources and Emerging Technologies", PHI Second Edition

[R2] Donald L.Klass, "Biomass for Renewable Energy, Fuels, and Chemicals, Elsevier, Academic Press

[R3] B T.Nijaguna, "Biogas Technology", New Age International Publishers

[R4] Tapan Bhattacharya, "Terrestrial Solar Photovoltaics", Narosa Publishing House

[R5] Thomas Ackermann, "Wind Power in Power Systems", Wiley Publications

Unit	Text Books	Reference Books
1	T1, T4	R4
2	T2, T3	R1
3	T5	R5
4	T7	R2,R3
5	T3,T6	R1
6	T6, T7	R1

Elective I: 403143 (D): Digital Signal Processing

Teaching Scheme		Credits	Examination Scheme [125 Marks]		
Theory	: 03 Hr/Week	03	In Sem	:	30 Marks
Practical	: 02 Hr/Week	01	End Sem	:	70 Marks
			Term work	:	25 Marks

Prerequisite:
Knowledge of basic signals and systems

Course Objective: The course aims:-

- To elaborate Sampling theorem
- To classify discrete signals and systems
- To analyze DT signals with Z transform, inverse Z transform and DTFT
- To describe Frequency response of LTI system
- To introduce Digital filters and analyze the response
- To demonstrate DSP Applications in electrical engineering

Course Outcome: Upon successful completion of this course, the students will be able to :-

1. Sample and reconstruct any analog signal
2. Construct frequency response of LTI system
3. Evaluate Fourier Transform of discrete signals
4. Design IIR filter and its implementation
5. Design FIR filter and implementation
6. Develop block diagram for DSP applications to electrical engineering

Unit 01 : Classification of Signals: (06 Hrs)
Analog, Discrete-time and Digital signals, Basic sequences and sequence operations, Discrete-time systems, Properties of D. T. Systems and Classification, Linear Time Invariant Systems, impulse response, linear convolution and its properties, properties of LTI systems: stability, causality, parallel and cascade connection, Linear constant coefficient difference equations, Periodic Sampling, Sampling Theorem, Frequency Domain representation of sampling, reconstruction of a band limited Signal, A to D conversion Process: Sampling, quantization and encoding.

Unit 02 : Z-transform, Inverse Z-transform and its properties: (06 Hrs)
Unilateral Z-transform, Z transform properties: Linearity, time shifting, multiplication by exponential sequence, differentiation, conjugation, time reversal, convolution, initial value theorem, Inverse z transform by inspection, partial fraction, power series expansion and complex inversion, solution of difference equation

Unit 03 : Discrete Time Fourier Transform (06 Hrs)
Representation of Sequences by Fourier Transform, Symmetry properties of D. T., F. T. theorems: Linearity, time shifting, frequency shifting, time reversal, differentiation, convolution theorem, Frequency response analysis of first and second order system, steady state and transient response

Unit 04 : Discrete Fourier Transform (06 Hrs)
Sampling theorem in frequency domain. The Discrete Fourier Transform, Relation with z transform Properties of DFT: Linearity, circular shift, duality, symmetry, Circular Convolution, Linear Convolution using DFT, Effective computation of DFT and FFT, DIT FFT, DIF FFT, Inverse DFT using FFT

Unit 05 : Frequency Response of LTI Systems: (06 Hrs)
Ideal frequency selective filters, Concept of filtering, specifications of filter, IIR filter design from continuous time filters: Characteristics of Butterworth, and Cheybyshev low pass filter, impulse invariant and bilinear transformation techniques, Design examples, Basic structures for IIR Systems: direct form, cascade form

Unit 06 : FIR filter design using windows: (06 Hrs)
specifications of properties of commonly used windows, Design Examples using rectangular, and hanning windows. Basic Structures for FIR Systems: direct form. Comparison of IIR and FIR Filters Applications: Measurement of magnitude and phase of voltage, current, power, frequency and power factor correction, harmonic Analysis and measurement, applications to machine control, DSP based protective relaying.

Guidelines for Instructor's Manual

Instructor's Manual should contain following related to every experiment –

- Theory related to the experiment.
- Basic MATLAB instructions for DSP/ Simulink basics.
- Observation table/ Expected simulation results.
- Sample calculations for one/two reading.
- Result table

Guidelines for Student's Lab Journal

The Student's Lab Journal should contain following related to every experiment –

- Theory related to the experiment
- Circuit diagram/Simulink diagram/MATLAB program
- Simulation results
- Sample calculations for one/two reading
- Result table, Conclusion
- Few short questions related to the experiment

Guidelines for Laboratory conduction

- Assessment must be based on understanding of theory, attentiveness during practical session.
- Assessment should be done how efficiently student is able to perform experiment/simulation and get the results.
- Understanding fundamentals and objective of experiment, timely submission of journal.

List of Experiments: :
[Minimum eight experiments are to be performed]
Note: Perform the practical using C language or any other professional software for group A and B

GROUP-A (Any Three)

1. Plotting of discrete time waveforms (a) Sin, (b) Unit Step, (c) Exponential.
2. Find Linear convolution
3. Plot frequency response of given system function (Magnitude and Phase)
4. Verification of Z-transform properties (any two)

GROUP-B (Any Four)

1. Find DFT and IDFT of sequence
2. Find Circular convolution Using DFT IDFT method and linear convolution using Circular convolution.

3 DIT- FFT or DIF-FFT algorithm

4. Design of IIR filter (Butterworth method).
5. Design of FIR filter (window (any one) method).

Group-C (Any one)
1. Study of DSP starter kit and generation of Sine wave.
2. Discrete implementation of FIR Filter using PIC18F/DSP kit.
3. Discrete implementation of IIR Filter using PIC18F/DSP kit.
4. Harmonic analysis of any non-sinusoidal signal using DSP.

Text Books:

[T1] Proakis J., Manolakis D., "Digital signal processing", 3rd Edition, Prentice Hall, ISBN 81- 203-0720-8
[T2] P. Ramesh Babu, "Digital Signal Processing", 4th Edition Scitech Publication
[T3] Dr.S. D. Apte,"Digital Signal Processing",2nd Edition Wiley India Pvt. Ltd ISBN: 978-81-265-2142-5
[T4] W.Rebizant, J.Szafran, A.Wiszniewski, "Digital Signal Processing in Power system Protection and Control", Springer 2011 ISBN 978-0-85729-801-0

Reference Books:

[R1] Mitra S., "Digital Signal Processing: A Computer Based Approach", Tata McGraw-Hill, 1998, ISBN 0-07-044705-5
[R2] A.V. Oppenheim, R. W. Schafer, J. R. Buck, "Discrete Time Signal Processing", 2nd Edition Prentice Hall, ISBN 978-81-317-0492-9
[R3] Steven W. Smith, "Digital Signal Processing: A Practical Guide for Engineers and Scientists",1st Edition Elsevier, **ISBN:** 9780750674447

Unit	Text Books	Reference Books
1	T1,T2	R1,R2,R3
2	T1,T2	R2,R3
3	T1,T2	R2,R3
4	T1,T2	R2,R3
5	T1,T2,T3	R1,R2,R3
6	T4	R3

Elective II : 403144 (A) : Restructuring and Deregulation

Teaching Scheme	Credits	Examination Scheme [100Marks]		
Theory : 03 Hr/Week	03	In Sem	:	30 Marks
		End Sem	:	70 Marks

Prerequisites: Knowledge in power system analysis and power system generation, transmission and distribution.

Course Objective: The course aims:-

- To educate students about the process and operation of restructuring of power system.
- To familiarize students about the various power system restructuring models.
- To elaborate students pricing of electricity.
- To explain fundamental concept of congestion, its management and transmission pricing.

Course Outcome: Upon successful completion of this course, the students will be able to: -

1. Enlist the functions of various key entities in India and explain the implications of various policies and acts on restructuring and deregulation.
2. Describe the regulatory process in India along with various methods of regulations.
3. List the components involved in tariff determination.
4. Explain different power sector restructuring models
5. Explain different types of electricity markets.
6. State different transmission pricing methods and discuss congestion management

Unit 01 : Power Sector Reforms in India (06 Hrs)

Need of Regulation. Institutional structure before reforms and after reforms. Roles of various key entities like Ministry of Power, CEA, Planning Commission, CERC and SERC in India. Electricity Act 2003 and 2010 and its implications for Restructuring and Deregulation. National Energy policy. Critical issues and challenges before the Indian power sector.

Unit 02 : Power Sector Regulation (06 Hrs)

Regulatory process in India, Principles of Tariff setting, Phases of Tariff determination, types and methods of Regulation, cost plus, performance-based regulation, price cap, revenue cap, rate of return regulation, benchmarking or yardstick regulation. Considerations of socio economic aspects in regulation.

Unit 03 : Power Sector Economics (06 Hrs)

Introduction to various concepts such as capital cost, debt and equity, depreciation, fixed and variable costs, working capital. Typical cost components of utilities such as return in equity, depreciation, interest and finance charges, O and M expenses etc. Key Indices for assessment of utility performances (Generation, transmission and distribution). Financial tools to compare investment options.

Unit 04 : Power Sector Restructuring Models and Introduction to energy Markets (06 Hrs)

Introduction, models based on energy trading or structural models – monopoly, single buyer, wholesale competition, retail competition. Models based on contractual arrangements – pool model, bilateral dispatch, pool and bilateral trades, multilateral trades. ISO models. Introduction to Energy Exchange, Day ahead market (DAM) and Term ahead market (TAM) procedure adopted in Energy exchanges and trading of Renewable Energy Credits and Carbon Credits.

Unit 05 : Electricity Markets (06 Hrs)

Rules that govern electricity markets, peculiarity of electricity as a commodity. Various electricity markets such as spot markets, forward contracts and forward markets, future contracts and future markets, day ahead market, reserve market, ancillary services market, market for differences, Options contracts. Market operation- settlement process, Market Clearing Price (MCP), Market efficiency, Market power.

Unit 06 : Transmission Pricing and Transmission Congestion issues (06 Hrs)

Cost components of transmission system, Cost allocation of Transmission system, Transmission pricing methods, physical transmission rights, Open Access, Role of Load Dispatch centers (SLDC, RLDC and NLDC). Congestion in power network, reasons for congestion, congestion management.

Text Books:

[T1] Know Your Power: A citizen Primer on the electricity Sector, Prayas Energy Group, Pune

[T2] Daniel S. Kirschen, Goran Strbac, “Power System Economics” John Wiely and Sons Publication Ltd. August 2006.

[T3] Mohammad Shahidehpour, Muwaffaq Alomoush, “Restructured Electrical Power Systems: Operation Trading and Volatility” CRC Press, 06-Jun-2001

Reference Books:

[R1] Steven Stoft, “Power System Economics: Designing Markets for Electricity”, John Wiley and Sons, 2002

[R2] Sally Hunt, “Making Competition Work in Electricity”, 2002, John Wiley Inc

[R3] Geoffrey Rothwell, Tomas Gomez, “Electricity Economics Regulation and Deregulation” A John Wiley and Sons Publication 2003

[R4] Mohammad Shahidehpour, Hatim Yamin, Zuyi Li, “Market operations in Electric Power System” A John Wiley and Sons Publication.

[R5] Deregulation in Power Industry – A course under continuing Education Program, Department of Electrical Engineering , IIT , Bombay

Websites:

1 http://www.cercind.gov.in/Function.html
2 www.cercind.gov.in/serc.html
3 http://www.power.gov.ng/index.php/about-us/our-functions
4 http://www.cea.nic.in/functions.html
5 http://planningcommission.nic.in/reports/genrep/arep9920/ar9920role.htm

Unit	Text Books	Reference Books
1	T1	Websites 1-5
2	T1	R3
3	T1	R1
4	T2	R5
5	T2	R5, R2, R4
6	T3	R1

Elective II : 403144 (B) : Electromagnetic Fields

Teaching Scheme	Credits	Examination Scheme [100 Marks]
Theory : 03 Hr/Week	03	In Sem : 30 Marks
		End Sem : 70 Marks

Prerequisite: Coordinate system, Vector algebra, Electric field intensity, Magnetic field intensity, Fundamental relations for electrostatic and magnetostatic fields

Course Objective: The course aims:-

- To impart knowledge on the basics of electric and magnetic fields and their applications for utilization in the development of the theory for power transmission lines and electrical machines.
- To describe how materials affect electric and magnetic fields
- To discuss the boundary conditions
- To analyze the relation between the fields under time varying situations
- To give insight to Maxwell's equations in different form and media

Course Outcome: Upon successful completion of this course, the students will be able to :-

1. Describe time varying Maxwell's equations and their applications in electromagnetic problems
2. Interpret electric and magnetic field with the help of associated laws
3. Solve simple electrostatic and magnetic boundary conditions
4. Determine the relationship between time varying electric and magnetic fields and electromotive force
5. Solve electromagnetic problems with the help of mathematical tools

Unit 01 : Introduction (06 Hrs)

Sources and effects of Electro-Magnetic Fields, Scalar and vector, Unit vector, Mathematical operations of Vector, Scalar and vector fields, Different Co-ordinate System, Operator Del, Physical interpretation of gradient, divergence and curl, Conversion between coordinate system, Expression for gradient, divergence and curl in three coordinate system.

Unit 02 : Basic Electrostatics (06 Hrs)

Coulomb's law, Electric field, Electric Field Intensity (EFI), EFI due to - point charge, line charge, surface charge and volume charge, Electric displacement, Electric flux density, Gauss's law (scalar and vector form), Applications of Gauss law, Electric field due to – point charge, infinite long straight conductor and infinite plane sheet of charge, Divergence theorem, Stoke's theorem.

Unit 03 : Applied Electrostatics (06 Hrs)

Electric Potential, Relationship between E and V, Equipotential surfaces, Electric dipole and flux lines, Electric field due to dipole, Energy density in electrostatic field, Energy stored in terms of D and E, Convection and Conduction currents, Current and current density, Continuity equation for current, Poisson's and Laplace's equations, Capacitor and its capacitance, Parallel plate capacitor, Capacitors with multiple dielectrics, Spherical capacitor, Coaxial capacitor.

Unit 04 : Magnetostatics and Applications (06 Hrs)

Magnetic flux density, Magnetic field intensity (MFI), Magnetic permeability, Biot-Savart's law, Applications of Biot-Savart's law, MFI due to - infinite long straight filament, finite length element, on the axis of circular loop, Ampere's Circuital law, Field due to – infinite line current, coaxial cable, uniform current sheet density, Magnetic flux density, Scalar magnetic potential, Vector magnetic potential, Poisson's Equations for Magnetostatic field, Derivations of Biot-Savart law and Ampere's law based on magnetic potential, Forces due to magnetic field, Magnetic dipole.

Unit 05 : Boundary Conditions and Analysis. (06 Hrs)

Conductors, Ohm's law employing mobility, Dielectrics, Polarization in Dielectrics, Dielectric constants and strength, Relaxation time, Boundary conditions : Dielectric-Dielectric boundary conditions, Conductor – Dielectric boundary conditions, Conductor – Free space boundary conditions, Boundary conditions for Magnetostatic fields

Unit 06 : Time Varying Fields and Maxwell's equations (06 Hrs)

Faraday's law, Transformer and motional EMFs – stationary loop in time varying B field, moving loop in static B field and moving loop in time varying field, Displacement current, Maxwell's equations in point form and integral form, Power and Poynting theorem, Time varying potentials, Time Harmonic Field, Maxwell's equations in point form and integral form for harmonic field, Concept of uniform plane wave.

Text Books:

[T1] W. H. Hayt and J. A. Buck, "Engineering Electromagnetics", Tata McGraw Hill

[T2] Mathew Sadiku, "Elements of Electromagnetics", Oxford University Press

Reference Books:

[R1] R. K. Shevgaonkar, "Electromagnetic Waves", Tata McGraw Hill

[R2] Liang Chi Shen, Jin Au Kong, Amalendu Patnaik, "Engineering Electromagnetics", CENGAGE Learning

[R3] K. B. Madhu Sahu, "Electromagnetic Fields", SciTech Publication

[R4] N. N. Rao, " Elements of Engineering Electromagnetics", Pearson Education

[R5] Edminister J. A., " Electromagnetics", Tata McGraw Hill

Unit	Text Books	Reference Books
1	T2	R2, R3, R4
2	T1, T2	R1,R2, R3
3	T1, T2	R2, R3, R4, R5
4	T1, T2	R2, R3
5	T2	R1, R4, R5
6	T1, T2	R2, R3, R4

Elective II : 403144 (C) : EHV AC Transmission

Teaching Scheme	**Credits**	**Examination Scheme [100Marks]**		
Theory : 03 Hr/Week	03	In Sem	:	30 Marks
		End Sem	:	70 Marks

Prerequisite : Fundamental course in Power System

The course aims:-

- To explain the need of EHV and UHV systems.
- To describe the impact of such voltage levels on the environment
- To identify problems encountered with EHV and UHV transmissions
- To describe methods of governance on the line conductor design, line height and phase etc.

Course Outcome: Upon successful completion of this course, the students will be able to :-

1. Highlight need for EHV ac transmission.
2. Calculate line and ground parameters.
3. Enlist problems encountered in EHV transmission.
4. Describe effect of electric and magnetic field on human being
5. Express issues related to UHV transmission discussed

Unit 01 : EHV ac transmission lines (06 Hrs)

Need for EHV transmission lines, Power handling capacity and line loss, Mechanical considerations in line performance, Vibrations.

Travelling wave equations, transmission reflection attenuation and distortion of travelling waves, transmission and reflection coefficients and examples.

Unit 02 : Calculation of line and ground parameters (06 Hrs)

Resistance of conductors, effect of temperature on overhead conductors, temperature rise of conductors and current carrying capacity, Properties of bundled conductors, Inductance of current carrying single conductor, Inductance of EHV line configurations, Line capacitance calculations

Unit 03 : Voltage gradient of conductors (06 Hrs)

Electrostatic Field of a point charge and its properties, Field of sphere gap, Field of line charges and their properties, charge potential relations for multi-conductor lines, Maximum charge condition on three phase line.

Surface voltage gradient on conductors-single conductor, two conductors and multi-conductor bundle, Maximum surface voltage gradient, Mangoldt formula, design of cylindrical cage for corona gradients

Unit 04 : Electrostatic and magnetic fields of EHV lines (06 Hrs)

Electric shock and threshold currents, Effects of high electrostatic fields on humans, animals and plants, Calculation of electrostatic field of single circuit of three phase line, Profile of electrostatic field of line at ground level.

Electrostatic induction on un-energized circuit of a double circuit line. Insulated ground wire and induced voltage in insulated ground wires.

Magnetic field calculation of horizontal configuration of single circuit of three phase lines, Effects of power frequency magnetic fields on human health.

Unit 05 : Corona and its effects (06 Hrs)

Corona formation, corona inception voltage, visual corona voltage, critical field for corona inception and for visual corona under standard operating condition and conditions other than standard operating conditions.

Power loss due to corona, corona loss formulae, corona current waveform, charge-voltage diagram and corona loss. Audible noise operation and characteristics limits for audible noise, AN measurement and meters, microphone, weighting networks.

Unit 06 : (06 Hrs)

A) **Design of EHV line**

Design of EHV lines based upon steady state limits and transient over voltages, design factors under state. Design examples: steady state limits. Line insulation design based on transient over voltages

B**) Extra high voltage cable transmission**

Classification of cables, Electrical characteristics of EHV Cables, Properties of cable insulation materials.

Text Books:

[T1] Rakosh das Begamudre "Extra high voltage transmission", New Age International publishers

Reference Books:

[R1] S. Rao , "EHV AC and DC Transmission" Khanna publication.

Unit	Text Books	Reference Books
1	T1	R1
2	T1	--
3	T1	--
4	T1	R1
5	T1	R1
6	T1	R1

Elective II : 403144 (D) : Electric and Hybrid Vehicles

Teaching Scheme	Credits	Examination Scheme [100 Marks]
Theory : 03 Hr/Week	03	In Sem : 30 Marks
		End Sem : 70 Marks

Prerequisite: Basic concept of Batteries, Electrical motors, Power electronic conversion

Course Objective: The course aims:-

- To make students aware the need and importance of Electric, Hybrid Electric Vehicles and Fuel cell vehicle.
- To differentiate and analyze the various energy storage devices and battery charging and management systems.
- To impart knowledge about architecture and performance of Electric and Hybrid Vehicles
- To classify the different drives and controls used in electric vehicles.

Course Outcome: Upon successful completion of this course, the students will be able to:-

1. Review history, Social and environmental importance of Hybrid and Electric vehicles.
2. Describe the performance and selection of energy storage systems and Analyze battery management system.
3. Distinguish between the performance and architecture of various drive trains.
4. Describe the different Instrumentation and Control used for electric vehicles.
5. Differentiate between Vehicle to Home, Vehicle to Vehicle and Vehicle to Grid energy systems concepts.

Unit 01 : Introduction (05 Hrs)

Conventional Vehicle: Basic of Vehicle performance, vehicle power source characterization, transmission characterization. Need and importance of transportation development.
History of Electric Vehicle, Hybrid Electric Vehicle and Fuel cell Vehicle. Social and environmental importance of Hybrid and Electric vehicles. Impact of modern drive-trains on energy supplies.

Unit 02 : Energy Storage Systems (07 Hrs)

Introduction to energy storage requirements in Hybrid and Electric vehicles, battery-based energy storage and its analysis, Fuel cell based energy storage and its analysis, Ultra capacitor based energy storage and its analysis, flywheel based energy storage and its analysis.
Hybridization of energy sources for Hybrid and Electric vehicle: - Hybridization of drive trains in HEVs, Hybridization of energy storage in EVs.
Selection of energy storage technology.

Unit 03 : Battery charging and Management systems (06 Hrs)

Introduction, charging algorithm, balancing method for battery pack charging.
Battery management system representation: - battery module, measurement unit block, battery equalization balancing unit, MCU estimation unit, display unit, fault warning block.
SoC and SoH, estimation of SoC, battery balancing, Thermal monitoring of Battery unit.

Unit 04 : Hybrid and Electric vehicles (05 Hrs)

Electric vehicles: - Components, configuration, performance, tractive efforts in normal driving, Advantages and challenges in EV design.
Hybrid Electric vehicles: - Concept and architecture of HEV drive train (Series, parallel and series-parallel).Energy consumption of EV and HEV

Unit 05 : Drives and control systems (07 Hrs)

Drives: - Application of BLDC drives and Switched reluctance motor drive for HEV and EV, performance characteristics of drives.

Instrumentation and control system related to Hybrid and Electric vehicles, speed control, acceleration characteristics, Electric steering, motion control, braking mechanism, Vehicle tracking through GPS, over speed indicating systems, Auto-parking systems

Unit 06 : Vehicle to Home, Vehicle to Vehicle and Vehicle to Grid energy systems (06 Hrs)

Vehicle to Home(V2H): PHEV control Strategies to V2H applications, V2H with demand response.

Vehicle to Vehicle(V2V): - Concept and structure of EV aggregator, control method for EV aggregator for dispatching a fleet of EV.

Vehicle to Grid(V2G): - planning of V2G infrastructure in the smart grid, ancillary services provided by V2G, cost emission optimization.

Text Books:

[T1] James Larminie and John Lowry, "Electrical Vehicle", John Wiley and Sons, 2012.

[T2] Ronald K. Jurgen, "Electric and Hybrid-Electric Vehicles", SAE InternationalPublisher.

[T3] K T Chau, "Energy Systems for Electric and Hybrid Vehicles", The institution of Engineering and Technology Publication

[T4] D.A.J Rand, R Woods, R M Dell, "Batteries for Electric Vehicles", Research studies press Ltd, New York, John Willey and Sons

[T5] Electric and Hybrid Vehicles-Design Fundamentals, CRC press

[T6] Mark Warner, The Electric Vehicle Conversion handbook –HP Books, 2011.

Reference Books:

[R1] Mehrdad Ehsani, Yimin Gao and Ali Emadi, "Modern Electrical Hybrid Electric and Fuel Cell Vehicles: Fundamental, Theory and design", CRC Press, 2009.

[R2] Junwei Lu, Jahangir Hossain,"Vehicle-to-Grid: Linking Electric Vehicles to the Smart Grid", IET Digital Library.

[R3] "Automobile Electrical and Electronic systems", Tom Denton, SAE International publications.

[R4] "Automotive handbook 5th edition", Robert Bosch, SAE international publication.

Unit	Text Books	Reference Books
1	T1,T2,T3, T4, T5	R1
2	T1,T2,T3, T4, T5	R1, R3
3	T2,T3,T4	R1
4	T1,T2,T5	R1
5	T1,T2,T5	R1
6	T3	R2

Elective II : 403144 (E) : Special Purpose Machines

Teaching Scheme	Credits	Examination Scheme [100 Marks]		
Theory : 03Hr/Week	03	In Sem	:	30 Marks
		End Sem	:	70 Marks

Prerequisite:

- Basic concepts of different electric motors
- Laws related to energy conversion in electrical machines
- Knowhow of D-Q axis theory related to electrical machines

Course Objective: The course aims:-

1. To explain operation and performance of synchronous reluctance motors.
2. To describe operation and performance of stepping motors.
3. To elaborate operation and performance of switched reluctance motors.
4. To familiarize with operation and performance of permanent magnet brushless D.C. motors.
5. To illustrate operation and performance of permanent magnet synchronous motors.

Course Outcome: Upon successful completion of this course, the students will be able to :-

1. Reproduce fundamentals of magnetic circuits
2. Reproduce principal of operation of PMSM, Stepper motor, SRM, Switch reluctance and linear motors.
3. Derive basic transformations used in machine modeling and control
4. Develop torque speed and performance characteristics of above motors
5. Enlist application of above motors
6. Demonstrate various control strategies.

Unit 01 : Generalised Machine Theory (06 Hrs)

Energy in singly excited magnetic field systems, determination of magnetic force and torque from energy. Determination of magnetic force and torque from co-energy, Forces and torques in systems with permanent magnets. MMF of distributed winding, Magnetic fields production of EMFs in rotating machines.

Unit 02 : Permanent Magnet Synchronous and brushless D.C. Motor Drives (06 Hrs)

Synchronous machines with PMs, machine configurations. Types of PM synchronous machines Sinusoidal and Trapezoidal. EMF and torque equations Torque speed characteristics Concept of electronic commutation, Comparative analysis of sinusoidal and trapezoidal motor operations. Applications

Unit 03 : Control of PMSM Machine (06 Hrs)

abc-αβ and αβ-dq transformations, significance in machine modelling, Mathematical Model of PMSM (Sinusoidal), Basics of Field Oriented Control (FOC), Control Strategies: constant torque angle, unity power factor.

Unit 04 : Reluctance Motor (06 Hrs)

Principle of operation and construction of Switch Reluctance motor, Selection of poles and pole arcs, Static and dynamics Torque production, Power flow, effects of saturation, Performance, Torque speed characteristics, Synchronous Reluctance, Constructional features; axial and radial air gap motors; operating principle; reluctance torque; phasor diagram; motor characteristics Introduction to control of Reluctance Drive. Applications.

Unit 05 : Stepper Motor **(06 Hrs)**

Construction and operation of stepper motor, hybrid, Variable Reluctance and Permanent magnet, characteristics of stepper motor; Static and dynamics characteristics, theory of torque production, figures of merit; Concepts of lead angles , micro stepping , Applications selection of motor.

Unit 06 : Linear Electrical Machines **(06 Hrs)**

Introduction to linear electric machines. Types of linear induction motors, Constructional details of linear induction motor, Operation of linear induction motor. Performance specifications and characteristics Applications.

Text Books:

[T1] K. Venkatratnam, ‘Special Electrical Machines’, University Press

[T2] A.E. Fitzgerald Charles Kingsley, Stephen Umans, ‘Electric Machinery’, Tata McGraw Hill Publication

[T3] T.J.E. Miller, ‘Brushless Permanent magnet and Reluctance Motor Drives’ Clarendon Press, Oxford 1989.

[T4] V. V. Athani, ‘Stepper Motors: Fundamentals, Applications and Design’, New age International, 1997

Reference Books:

[R1] R Krishnan, ‘Permanent Magnet Synchronous and Brushless D.C. Motor Drives’ CRC Press.

[R2] Ion Boldea, ‘Linear Electric Machines, Drives and maglevs’ CRC press

[R3] Ion Boldea S. Nasar, ‘Linear Electrical Actuators and Generators’, Cambridge University Press.

Unit	Text Books	Reference Books
1	T2	--
2	T1,T3	R1
3	T1	--
4	T1	--
5	T1,T4	--
6	--	R2, R3

403145: Control System II

Teaching Scheme		Credits	Examination Scheme [150 Marks]		
Theory	: 03 Hr/Week	03	In Sem	:	30 Marks
Practical	: 02 Hr/Week	01	End Sem	:	70 Marks
			Oral	:	25 Marks
			Term work	:	25 Marks

Prerequisite: Basic concepts of Control System, Transfer Function, Pole zero plot.

Course Objective: The course aims to:-

- Explain the basic digital control system and the concept of sampling and reconstruction.
- Elaborate the concept of state and to be able to represent a system in the state space format.
- Solve the state equation and familiarize with STM and its properties.
- Design a control system using state space techniques including state feedback control and full order observer.

Course Outcome: Upon successful completion of this course, the students will be able to :-

1. Recognize the importance of digital control system.
2. Derive pulse transfer function.
3. Analyze digital controllers.
4. Convert system in state space format.
5. Solve state equation.
6. Design observer for system.

Unit 01 : Digital Control System (06 Hrs)

Introduction, Configuration of the basic digital control system. Advantages and limitations of digital control; data conversion and quantization, Sampling and Reconstruction processes, Shannon's Sampling theorem, practical aspects of choice of sampling rate. Zero order hold (ZOH) and it's transfer function, Basic concepts and transfer function of first order hold.

Unit 02 : Z-transform and Pulse-transfer-function (06 Hrs)

Review of z-transform, Inverse z-transform, difference equations and solution using z transform method. Pulse transfer function and Z-transfer function, General procedure for obtaining Pulse-transfer-function, pulse transfer function of ZOH.

Unit 03 : Stability Analysis (06 Hrs)

Sampled data closed loop systems, characteristic equation, causality and physical realizability of discrete data system, realization of digital controller by digital programming, direct digital programming, cascade digital programming, parallel digital programming. Mapping between S-plane and Z-plane, stability analysis of closed loop system in z-plane using Jury's test, Bilinear Transformation.

Unit 04 : Introduction to state space analysis (06 Hrs)

Important definitions – state, state variable, state vector, state space, state equation, output equation. State space representation for electrical and mechanical system, n^{th} order differential equation and transfer function. Conversion of transfer function to state model and vice versa. State model of armature control DC motor

Unit 05 : Solution of state equations (06 Hrs)

Concept of diagonalization, eigen values, eigenvectors, diagonalization of system matrices with distinct and repeated eigen values, Vandermonde matrix.

Solution of homogeneous and non-homogeneous state equation in standard form, state transition matrix, its properties, Evaluation of STM using Laplace transform method and infinite series method Cayley Hamilton theorem.

Unit 06 : Design of Control System Using State Space Technique: (06 Hrs)

Concept of controllability and observability, controllability and observability Tests, condition for controllability and observability from the system matrices in Canonical form, Jordan canonical form, effect of pole zero cancellation on the controllability and observability of the system, duality property. Pole placement design by state variable feedback. Necessity of an observer, design of full order observer.

Guidelines for Instructor's Manual

Instructor's Manual should contain following related to every experiment –

- Theory related to the experiment.
- Connection diagram /circuit diagram.
- Basic MATLAB instructions for control system/ Simulink basics.
- Observation table/ Expected simulation results.
- Sample calculations for one/two reading.
- Result table.

Guidelines for Student's Lab Journal

The Student's Lab Journal should contain following related to every experiment –

- Theory related to the experiment.
- Circuit diagram/Simulink diagram/MATLAB program.
- Observation table/ simulation results.
- Sample calculations for one/two reading.
- Result table, Conclusion.
- Few short questions related to the experiment.

Guidelines for Laboratory Conduction

- Assessment must be based on understanding of theory, attentiveness during practical session.
- Assessment should be done how efficiently student is able to perform experiment/simulation and get the results.
- Understanding fundamentals and objective of experiment, timely submission of journal.

List of Experiments

Any 8 experiments out of the list given below:

1. Plotting of discrete time wave forms a) sin, b)Unit step c) Exponential
2. Effect of sampling and verification of sampling theorem
3. Software programming for determination of STM of Discrete Time system.
4. Design and analysis of digital position control system.
5. Software programming for determination of state space representation for given transfer function and vice versa.
6. Check for observability and controllability in MATLAB
7. Verify State Feedback control using pole placement.
8. Convert a continuous time system to digital control system and check response using software.
9. Design state observer and validate it by software.
10. Software programming for determination of STM.

Text Books:

[T1] K. Ogata, "Discrete Time Control System", 2nd Edition, PHI Learning Pvt. Ltd. 2009
[T2] Benjamin C. Kuo "Digital Control System", Prentice Hall of India Pvt. Ltd.
[T3] J. Nagrath, M. Gopal "Control System Engineering", 5^{th} Edition. New Age International Publishers
[T4] R.Anandanatarajan and P.Ramesh Babu "Control System Engineering",4^{th} Edition, SCITECH Publications, India Pvt. Ltd.

Reference Books:

[R1] K. Ogata, "Modern Control Engineering", Prentice Hall of India Pvt. Ltd.
[R2] M. Gopal, "Digital Control and State Variable Methods", Tata McGraw-Hill.
[R3] M. N. Bandyopadhyay, "Control Engineering – Theory and Practice", Prentice Hall of India Ltd. Delhi.

Unit	Text Books	Reference Books
1	T1,T2	R1,R2
2	T1,T2	R2,R3
3	T1,T2	R2
4	T3, T4	R1, R3
5	T3, T4	R1, R3
6	T3, T4	R1, R3

403146 : Project I

Teaching Scheme	Credits	Examination Scheme [50 Marks]
Tutorial : 02 Hr/Week	02	Oral : 50 Marks

The student shall take up a project in the field closely related to Electrical Engineering. Preferably, group of 3/4 students should be formed for project work.

The project work should be based on the knowledge acquired by the student during the graduation and preferably it should meet and contribute towards the needs of the society. The project aims to provide an opportunity of designing and building complete system or subsystems based on area where the student likes to acquire specialized skills.

Project work in this semester is an integral part of the complete project. In this, the student shall complete the partial work of the project which will consists of problem statement, literature review, project overview and scheme of implementation. As a part of the progress report of project work, the candidate shall deliver a presentation on the advancement in Technology pertaining to the selected project topic.

Guidelines for VIIth Semester for Project work:

1. To identify the problems in industry and society.
2. Perform Literature survey on the specific chosen topic through research papers, Journals, books etc. and market survey if required.
3. To narrow down the area taking into consideration his/her strength and interest. The nature of project can be analytical, simulation, experimentation, design and validation.
4. Define problem, objectives, scope and its outcomes.
5. Design scheme of implementation of project.
6. Data collection, simulation, design, hardware if any, needs to be completed.
7. Presentation based on partially completed work.
8. Submission of report based on the work carried out.
9. Student should maintain Project Work Book.

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Audit Course V (A) : 403152: Hydro Energy Systems

Teaching Scheme
Theory : 02 Hr/Week
Field visit : 1 Day

Examination Schemes: Audit (P/F)
Written / MCQ / Term paper

Course Objectives:

- To elaborate various hydro electric generators
- To be familiar with basic operation and various elements of hydro electric systems

Course Outcomes:

On completion of the course, students will be able to:-

- Explain and differentiate various types of hydro electric generators; pico, micro and small hydro

Description:
The following topics may be broadly covered in the classroom. The course will introduce the basics of: hydro energy, availability, introduction to hydraulic machines, turbines, basics of design of hydro electric generators, pico, micro and small hydro, grid interaction, advantages and limitations of the technology, environmental impact, and introduction to manufacturing of the systems, characterization, quality assurance, standards, certification and economics. The site visit will be organized to understand the basic operation and system elements.

Details:

- Energy in water
- Basic hydro energy conversion
- Types of turbines and their applications
- Decentralized hydroelectric plants
- Pico, Micro, small and large hydroelectric power plants
- Energy conversion calculations
- Hydro turbine basics and design
- Generator designs for hydro power
- Controllers for hydroelectric power
- Site requirements for hydro power
- Grid integration of micro-hydro
- Operation and maintenance of hydro power plants
- Financial modeling of hydro power
- Software tools for simulation, validation and economics of hydro power
- Environmental impact of various capacity hydroelectric plants
- Manufacturing and assembly
- Quality assurance and standards
- Standards and certification for hydroelectric power plants

Field Trip:

- Visit to Pico, Micro or Small hydroelectric plant

Audit Course V (B) : 403152
Foreign language- German

Teaching Scheme
Theory : 02 Hr/Week

Examination Schemes: Audit (P/F)
Written / MCQ / Term paper

Course Objectives:

- To meet the needs of ever growing industry with respect to language support
- To get introduced to German society and culture through language

Course Outcomes:

On completion of the course, students will be able to:-

- Comprehend everyday expressions and very simple sentences
- Read, write, listen and grasp German Language
- Develop interest to pursue professional German language

Description:

On a professional level, speaking and understanding another language opens many career opportunities. Knowing more than one language enhances employment opportunities in business, teaching, technology, communications, social service, etc.

In an increasingly globalized world, knowledge of German gives students access to the language, culture, and marketplace of few leading nations.

Speaking German gives significant advantages in the world of business since many companies nowadays would choose a competent German speaker over an equally qualified candidate for a job. A proficiency in German prepares you to function productively on behalf of a multinational employer who wants to capitalize on business.

Course Contents:

- Introduction to alphabets, numbers, months, days of the week and time of the day
- Pronouns, Modal and normal verbs, W/V questions
- Bestimmt, Unbestimmt Artikel, Akkusative and Akkusative prepositions
- Hobbies and Freizeit activities, Perfekt tense, basic adjectives and conjunctions.

References:

- Netzwerk Deutsch als Fremdsprache A1, Langenscheidt, First Indian Edition 2015
- www.dw.de

403147: Switchgear and Protection

Teaching Scheme		Credits	Examination Scheme [175Marks]	
Theory	: 3 Hrs./Week	03	In Sem	: 30 Marks
Practical	: 2 Hrs./Week	01	End Sem	: 70 Marks
			Oral	: 25 Marks
			Term work	: 50 Marks

Prerequisite:
- Different type of faults in power system
- Various switchgears and their use in substation
- Principle and working of rotating machines and transformer with vector groups

Course Objective: The course aims to:-
1. Acquaint about construction and working principle of different types of HVCBs
2. Elaborate the Need of protective Relaying and operating principles of different types of relays.
3. Explain different type of faults in transformer, alternator and 3 phase Induction motor and various protective schemes related to them.
4. Impart knowledge about transmission line protection schemes and characteristics of different types of distance relays

Course Outcome: Upon successful completion of this course, the students will be able to :-
1. Describe arc interruption methods in circuit breaker.
2. Derive expression for restriking voltage and RRRV in circuit breaker
3. Explain construction and working of different high voltage circuit breakers such as ABCB, SF_6 CB, and VCB.
4. Classify and Describe different type of relays such as over current relay, Reverse power relay, directional over current relay, Differential relay, Distance relay, Static relay and numerical relay
5. Describe various protection schemes used for transformer, alternator and busbar
6. Describe transmission line protection schemes.

Unit 01 : Fundamentals of protective relaying (08 Hrs)

Need for protective system, nature and causes of fault, types of faults, effects of faults, evolution of protective relaying, classification of relays, zones of protection, primary and backup protection, essential qualities of protective relaying. Trip circuit of circuit breaker, zone of protection. Various basic operating principles of protection- over current, (current graded and time graded), directional over current, differential, distance, induction type relay, torque equation in induction type relay, current and time setting in induction relay, Numericals on TSM , PSM and operating time of relay

Unit 02 : Fundamentals of arc interruption (06 Hrs)

Ionization of gases, deionization, Electric arc formation , Current interruption in AC circuit breaker, high and low resistance principles, arc interruption theories, arc voltage, recovery voltage, derivation and definition of restriking voltage and RRRV, current chopping, interruption of capacitive current, resistance switching, Numerical on RRRV, current chopping and resistance switching.

Unit 03 : Circuit Breaker (05 Hrs)

Different ratings of circuit breaker (like rated voltage, rated current, rated frequency, rated breaking capacity – symmetrical and unsymmetrical breaking, making capacity, rated interrupting duties, rated operating sequence, short time rating). Classification of high voltage circuit breaker. Working and constructional features of ACB, SF_6 VCB- advantages, disadvantages and applications. Auto reclosing.

Unit 04 : (05 Hrs)

A) Static and Digital Relaying

Overview of Static relay, block diagram, operating principal, merits and demerits of static relay. Numerical Relays :-Introduction and block diagram of numerical relay, Sampling theorem, Anti –Aliasing Filter, Block diagram of PMU

B) 3 Phase Induction Motor Protection

Abnormal conditions and causes of failures in 3 phase Induction motor, single phasing protection, Overload protection, Short circuit protection.

Unit 05 : (06 Hrs)

A) Transformer Protection

Types of faults in transformer, Percentage differential protection in transformers, Restricted E/F protection, incipient faults, Buchholz relay, protection against over fluxing, protection against inrush current,

B) Alternator Protection

Various faults in Alternator, abnormal operating conditions- stator faults, longitudinal percentage differential scheme and transverse percentage differential scheme. Rotor faults- abnormal operating conditions, inter turn fault, unbalance loading, over speeding, loss of excitation, protection against loss of excitation using offset Mho relay, loss of prime mover.

Unit 06 : Transmission line protection (06 Hrs)

Over current protection for feeder using directional and non directional over current relays, Introduction to distance protection, impedance relay, reactance relay, mho relay and Quadrilateral Relays, Introduction to PLCC, block diagram, advantages, disadvantages, three stepped distance protection, Effect of arc resistance, and power swing on performance of distance relay. Realization of distance relays(impedance, reactance, and mho relay) using numerical relaying algorithm(flowchart, block diagram), Introduction to Wide Area Measurement (WAM) system.

Guidelines for Instructor's Manual

Prepare 3/4 sets of standard experiments. It must contain title of the experiment, Aim, Apparatus

- **Theory:** Brief theory explaining the experiment
- **Circuit / connection diagram** or construction diagram must be drawn either manually using geometrical instruments or using software on A-4 size quality graph paper / plain white paper.
- **Procedure:** Write down step by step procedure to perform the experiment.
- **Specifications of Switchgear:**
- **Observation table:**
- **Graph:**
- **Detailed constructional diagram with nomenclature:**
- **Conclusion:**

Guidelines for Student's Lab Journal

- Students should write the journal in his own hand writing using A4 size both side ruled paper.
- Circuit / Connection diagram or construction diagram must be drawn either manually or using software. [Do not use Photo copy of standard journal] on A4 size blank/graph paper.
- Hand writing must be neat and clean.
- Journal must contain certificate indicating name of the institute, student, department, subject, class/ year, number of experiments completed, signature of staff, Head of the department and the Principal.
- Index must contain sr. number, title of the experiment, page number, and the signature of staff along with date.
- (Use black or blue ink pen for writing.)

Guidelines for Laboratory conduction

- Check whether the MCB / main switch is off.
- Make connections as per circuit diagram. Do not keep loose connection. Get it checked from teacher / Lab Assistant.
- Perform the experiment only in presence of teacher or Lab Assistant.
- After completion of experiment, switch off the MCB / main switch.
- Write the experiment in the journal and get it checked within a week

List of Experiments :

A) Compulsory Experiments

1. Study of switchgear testing kit.
2. Study of bus-bar protection schemes.

B) Minimum 6 Experiments to be performed from the following list:

1. Study of Fuse, MCB and MCCB
2. Testing of MCB and MCCB.
3. Study and testing of contactors.
4. Study and testing of ACB.
5. Study and testing of thermal overload relay for Induction Motor protection.
6. Study and plot Characteristics of IDMT type Induction over current relay
7. Study and plot Characteristics of digital over current relay
8. Percentage differential protection of transformer.
9. Protection of alternator.
10. Protection of Transmission line using Impedance relay
11. Study of various LT switchgears like RCCB, timers.

Industrial Visit:

A compulsory industrial visit to switchgear training centre /or switchgear/relay manufacturing unit/ or 220 kV substation visit and report to be submitted as a part of term-work.

Assignments:

Minimum 3 assignments (at least 4 to 6 questions in each) to be submitted as a part of term-work.

Text Books:

[T1] S. Rao, “Switchgear Protection and Power Systems”, Khanna Publications

[T2] Y. G. Paithankar, S. R. Bhide, “Fundamentals of Power System Protection”, Prentice Hall of India

[T3] Bhavesh Bhalja,R.P. Maheshwari, N.G. Chothani,” Protection and Switchgear”, Oxford University Press, 2011 Edition.

[T4] J.B.Gupta “ Switchgear and Protection”, S.K. Kataria and Sons.

Reference Books:

[R1] Badri Ram, D. N. Vishwakarma, “Power System Protection and Switchgear”, Tata McGraw Hill Publishing Co. Ltd.

[R2] J Lewis Blackburn , “Protective Relaying- Principles and Applications”, Dekker Publications.

[R3] Prof. Dr S.A. Soman, IIT Mumbai, A Web course on “Digital Protection of power System” **http://www.cdeep.iitb.ac.in/nptel/Electrical%20Engineering/Power%20System%20Protection/Course_home_L27.html**

[R4] A.G. Phadke, J.S. Thorp ,Computer relaying for Power System , Research Studies Press LTD, England.(John Willy and Sons Inc New York)

[R5] Mason C.R., “Art and Science of Protective Relaying”, Wiley Eastern Limited.

[R6] Arun Ingole, “Switchgear and Protection”, Pearson.

Unit	Text Books	Reference Books
1	T1,T2,T4	R1, R2, R6
2	T1,T3,T4	R1, R6
3	T1,T4	R1
4	T2,T3,T4	R3, R4, R6
5	T1	R5
6	T1,T4	R2, R5

403148: Power Electronic Controlled Drives

Teaching Scheme	Credits	Examination Scheme [175 Marks]
Theory : 4 Hrs./Week	04	In Sem : 30 Marks
Practical : 2 Hrs./Week	01	End Sem : 70 Marks
		PR : 50 Marks
		Term work : 25 Marks

Prerequisite:
1. Construction, working and characteristic of different electrical motors and soft starting methods.
2. Power Electronic Applications such as converter, inverter, chopper etc.
3. Basic concept of control system

Course Objective: The course aims to
- To understand motor load dynamics.
- To analyze the operation of the converter fed and chopper fed dc drives.
- To elaborate braking methods of D.C. and Induction motor drive.
- To explain vector control of induction motor.
- To differentiate synchronous and BLDC motor drive.
- To identify classes and duty of motor.
- To describe the modes of operation of drive in various applications.

Course Outcome: Upon successful completion of this course, the students will be able to

1. Explain motor load dynamics and multi quadrant operation of drives
2. Analyze operation of converter fed and chopper fed DC drives.
3. Describe braking methods of D.C. and induction motor drive.
4. Explain vector control for induction motor drives
5. Describe synchronous motor drive.
6. Identify classes and duty cycles of motor and applications of drives in industries.

Unit 01 : Electrical Drives (08 Hrs)

A. Definition, Advantages of electrical drives, Components of Electric drive system, Types of Electrical Drives (DC and AC).

B. Motor-Load Dynamics, Speed Torque conventions and multi quadrant operation, Equivalent values of drive parameters. Load Torque Components, Nature and classification of Load. Constant Power operation of a Drive. Steady state stability, Numerical based on motor load dynamics.

Unit 02 : DC Motor Drives (08 Hrs)

A. Braking methods: Rheostatic, Plugging, and Regenerative. Closed loop control of drives: current limit control, torque control and speed control.

B. Single phase and three phase fully controlled converter drives and performance of converter fed separately excited DC Motor for speed control operations.

Chopper controlled drives for separately excited and series DC Motor operations.

Numerical based on above. Closed loop speed control of DC motor below and above base speed.

Unit 03 : Induction motor Drives I (08 Hrs)

Braking methods: DC Dynamic Braking, AC Rheostatic braking, Plugging, Regenerative Braking, V/f control and comparison with stator voltage control, voltage source inverter (VSI) control, Steady State Analysis. Current source inverter (CSI) control-open and closed loop, Regenerative braking and multiquadrant operation of Induction motor drives, relative merits and demerits of VSI and CSI for induction motor drives, Numerical on VSI and CSI fed I.M. drives

Unit 04 : Induction Motor Drives II (08 Hrs)

A. Principle of vector control, Block diagram of Vector control of induction motor. Servo mechanism in drives and block diagram for position control (Descriptive treatment only).
B. Thermal model of motor for heating and cooling, classes of motor duty, types of enclosures for motor.

Unit 05 : Synchronous motor Drives (08 Hrs)

Types of motor, cylindrical rotor wound field motor, equivalent circuit, speed torque characteristics and effect of power factor, salient pole wound field motor, phasor diagram, simple numerical based on above, closed loop speed control of self controlled synchronous motor drives fed from VSI and CSI.
BLDC drives, block diagram and speed torque characteristics.

Unit 06 : Industrial application (08 Hrs)

A. Specific requirement and choice of drives for following applications.
1. Machine tools
2. Textile mills
3. Steel rolling mills
3. Sugar mills
4. Traction drives
5. Crane and hoist drives
6. Solar and battery powered drives

Guidelines for Instructor's Manual

- Title and circuit diagram of power electronic controlled drives/ electrical machine circuit.
- Working operation and output characteristics / output waveforms of power electronic switching device /converter circuit used to control the electric motor.
- Procedure to carry out the experiment

Guidelines for Student's Lab Journal

- Title, aim, circuit diagram, procedure and theory of power electronic switching device or converter circuit and expected machine performance with speed torque characteristics.
- Equipments along with the specifications needed to carry out the experiment.
- Circuit diagram, observation table, calculations must be written on left side of the journal and aim, theory related to experiment and procedure must be written on right side.
- Analyse and interpret the experimental results and write the conclusions appropriately.

Guidelines for Laboratory conduction

- Each group in the lab should have not more than three students.
- All the students in the group must do the connections and perform the practical under the guidance of the staff member.
- Staff member has to check the result of all the groups.

List of Experiments: Minimum eight experiments are to be performed out of the list mentioned as below:

GROUP A: Any FIVE Experiment (Hardware)

1. Study of Electrical braking of D.C. Shunt motor (Rheostatic, Plugging).
2. Study speed control characteristics of single phase fully converter fed separately excited D.C. motor
3. Study speed control characteristics of 3-ph fully converter fed separately excited D.C. motor
4. Study of Chopper fed D.C. series/separately motor speed control characteristics.
5. Study of electrical braking of 3 phases Induction Motor (DC Dynamic Braking, Plugging).
6. Study of VSI fed 3 phase Induction motor (using V/f control PWM inverter) speed control characteristics.
7. Study of Solid state stator voltage control of 3 phase Induction motor (Using AC voltage Regulator).
8. Study of constant torque and constant power characteristic of induction motor.

GROUP B: Any THREE Experiment (Software)

1. Simulation of starting characteristics of D.C. motor.
2. Simulation of starting characteristics of 3 phase Induction motor.
3. Study of Closed loop speed control of separately excited D.C. motor/ Induction Motor.
4. Simulation of an electric drive system for steady state and transient analysis.
5. Simulation of closed loop control of synchronous motor
6. Simulation of chopper controlled DC series motor.

Industrial Visit:

Minimum one industrial visit must be organized for drives application in industry such as railways, sugar mill, machine shop, textile mill, paper mill etc.

Text Books:

[T1] G. K. Dubey, "Fundamentals of Electric Drives", 2nd Edition, Narosa Publishing House

[T2] N. K. De, P. K. Sen, "Electric Drives", Prentice Hall of India Eastern Economy Edition

[T3] S. K. Pillai, "Analysis of Thyristor Power Conditioned Motors", University Press

[T4] R. Krishnan, "Electric Motor Drives – Modeling Analysis and Control", PHI India

[T5] G.K. Dubey, "Power Semiconductor controlled drives", PHI publication

Reference Books:

[R1] B. K. Bose, "Modern Power Electronics and AC Drives", Pearson Education

[R2] Malcolm Barnes, "Practical Variable Speed Drives and Power Electronics", Elsevier Newnes Publications

[R3] V. Subrahmanyam, "Electric Drives: Concepts and Application", Tata Mc-Graw Hill (An imprint of Elsevier)

[R4] M.D. Singh and Khanchandani "Power Electronics", Tata Mc-Graw Hill

[R5] Austin Huges, "Electrical motor and drives: Fundamental, types and applications", Heinemann Newnes, London

[R6] Tyagi MATLAB for engineers oxford (Indian Edition)

Unit	Text Books	Reference Books
1	T1	R3
2	T1,T5	R2,R4
3	T1,T4	R1,R5
4	T1,T2,T5	R1,R2
5	T1,T3,T5	R1,R6
6	T1,T2	R3,R5

Elective –III : 403149 (A): High Voltage Engineering

Teaching Scheme	Credits	Examination Scheme [150 Marks]
Theory : 03 Hrs./Week	03	In Sem : 30 Marks
Practical : 02 Hrs./Week	01	End Sem : 70 Marks
		Oral : 25 Marks
		Term work : 25 Marks

Prerequisite: Atomic and molecular structure of gaseous and solid materials, basic properties of conductors and insulators, knowledge of material science.

Course Objective: The course aims to:-

- To enable students to know and compare the various processes of breakdown in solid, liquid and gaseous dielectric materials
- To enable students understand and apply various methods of generation and measurement of DC, AC, impulse voltage and current.
- To enable students to know the charge formation and separation phenomenon in clouds, causes of overvoltage and lightening phenomenon
- To develop ability among learners to execute testing on various high voltage equipments as per standards
- To introduce students to the design, layout, safety precautions, earthing, and shielding of HV laboratory.

Course Outcome: Upon successful completion of this course, the students will be able to

1. Identify, describe and analyze the breakdown theories of solid, liquid and gaseous materials
2. Describe as well as use different methods of generation of high AC, DC, impulse voltage and current.
3. Demonstrate and use different methods of measurement of high AC, DC, impulse voltage and current.
4. Identify the occurrence of overvoltage and to provide remedial solutions
5. Demonstrate an ability to carry out different tests on high voltage equipment and devices as well as ability to design the high voltage laboratory with all safety measures

Unit 01 : Breakdown in Gases (06 Hrs)

Ionization process in gas, Townsend's Theory, current growth equation in presence of primary and secondary ionization processes, Townsend's breakdown criterion, primary and secondary ionization coefficients, limitations of Townsend's theory, Streamer mechanism of breakdown, Paschen's Law and its limitations, Corona discharges for point plane electrode combination with positive and negative pulse application, time lag and factors on which time lag depends. (Numerical on Townsend's theory and Paschen's law).

Unit 02 : **(06 Hrs)**

1. **Breakdown in Liquid Dielectrics:** Pure and commercial liquids, Different breakdown theories: Breakdown in Pure liquid and breakdown in commercial liquids: Suspended Particle theory, Cavitations and bubble theory, Thermal mechanism of breakdown and Stressed Oil volume theory

2. Breakdown in Solid Dielectrics: Intrinsic breakdown: electronic breakdown, avalanche or streamer breakdown, electro-mechanical breakdown, thermal breakdown, treeing and tracking phenomenon, Chemical and electrochemical breakdown, Partial discharge(Internal discharge),Composite dielectric material, Properties of composite dielectrics, breakdown in composite dielectrics. (Numerical on theories of liquid and solid dielectric materials)

Unit 03 : Generation of High Voltages and Current **(06 Hrs)**

a)Generation of high ac voltages-Cascading of transformers, series and parallel resonance system, Tesla coil

b)Generation of impulse voltages and current-Impulse voltage definition, wave front and wave tail time, Multistage impulse generator, Modified Marx circuit, Tripping and control of impulse generators, Generation of high impulse current

Unit 04 : Measurement of High Voltage and HighCurrents: **(06 Hrs)**

Sphere gap voltmeter, electrostatic volt meter, generating voltmeter, peak reading voltmeter, resistive, capacitive and mixed potential divider , capacitance voltage transformer, cathode ray oscilloscope for impulse voltage and current measurement, measurement of dielectric constant and loss factor, partial discharge measurements. Measurement of high power frequency a.c. using current transformer with electro-optical signal converter, Radio interference measurements.

Unit 05 : Lightning and Switching Over Voltages **(06 Hrs)**

Causes of over voltages, lightning phenomenon, Different types of lightening strokes and mechanisms of lightening strokes, Charge separation theories, Wilson theory, Simpson theory, Reynolds and Mason theory, Over voltage due to switching surges and methods to minimize switching surges. Statistical approach of insulation coordination

Unit 06 : High Voltage Testing of Electrical Apparatus and H V Laboratories: **(06 Hrs)**

a)Testing of insulators and bushings, Power capacitors and cables testing, testing of surge arresters.

b) Design, planning and layout of High Voltage laboratory:-Classification and layouts, earthing and shielding of H.V. laboratories.

Guidelines for Instructor's Manual

The Instructor's Manual should contain following related to every experiment

- Brief theory related to the experiment.
- Circuit diagram and apparatus with their detail specification as per IS code.
- Students should be encouraged to visit industries/HV laboratories/HV installations.
- Students should be encouraged to use virtual labs.
- Few short questions related to each practical.

Assignments based on use of IS and IEC

Guidelines for Student's Lab Journal

The Students lab journal should contain:

- Brief theory related to the experiment.
- Circuit diagram and apparatus with their detail specification as per IS code.
- Observations, result tables and proper inferences/ conclusion from each experiment conducted.
- Reports on visit to industries/HV laboratories/HV installations.
- Simulations and print outs of use of virtual labs.
- Few short questions and answers related to each practical.
- Assignments based on use of IS and IEC.

Guidelines for Laboratory conduction

- There should be continuous assessment for the TW.
- Assessment must be based on understanding of theory, attentiveness during practical.
- Session, how efficiently the student is able to do connections and get the results.
- Timely submission of journal.

List of Experiments

1. To find the constants of breakdown equation of transformer oil.(Analytical and graphical method)
2. Measurement of unknown high a.c. voltage using sphere gap
3. To obtain breakdown strength of composite insulation system, and observe the effect of parameter like no. of layers, thickness of layer, effect of interfacing.
4. To find out the breakdown of air in uniform and non uniform field and compare it.
5. To study surface flashover on corrugated porcelain/polymeric insulation system.
6. To understand basic principle of corona and obtain audible and visible corona inception and extinction voltage under non uniform field.
7. To perform experiment on horn gap arrestor and understand arc quenching phenomenon.
8. To observe development of tracks and trees on polymeric insulation system.
9. Parametric analysis of Impulse current generator using virtual Laboratory.
10. To perform experiment on rod gap arrestor.
11. To Study effect of barrier on breakdown voltage of air/ transformer oil.
12. Simulation of lightening and switching impulse voltage generator using any simulation software.
13. To perform various HV insulation tests on cables as per IS.
14. Study of layout /earthing/safety of HV installation /lab in any industry by visit /virtual lab
15. Study of any IS for any power apparatus (Power Transformer/Induction Motor/ Alternator etc)

Industrial Visit: Industrial visit to high voltage equipment manufacturing industry/EHV substation/High Voltage Testing Unit.

Text Books:

[T1] M. S. Naidu, V. Kamaraju, "High Voltage Engineering", Tata McGraw Hill Publication Co. Ltd. New Delhi

[T2] C. L. Wadhwa, "High Voltage Engineering", New Age International Publishers Ltd.

Reference Books:
[R1] E. Kuffel, W. S. Zaengl, J. Kuffel, “High Voltage Engineering Fundamentals”, Newnes Publication
[R2] Prof. D. V. Razevig Translated from Russian by Dr. M. P. Chourasia, “High Voltage Engineering”, Khanna Publishers, New Delhi
[R3] Ravindra Arora, Wolf Gang Mosch, “High Voltage Insulation Engineering”, New Age International
[R4] High Voltage Engineering Theory and Practice by M. Khalifa Marcel Dekker Inc. New York and Basel.
[R5] Subir Ray, “An Introduction to High voltage Engineering” PHI Pvt. Ltd. New Delhi
[R6] NPTEL lectures
[R7] IS 731-1971:Porcelain insulator for overhead power lines with nominal voltage > 1000 Volt
[R8] Bushings :IS2099-1986,specification for bushings for A.C. Voltages > 1000 Volts
[R9] Pollution test :IEC 60507-1991 on external and internal insulator
[R10] High voltage test techniques, general definitions and test requirements: IS 2071(part 1) 1993,IEC Pub 60-1(1989)

Unit	**Text Books**	**Reference Books**
1	T1,T2	R1,R2,R3,R6
2	T1,T2	R1,R2,R3,R5,R6
3	T1,T2	R1,R2,R3,R5,R6
4	T1,T2	R1,R2,R3,R4,R5,R6
5	T1,T2	R1,R2,R3,R4,R5,R6
6	T1,T2	R1,R2,R3,R7,R8,R9, R10

Elective –III : 403149 (B): HVDC and FACTS

Teaching Scheme	Credits	Examination Scheme [150 Marks]
Theory : 03Hrs./Week	03	In Sem : 30 Marks
Practical : 02Hrs./Week	01	End Sem : 70 Marks
		Oral : 25Marks
		Term work: : 25 Marks

Prerequisite:
1. Fundamental knowledge of Power Electronics and power controllers
2. Fundamentals of Power system Operation of three phase converters
3. Inverter topologies
3. Operation of VSI

Course Objective: The course aims to:-
- To provide students knowledge about modern trends in Power Transmission Technology
- To make students describe applications of power electronics in the control of power transmission.
- To educate students for utilization of software such as PSCAD, MATLAB for power transmission and control.

Course Outcome: Upon successful completion of this course, the students will be able to :-
1. Compare HVDC and EHV AC systems for various aspects
2. Reproduce the layout of HVDC system with various components including protective devices
3. Differentiate VSC HVDC and conventional HVDC system
4. Differentiate various types of Power Electronic Controllers
5. Analyze modeling of FACTs Controllers
6. Simulate various controllers and HVDC systems using softwares

Unit 01 : (06 Hrs)
EHVAC versus HVDC transmission, power flow through HVDC link, Graetz circuit, equation for HVDC power flow bridge connection, control of DC voltage and power flow, effects of angle of delay and angle of advance commutation, CIA, CC and CEA control.

Unit 02 : (06 Hrs)
Twelve pulse converter operation, Harmonics in HVDC systems. HVDC system layout and placement of components, HVDC protection, grounding, multi terminal HVDC systems, configurations and types.

Unit 03 : VSC HVDC Technology (06 Hrs)
Introduction to VSC transmission, power transfer characteristics, structure of VSC link, VSC DC system control, HVDC light technology. HVDC plus, introduction, construction, operation and applications to renewable energy sources

Unit 04 : Power Electronic Controllers (06 Hrs)
Basics, Challenges and needs, Review of rectifiers and inverters, back to back converter, dc link converter, static Power converter structures, AC controller based structures, DC link converter topologies, converter output and harmonic control, power converter control.

Unit 05 : Shunt and Series Compensation (06 Hrs)

Operation and control of SVC, STATCOM configuration and control, characteristics and applications of SVC and STATCOM, TCSC layout and modes of operation, layout, operation and characteristics of Static Synchronous Series Compensator (SSSC).

Unit 06 : Unified Power Flow Controller (06 Hrs)

UPFC configuration, steady state operation, control and characteristics, operational constraints of UPFC, Power flow studies in UPFC embedded systems.

Guidelines for Instructor's Manual

- Title and circuit diagram of experiment (block diagram) /power network.
- Working operation and output characteristics / output waveforms of power electronic Controllers/FACTS devices /converter circuit used to control.
- Procedure to carry out the experiment
- For simulation experiments print out of model and simulation results

Guidelines for Student's Lab Journal

- Title, aim, circuit diagram, procedure and theory of power electronic switching device or converter circuit and expected machine performance with speed torque characteristics.
- Equipment along with the specifications needed to carry out the experiment.
- Circuit diagram, observation table, calculations if any.
- Analyse and interpret the experimental results and write the conclusions appropriately.

Guidelines for Laboratory conduction

- Minimum eight experiments are to be performed out of the list mentioned as below:
- Out of which at least two experiments shall be conducted on hardware setups.
- For simulation experiment ready models/demo models can be used. However study should simulate models for different conditions and attached prints of simulation models and test results.
- Term work should be assessed continuously.
- Term work marks are based on quality of work, initiative, timely submission

List of Experiments

Minimum eight experiments are to be performed out of the list mentioned as below:

A) Hardware experiments

1. Study effects of angle of delay and angle of advance commutation, CIA, CC and CEA control on single bridge converter
2. Study of Single Phase Thyristor Control Reactor(A) Study of Voltage and Current Waveforms with different delay angles (B) harmonic analysis (C) Basic control law (D) V-I characteristics
3. Single Phase TCR with fixed capacitor and filter.
4. Complete characteristics of a three phase voltage source converter, constant alpha and extinction angle control.

B) Simulation Experiments

1. Study and simulation of Three phase TCR with and without shunt capacitor
2. Study and simulation of resonance in electrical Power systems
3. Application study of SVC in Power System.
4. Application study of TCSC in Power System
5. Study and simulation of 6 pulse HVDC system
6. Study of 12 pulse or 24 pulse or 48 pulse inverter
7. Application study of DSTATCOM in Power System
8. Study and simulation of Power Flow control in a five bus system using any one of the following FACTS Controllers: (i) SVC (ii) STATCOM (iii) SSSC (iii) UPFC

Industrial Visit: Desirable visit to nearest HVDC substation

Text Books:

[T1] E. Acha, V.A. Agelidis, O.Anaya-lara and TJE Miller, “Power Electronic control in Electrical Systems” Newnes, Oxford.
[T2] J. Arrillaga, “High Voltage Direct Current Transmission” Peter Peregrinus Ltd., London, UK.
[T3] N.G. Hingorani and L.Gyugi, “Understanding FACTS” IEEE Press[Indian Edition], New York.
[T4] J. Arrillaga, Y.H.Liu and N.R.Watson, “Flexible Power Transmission The HVDC Options”, John Wiley and sons Ltd., New York.
[T5] Erich Uhlmann, “Power Transmission by Direct Current” Springer International.

Reference Books:

[R1] Yong Hua Song and Allan T Johns, “Flexible ac transmission systems(FACTS), Published by The Institution of Electrical Engineers, London.
[R2] K.R.Padiyar, “FACTS controllers in transmission and Distribution” New Age Publications, New Delhi.
[R3] K.R.Padiyar , “HVDC Power Transmission Systems”, New Age Publications, New Delhi, (2nd Edition)
[R4] M.H.Rashid , “Power Electronics Handbook”, Academic Press.
[R5] PrabhaKundur, “Power System Stability and Control”, McGraw Hill
[R6] S Kamakshaiah, V Kamaraju, “HVDC Transmission”, McGraw Hill

Unit	Text Books	Reference Books
1	T2,T4,T5	R3,R6
2	T1, T3	R3, R4,R7
3	T1, T2	R1, R6
4	T2	R5, R8
5	T6	R2
6	T2, T3	R6

Elective –III : 403149 (C) : Digital Control Systems

Teaching Scheme		Credits	Examination Scheme [150 Marks]	
Theory	: 03 Hrs./Week	03	In Sem	: 30 Marks
Practical	: 02Hrs./Week	01	End Sem	: 70 Marks
			Oral	: 25Marks
			Term work	: 25 Marks

Prerequisite : Z-Transform, Basics of discrete systems.

Course Objective: The course aims to:-

- Make students elaborate basic concepts of discrete signals and systems.
- Educate students to analyze the stability of discrete systems.
- Explain formulation of state space discrete model and design the digital controllers.
- Elaborate digitize analog controllers using various numerical methods.
- Explore application of the theory of digital control to practical problems.

Course Outcome: Upon successful completion of this course, the students will be able to :-
1. Analyze digital control system and its stability.
2. Differentiate between various control systems
3. Present system in state space format.
4. Design observer for system.
5. Understand digital controllers
6. Elaborate applications such as digital temperature control and position control

Unit 01 : Discrete systems and Signals (06 Hrs)

Standard discrete test signals, Basic operations on signals. Classification of discrete systems. Detail analysis of frequency aliasing and quantization, Brief review of Sampling theorem, Ideal low pass filter. Transfer function of ZOH, Frequency domain characteristics of ZOH, First order hold, frequency domain characteristics of first order hold.

Unit 02 : State - Space analysis (06 Hrs)

Conversion of Pulse transfer functions to State space model and vice a versa. Solution of LTI Discrete –time state equation; State Transition Matrix (STM) and properties of STM; Computation of STM by Z-transform method, by power series expansion method, by Cayley Hamilton theorem, by Similarity transformation method, Discretization of continuous time state space equation.

Unit 03 : Design using state space (05 Hrs)

Controllability and observability of linear time invariant discrete-data system, Tests for Controllability and observability; Principal of Duality; Effect of pole- zero cancellation; Relationship between controllability, observability and stability. Pole placement design using linear state-feedback.

Unit 04 : Design of State Observers (06 Hrs)

Full order state observer, reduced order state observer, State estimation and full order observer design. Ackermann's formula. Compensator design by the separation principle, State feedback with integral control, State regulator design.

Unit 05 : State space model and digitising analog controllers (07 Hrs)

State space model of digital systems: Transformation of state-space model to various forms (controllable, observable, diagonal and Jordan canonical forms). Numerical approximation of differential equations, Eulers foreword and backward method, Trapezoidal method, Bilinear transformation with frequency warping. Numerical differentiation, Matching step and other response. Pole-zero matching.

Unit 06 : Digital control system applications (0 6 Hrs)

Hybrid system simulation, Computer program structure for simulation of discrete time control of continuous time plant. Digital temperature control, position control, Stepper motor control, Block diagram presentation and control algorithms.

List of Experiments Perform any eight experiments using MATLAB

1. Design and analysis of digital temperature control system
2. Design and analysis of digital position control system.
3. Software programming for determination of STM of DT system.
4. Software programming to design DT system by pole placement through state feedback.
5. Software programming for determination of controllability and observability of DT System.
6. Software programming to observe effect of sampling on response of the system
7. Software programming to observe effect of sampling on stability of DT system.
8. Solution of state equation of L.T.I. systems by the use of digital computer.
9. Digital computer aided difference equation solution.
10. Conversion of continuous time state space model to discrete time state space model

Text Books:

[T1] K. Ogata, "Discrete Time Control System", 2nd Edition, PHI Learning Pvt. Ltd. 2009

[T2] B. C. Kuo, "Digital Control Systems", 2nd Edition, Oxford University Press

[T3] M. Gopal, "Digital Control Engineering", New Age International Publishers

[T4] M. Gopal, "Digital Control and State Variable Methods", 3rd Edition The McGraw Hill Co.

Reference Books:

[R1] Load D. Landau, Gianluca Zito, 'Digital Control Systems: design, Identification and Implementation' Springer.

[R2] Mohammed Santina, Allen Stubberud, Gene Hostetter 'Digital control System Design', Sanders College publishing

[R3] K.J. Astrom, B Wittenmark 'Computer Controlled Systems: Theory and Design' Prentice-Hall Inc New Jersey, 2011 Dover.

Unit	Text Books	Reference Books
1	T2,T3	R3
2	T2,	R3
3	T1,T2	R3
4	T1,T2	R1,R2
5	T1,T3	R1,R2
6	T2,T4	R3

Elective – III : 403149 (D): Intelligent Systems and Applications in Electrical Engineering

Teaching Scheme		Credits	Examination Scheme [150 Marks]	
Theory	: 03 Hrs./Week	03	In Sem	: 30 Marks
Practical	: 02 Hrs./Week	01	End Sem	: 70 Marks
			Oral	: 25 Marks
			TW	: 25 Marks

Prerequisite: Knowledge of MATLAB, C- Programming

Course Objective: The course aims to:-

- To enhance knowledge of intelligence system to carry out power system problems.
- To impart knowledge about Artificial neural network and fuzzy logic programming for electrical engineering applications like load dispatch and load shedding.

Course Outcome: Upon successful completion of this course, the students will be able to :-

1. Classify neural networks
2. Compare various AI tools
3. Develop algorithms for AI tools
4. Apply AI tools for Applications in electrical engineering

Unit 01 : Introduction to Artificial Neural Network (06 Hrs)

Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Historical Developments. Essentials of Artificial Neural Networks: Artificial Neuron Model, operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures

Unit 02 : Classification Taxonomy of ANN (06 Hrs)

Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules.

Perceptron Models: Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem. Multilayer feed forward Neural Networks

Unit 03 : Memory (06 Hrs)

Associative Memory, Bi-directional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function, Self-Organizing Maps (SOM) and Adaptive Resonance Theory (ART).

Unit 04 : Introduction to Fuzzy Logic system (06 Hrs)

Fuzzy versus crisp, fuzzy sets: membership function, Basic fuzzy set operations, properties of fuzzy sets, fuzzy relations.

Unit 05 : Fuzzy Control (06 Hrs)

Predicate logic (Interpretation of predicate logic formula, Inference in predicate logic), fuzzy logic (Fuzzy quantifiers, fuzzy Inference), fuzzy rule based system, defuzzification methods

Unit 06 : Introduction to other Intelligent tools (06 Hrs)

Introduction to Genetic Algorithm: biological background, GA operators, selection, encoding, crossover, mutation, chromosome.

Expert System: software architecture, rule base system

List of Experiments
Minimum eight experiments are to be performed out of the list mentioned as below:

[Matlab Programming based experiments.]

1. Write program to evaluate output of any given architecture of neural network with different transfer functions such as linear logsig tanh, threshold function.
2. Verify the fault tolerant nature of neural network by disconnecting few weight link for a given architecture
3. Write program for perceptron learning algorithm.
4. To study some basic neuron models and learning algorithms by using ANN tool
5. Power system failure analysis using ANN tool
6. Predict power factor of four bus system using neural network
7. Predict system analysis for measurements like rms voltage using ANN tool
8. Write supervised and unsupervised ANN program for Signal Frequency Separation using Perceptron
9. Temperature monitoring using fuzzy logic
10. Speed control of DC motor using fuzzy logic
11. Fuzzy logic based washing machine control
12. Fuzzy logic based air conditioner
13. Design of a Fuzzy Multi-Objective Power System Stabilizer via Linear Matrix Inequalities

Text Books:

[T1] Simon Haykin, "Neural Networks: A Comprehensive Foundation", 2nd Edition, Pearson Education

[T2] S. Rajsekaram, G. A. Vijayalaxmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms Synthesis and Applications", Practice Hall India

[T3] James A. Anderson, "An Introduction to Neural Networks", Practice Hall India Publication

[T4] Mohamed H. Hassoun, "Fundamentals of Artificial Neural Network", Practice Hall India

Reference Books:

[R1] Kelvin Waruicke, Arthur Ekwlle, Raj Agarwal, "AI Techniques in Power System", IEE London, U.K.

[R2] S. N. Sivanandam, S. Sumathi, S. N. Deepa, "Introduction to Neural Network Using MATLAB 6.0", Tata McGraw Hill

[R3] Jacek Zurada, "Introduction to Artificial Neural Network", Jaico Publishing House India

Unit	Text Books	Reference Books
1	T1,T2	R1,R2
2	T1,T2	R1,R2
3	T1,T2	R1,R2
4	T2	R1
5	T2	R1
6	T1	R1,R2

Elective – III : 403149 (E): Analog Electronics and Sensing Technology [Open Elective]

Teaching Scheme		Credits	Examination Scheme [150 Marks]	
Theory	: 03 Hrs./Week	03	In Sem	: 30 Marks
Practical	: 02 Hrs./Week	01	End Sem	: 70 Marks
			Oral	: 25 Marks
			TW	: 25 Marks

Course Objective: The course aims to:-

- Study operational amplifiers for various analog operations.
- Understand different types of analog filters and waveform generation techniques.
- Study advance applications such as mux/demux and multipliers.
- Understand various analog sensors for various applications.

Course Outcome: Upon successful completion of this course, the students will be able to :-

1. Develop various analog circuits using operational amplifiers.
2. Design filters and waveform generators and various signal converter circuits.
3. Find characteristics of sensors used for system monitoring and protection.
4. Interface various position sensors to microcontrollers.
5. Find characteristics of sensors used for light and image sensing.

Unit 01 : Operational Amplifier & Applications (06 Hrs)

Study of Various types of Operational Amplifiers and their applications; Op-Amp: Block diagrams of LM741 and TL082, ideal and practical parameters, open loop and close loop configuration, Power supply configurations, DC and AC parameters.

Applications of Op- Amp- Comparator, zero crossing detectors, Voltage limiters, Integrator and Differentiator, V-I and I-V converters, V to f and f to V circuits using LM331, peak detector.

Unit 02 : Waveform generators, Filters & Regulators (06 Hrs)

Waveform generation using Op-amp - sine, square, saw tooth and triangular generator, Active filters-Its configuration with frequency response, Analysis of first order Butterworth low pass and high pass filters, bandpass and band-stop filters, notch filter, all pass filters, Universal Active filter design using UAF42.

OP-AMP Voltage regulator, Fixed and Adjustable Voltage Regulators, Basic Switching Regulator and characteristics of standard regulator ICs –TPS40200 and Low Drop out (LDO) Regulators ICs- TPS7250.

Unit 03 : Advanced applications (06 Hrs)

Introduction to analog multiplier e.g.MPY634, Basic application of Analog multiplier: AM, FM, FSK; Typical application using op-AMP and analog multipliers: Voltage Controlled Oscillator, Phase Locked Loop and its applications, self-tuned filters.

Analog Switches and Multiplexers Overview, MUX507 Multiplexer, SN74LV4051A-Q1 8-Channel Analog Multiplexer/Demultiplexer

Unit 04 : System monitoring & protection sensing (06 Hrs)

Principle of operation and application of following sensors for Real-time system protection, feedback control and high-accuracy system monitoring: LM35 Temperature Sensor, INA240 current sense amplifier, DRV5053 Hall Effect based current sensor, HDC1080 / HDC1010 / HDC2010 Humidity Sensor.

Unit 05 : Position Sensing (06 Hrs)

Absolute and relative position sensing solutions including: angular, presence, proximity, distance, flow, level, and velocity basics, DRV 5032 Hall Effect Sensor, mmWave Sensor, AFE5805 Ultrasonic sensor, Encoder, Resolver, Inductive position sensor, Capacitive Position Sensor, LVDT.

Unit 06 : Light & image sensing (06 Hrs)

Sensors and sensing AFEs for capturing a broad range of wavelengths introduction, 3D Depth Sensor, Near Infrared spectroscopy, OPT3007 Light Sensor, Optical Isolators.

Guidelines for Instructor's Manual

Instructor's Manual shall have

- Brief relevant theory of all analog and sensing devices.
- Equipment with specifications.
- Connection diagram/ methodology.

Format of observation table, analog device characteristics and sample results.

Guidelines for Student's Lab Journal

The Student's Lab Journal should contain following related to every experiment –

1. Theory related to the experiment.
2. Apparatus with their detailed specifications.
3. Connection diagram /circuit diagram.
4. Observation table/ simulation waveforms.
5. Sample calculations for one/two reading.
6. Result table.
7. Graph and Conclusions.
8. Few short questions related to the experiment.

Guidelines for Laboratory conduction

Lab Requirement: LM741, TL082, LM331 operational amplifiers, ICs – TPS40200,TPS7250,TPS 7A4901, TPS7A8300, UAF42, MPY634, MUX507 and SN74LV4051A-Q1;LM35, INA240, DRV5053, HDC1080 modules; Angular, Presence, Proximity, Distance, Flow, level and other position sensor modules and OPT3007 light sensor module with relevant power supply and DSO/CRO and other metering equipment for characterization of all analog devices.

List of Experiments

Minimum eight experiments are to be performed out of the list mentioned as below:

1. LM741 based comparator circuit.
2. LM318 based zero crossing detector.
3. LM331 based V to f and f to V converter.
4. LM741 based triangular, square and sinusoidal waveform generation.
5. Universal Active filter design using UAF42.
6. Voltage Regulators using TPS40200 and TPS7250.
7. Analog multiplier using MPY634
8. Analog Multiplexer using MUX507
9. Study characteristics of LM35 based temperature sensor module
10. Study characteristics of HDC 1080 based Humidity sensor module
11. Hall Effect based position sensing / Ultrasonic based distance sensing.
12. Study characteristics of OPT 3007 light sensor module.

Text Books:

[T1] HANDBOOK OF OPERATIONAL AMPLIFIER APPLICATIONS, http://www.ti.com/lit/an/sboa092b/sboa092b.pdf

[T2] Thomas L. Floyd, "Electronics Devices", Pearson Education.

[T3] Mottershed, "Electronics Devices & Circuits", PHI New Delhi

[T4] Muhammad H. Rashid, "Power Electronics: Circuits, Devices and Applications", 3rd edition, PearsonEducation.

[T5] Linear Integrated Circuits and its Applications: https://www.ti.com/seclit/ml/ssqu016/ssqu016.pdf

[T6] http://www.ti.com/lit/ds/symlink/tps40200.pdf

[T7] www.ti.com/lit/ds/symlink/lm35.pdf

[T8] AIP Handbook of Modern Sensors: Physics, Design and Applications, Jacob Fraden, American Institute of Physics.

Reference Books:

[R1] K. R. Botkar, "Integrated Circuits", Khanna Publication, New Delhi.

[R2] James, "Operational Amplifier and Linear Integrated Circuits Theory and Application." P John Paul, "Electronics Devices and circuits", New Age international Publications.

[R3] P. S. Bimbhra, "Power Electronics", Khanna Publications

[R4] http://www.ti.com/lit/an/sboa092b/sboa092b.pdf

[R5] The Signal e-Book, Texas Instruments

[R6] http://www.ti.com/lit/ds/symlink/uaf42.pdf

[R7] https://www.ti.com/lit/ds/symlink/mpy634.pdf

[R8] www.ti.com/lit/ds/symlink/mux506.pdf

[R9] www.ti.com/lit/ds/symlink/hdc1080.pdf

[R10] The fundamentals of millimeter wave, Texas Instruments

[R11] www.ti.com/lit/ds/sbos864/sbos864.pdf

Unit	Text Books	Reference Books
1	T1, T2, T3	R1, R2, R6
2	T4, T5, T6	R3, R4, R5, R6, R7
3	-	R6, R8, R9
4	T7, T8	R6, R10
5	T8	R6, R11
6	T8	R6, R12

Elective –IV : 403150 (A): Smart Grid

Teaching Scheme	Credit	Examination Scheme [100 Marks]
Theory : 03 Hrs / Week	03	In Sem : 30 Marks
		End Sem : 70 Marks

Prerequisite: Knowledge of power system and power electronics

Course Objective: The course aims:-

- To explain the concept of Smart Grid, compare with conventional grid, and identify its opportunities and barriers.
- To describe the concept of Smart Meter, Smart Appliances, Automatic Meter Reading, Outage Management System, Plug in Hybrid Electric Vehicles, Vehicle to Grid, Smart Sensors, Home and Building Automation, Phase Shifting Transformers.
- To elaborate the concept of Substation Automation, Feeder Automation. Intelligent Electronic Devices, Smart storage like Battery, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System, Phase Measurement Unit.
- To elaborate the concept of microgrid
- To acquaint Power Quality issues of Grid connected Renewable Energy Sources, Web based Power Quality monitoring, Power Quality Audit.

Course Outcome:

1. Apply the knowledge to differentiate between Conventional and Smart Grid.
2. Identify the need of Smart Grid, Smart metering, Smart storage, Hybrid Vehicles, Home Automation, Smart Communication, and GIS
3. Comprehend the issues of micro grid
4. Solve the Power Quality problems in smart grid
5. Apply the communication technology in smart grid

Unit 01 : Introduction to Smart Grid: (06 Hrs)

Concept of Smart Grid, Need of Smart Grid, Functions of Smart Grid, Opportunities and Barriers of Smart Grid, Drivers of SG in India, Functionalities and key components of smart grid, Difference between conventional and smart grid, Smart Grid Vision and Roadmap for India, Concept of Resilient and Self-Healing Grid, Present development and International policies in Smart Grid, Smart Cities, Pilot projects in India.

Unit 02 : Smart Grid Technologies (06 Hrs)

Remote Terminal Unit (RTU):Block diagram and function of each block, Intelligent Electronic Devices (IED), Phase Measurement Unit (PMU). Smart Substations, Substation and Feeder Automation, application for monitoring, protection and control, Plug in Hybrid Electric Vehicles(PHEV), Vehicle to Grid(V2G), Grid to vehicles(G2V), Smart storage technologies and applications – Battery(flow and advanced), SMES, Super Capacitors, Compressed Air Energy Storage(CAES) and its comparison, Optimal location of PMUs for complete Observability.

Unit 03 : Smart Meters and Advance Metering Infrastructure: (06 Hrs)

Introduction to Smart Meters, Advanced Metering Infrastructure (AMI), Real Time Prizing, Automatic Meter Reading (AMR), Outage Management System (OMS) Smart Sensors, Smart Appliances, Home and Building Automation, Geographic Information System (GIS).

Unit 04 : Microgrids: (06 Hrs)

Concept of Microgrid, need and applications of Microgrid, Microgrid Architecture, DC Microgrid, Formation of Microgrid, Issues of interconnection, protection and control ofMicrogrid, Integration of renewable energy sources, Smart Microgrid, Microgrid and Smart Grid Comparison, Smart Microgrid Renewable Green Energy System, Cyber Controlled Smart Grid.

Unit 05 : Power Quality Management in Smart Grid (06 Hrs)

Power Quality and EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

Unit 06 : Communication Technology for Smart Grid (06 Hrs)

Communication Architecture of SG, Wide Area Measurement System (WAMS), Home Area Network (HAN), Neighbourhood Area Network (NAN), Wide Area Network (WAN)., ZigBee, GPS, Wi-Fi, Wi-Max based communication, Wireless Mesh Network, Basics of CLOUD Computing and Cyber Security for Smart Grid, Broadband over Power line (BPL).

Text Books:

[T1] Ali Keyhani, Mohammad N. Marwali, Min Dai "Integration of Green and Renewable Energy in Electric Power Systems", Wiley

[T2] Clark W. Gellings, "The Smart Grid: Enabling Energy Efficiency and Demand Response",CRC Press

[T3] Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley Publications.

[T4] Stuart Borlase, "Smart Grids-Infrastructure, Technology and Solutions", CRC Press, Taylor and Francis group

[T5] James Momoh, "Smart Grid-Fundamentals of design and analysis", Wiley Publications.

Reference Books:

[R1] Nikos Ziargyriour, "Micro grid, Architecture and Control", IEEE Press, Wiley Publications.

[R2] Yang Xiao, "Communication and Networking in Smart Grids", CRC Press, Taylor and Francis group

[R3] Lars T. Berger and Krzysztof Iniewski, "Smart Grid-Applications, Communications and Security", Wiley Publications.

[R4] Mladen Kezunovic, Mark G. Adamiak, Alexander P. Apostolov, Jeffrey George Gilbert "Substation Automation (Power Electronics and Power Systems)", Springer Publications.

[R5] Smart grid handbook for regulators and policy makers November 2017,ISGF

Unit	Text Books	Reference Books
1	T1,T3,T5	R5
2	T1	R5
3	T1,T4	R4, R5
4	T1,T3	R5, R1
5	T5,T2	R5, R2
6	T4	R2, R3, R5

Elective – IV : 403150 (B): Robotics and Automation

Teaching Scheme	Credits	Examination Scheme [100Marks]	
Theory : 03 Hrs./Week	03	In Sem	: 30 Marks
		End Sem	: 70 Marks

Course Objective: The course aims to:-

- To know basic parts of a typical industrial robot system with its anatomy with human body.
- To analyze mathematically kinematic and dynamic modeling of a typical robot manipulator.
- To select an appropriate type of robot with given specifications for different industrial applications.
- To know the basics of actuators, sensors and control of an industrial robot for different applications

Course Outcome: Upon successful completion of this course, the students will be able to :-

1. Differentiate between types of robots based on configuration, method of control, types of drives, sensors used etc.
2. Choose a specific robot for specific application with given specifications.
3. Analyze the robot arm dynamics for calculation of torques and forces required for different joints of robots for control of robot arm.
4. Determine the D-H parameters for a robot configuration using concepts from robot arm kinematics which further leads to forward/inverse kinematics.
5. Calculate the Jacobian matrix for robot arm velocity and decide the singular positions.

Unit 01 : Introduction (06 Hrs)

Robot components, Degrees of freedom, Robot joints, Robot reference frames,Robot specifications: repeatability, spatial resolution, compliance, load carrying capacity, speed of response, work volume, work envelope, reach etc., end effectors (Wrist), concept of: yaw, pitch and roll. Robot classification: according to Co-ordinate system: Cartesian, cylindrical, spherical, SCARA, Articulated, Control Method: Servo controlled and non-servo controlled, their comparative study, formof motion: P-T-P (point to point), C-P (continuous path), pick and place etc. and their comparative study.

Unit 02 : Mathematical preliminaries (06 Hrs)

Homogeneous Coordinate, Translational Transformation, Rotational Transformation, coordinate reference frames, Effect of pre and post multiplication of transformation, Concept of Homogeneous transformation, Euler angles and singularities

Unit 03 : Forward Kinematics (06 Hrs)

Denavit-Hartenberg (D-H) representation of kinematic chains. Rules for establishing link co-ordinate frames. Forward solution of robotic manipulator for SCARA Robot and PUMA Robot. Forward solution for simple robot systems.

(06 Hrs)

Unit 04 :

Inverse Kinematics: Concept of Inverse Kinematics, general properties of inverse solution such as existence and uniqueness of solution, inverse solution by direct approach, Geometric approach, inverse solution for simple SCARA Robots, numericals for simple three axis robots based on direct approach.

Robot Dynamics: Lagrange's Equation, Kinetic and potential energy Equations, Euler-Lagrange analysis for a single prismatic joint working against gravity and single revolute joint. Equation of motion.

Unit 05 : Differential motion and Control **(06 Hrs)**

Manipulator Differential Motion: Concept of linear and angular velocity, Relationship between transformation matrix and angular velocity, manipulator Jacobian, Jacobian for prismatic and revolute joint, Jacobian Inverse, Singularities.

Control of Robot Arm: Modeling of DC motor and load, closed loop control in position servo, the effect of friction and gravity, control of a robotic joint, position velocity and acceleration profiles for trapezoidal velocity profile.

Control of Robot manipulator: joint position controls (JPC), resolved motion position controls (RMPC) and resolved motion rate control (RMRC).

Unit 06 : Actuators and Sensors **(06 Hrs)**

Drive Technology: Hydraulic, Pneumatic, Electric (stepper motor, D.C. servo motor, BLDC Motors) in detail with selection criteria. Sensors in servo control system: Resolver, rotary shaft encoders, potentiometers, tacho-generators.

Industrial Applications of Robots: Welding, Spray-painting, Grinding, Handling of rotary tools, Parts handling/transfer, Assembly operations, parts sorting, parts inspection, Potential applications in Nuclear and fossil fuel power plant etc. (Details for the above applications are selection criterion of robots, sensors used, selection of drives and actuators, methods of control, peripheral devices used etc).

Industrial Visit: At least one industrial visit should be arranged supporting the classroom teaching and student should submit a report on that industrial robot application including type of robot, method of control, type of application, sensor interface, method of programming etc.

Text Books:

[T1] Mikell P. Groover, Mitchell Weiss, Roger N. Nagel, Nicholas G. Odrey, Ashish Dutta, "Industrial Robotics:Technology, Programming and Applications", Tata- McGraw Hill Education Private Limited, New Delhi, 2012.

[T2] Richard D. Klafter, Thomas A. Chemielewski, Michael Neign, "Robotic Engineering – An IntegralApproach", Prentice Hall of India Pvt. Ltd., New Delhi. Eastern Economy Edition.

[T3] Robert J. Schilling, "Fundamentals of Robotics: Analysis and Control", Prentice Hall of India, New Delhi

Reference Books:

[R1] K. S. Fu, R. C. Gonzalez, C. S. G. Lee, “Robotics: Control Sensing, Vision and Intelligence”, International Edition, McGraw Hill Book Co.

[R2] John J. Craig, “Introduction to Robotics: Mechanics and Control”, Pearson Education

[R3] R. K. Mittal, I. J. Nagrath, “Robotics and Control”, Tata McGraw Hill Publishing Company Ltd., New Delhi.

[R4] Saeed b. Niku, “Introduction to Robotics: Analysis, Control, Applications”, Wiley Publication, 2011.

Unit	Text Books	Reference Books
1	T1,T2	R3
2	T1,T2,T3	R1, R2,R3,R4
3	T1,T2,T3	R1,R3,R4
4	T1,T2,T3	R1,R3,R4
5	T2, T3	R1,R2, R3
6	T2	R1

Elective IV :403150 (C): Illumination Engineering

Teaching Scheme	Credits	Examination Scheme [100Marks]	
Theory : 03 Hr/Week	03	In Sem	: 30 Marks
		End Sem	: 70 Marks

Prerequisite:
The working of the conventional lamps, generation of light and physics of light, techniques for natural and artificial lighting

Course Objective: The course aims :-

- To explain conventional and modern lamps and their accessories.
- To get detailed insight of indoor and outdoor illumination system components, control and design aspects.
- To know the requirements of energy efficient lighting.
- To introduce the modern trends in the lighting

Course Outcome: Upon successful completion of this course, the students will be able to :-

1. Define and reproduce various terms in illumination.
2. Identify various parameters for illumination system design.
3. Design indoor and outdoor lighting systems.
4. Enlist state of the art illumination systems.

Unit 01 : Importance of Lighting in Human Life (05 Hrs)
Optical systems of human eye, Dependence of human activities on light, performance characteristics of human visual system, External factors of vision-visual acuity, contrast, sensitivity, time illuminance, colour, visual perception, optical radiation hazards, Good and bad effects of lighting and perfect level of illumination, Artificial lighting as substitute to natural light, Ability to control natural light, Production of light, physics of generation of light, Properties of light, Quantification and Measurement of light.

Unit 02 : Light Sources and Electrical Control of Light Sources (08 Hrs)
(A) Light Sources- Lamp materials: Filament, glass, ceramics, gases, phosphors and other metals and non-metals. Discharge Lamps: Theory of gas Discharge phenomena, lamp design considerations, characteristics of low and high pressure mercury and Sodium vapour lamps, Low Vapour Pressure discharge lamps - Mercury Vapour lamp, Fluorescent Lamp, Compact Fluorescent Lamp (CFL)
High Vapour Pressure discharge lamps - Mercury Vapour lamp, Sodium Vapour lamp, Metal halide Lamps, Solid Sodium Argon Neon lamps, SOX lamps, Electro luminescent lamps, Induction lamps.
Ballast, ignitors and dimmers for different types of lamps

(B) Control of Light Sources
Photometric Control of Light Sources and their Quantification: Types of Luminaries, factors to be considered for designing luminaries Types of lighting fixtures.
Optical control schemes, design procedure of reflecting and refracting type of luminaries. Lighting Fixture types, use of reflectors and refractors, physical protection of lighting fixtures, types of lighting fixtures according to installation type, types of lighting fixtures according to photometric usages, luminaries standard (IEC-598-Part I).

Unit 03 : Design Considerations for illumination schemes (04 Hrs)

Zonal cavity method for general lighting design, determination for zonal cavities and different shaped ceilings using COU (coefficient of utilization), beam angles and polar diagrams. Factors to be considered for design of indoor illumination scheme

Unit 04 : Design of lighting schemes-I (06 Hrs)

Indoor illumination design for following installations-

Residential (Numerical)
Educational institute
Commercial installation
Hospitals
Industrial lighting
Special purpose lighting schemes
Decorative lighting
Theatre lighting
Aquarium, swimming pool lighting

Unit 05 : Design of lighting schemes-II (08 Hrs)

Factors to be considered for design of outdoor illumination scheme

Outdoor Lighting Design: Road classifications according to BIS, pole arrangement, terminology, lamp and luminaries' selection, different design procedures, beam lumen method, point by point method, isolux diagram, problems on point by point method.

Outdoor illumination design for following installations:

Road lighting (Numerical)
Flood lighting (Numerical)
Stadium and sports complex
Lighting for advertisement/hoardings

Unit 06 : Modern trends in illumination (05 Hrs)

LED luminary designs
Intelligent LED fixtures
Natural light conduiting
Organic lighting system
LASERS, characteristics, features and applications, non-lighting lamps
Optical fiber, its construction as a light guide, features and applications

Text Books:

[T1] H. S. Mamak, "Book on Lighting", Publisher International lighting Academy.
[T2] Joseph B. Murdoch, "Illumination Engineering from Edison's Lamp to Lasers" Publisher -York, PA : Visions Communications
[T3] M. A. Cayless, A. M. Marsden, "Lamps and Lighting", Publisher-Butterworth-Heinemann(ISBN 978-0-415-50308-2)
[T4] Designing with light: Lighting Handbook., Anil Valia; Lighting System 2002

Reference Books:

[R1] "BIS, IEC Standards for Lamps, Lighting Fixtures and Lighting", Manak Bhavan, New Delhi.

[R2] D. C. Pritchard, "Lighting", 4th Edition, Longman Scientific and Technical, ISBN 0-582-23422-0.

[R3] "IES Lighting Handbook", (Reference Volume 1984), Illuminating Engineering Society of North America.

[R4] "IES Lighting Handbook", (Application Volume 1987), Illuminating Engineering Society of North America

[R5] IESNA lighting Handbook., Illuminating Engineering Society of North America 9th edition 2000

[R6] Applied Illumination Engineering, Jack L. Lindsey FIES (Author), Scott C. Dunning PHD PECEM (Author) ,ISBN-13: 978-0824748098 ISBN-10: 0824748093, 3rd Edition.

[R7] IS 3646: Part I: 1992, Code of practice for interior illumination.

[R8] Organic Light Emitting Diodes (OLEDs): Materials, Devices and Applications, Alastair Buckley, University of Sheffieid, UK, ISBN: 978-0-85709-425-4.

Unit	**Text Books**	**Reference Books**
1	T1,T4	R6
2	T3,T4	R1,R3,R4,R8
3	T2,T4	R2,R3,R7
4	T3,T4	R2,R3,R4,R5,R7
5	T3,T2,T4	R3,R4,R6,R7
6	T1,T2,T4	R8,R5,R3,R2

403150 (D) : VLSI Design [Open Elective]

Teaching Scheme	**Credits**	**Examination Scheme [100 Marks]**	
Theory : 03 Hrs. /Week	03	In Sem	: 30 Marks
		End Sem	: 70 Marks

Prerequisite : Concepts of Digital Electronics, Number systems, any programming language like C

Course Objective: The course aims to:-

- Develop Digital designing skills of Students
- Train the students for Hardware Description Language.
- Develop various applications using VHDL coding.

Course Outcome: Upon successful completion of this course, the students will be able to :-

1. To understand Modeling of Digital Systems Domains for different combinational and sequential circuits
2. To understand Levels of Modeling using Modeling Language VHDL.
3. To Understand Modeling and programming Concepts by Learning a New Language
4. To develop of logic design and programming skills in HDL language.
5. To study HDL based design approach.
6. To learn digital CMOS logic design

Unit 01 : Overview of Digital Logic Circuits and Introduction to VLSI (06 Hrs)

Combinational circuits: Decoders, Multiplexer, ALU. Sequential circuits: latch, flip flop – RS, JK, D,T., shift registers ,Counters, Moore, Mealy Machines. Introduction to VLSI: complete VLSI design flow (with reference to an EDA tool), IEEE Standards ,VHDL Terms Definitions – Entity, architecture, Schematic, Components, Configuration.

Unit 02 : VHDL Modeling (06 Hrs)

Data objects, Data types, Entity, Architecture and types of modeling: Behavioral, data flow, and Structural with the help of digital functions like multiplexer, Shift Register, counter. Sequential statements, Concurrent statements. VHDL Test bench. VHDL modeling of Combinational, Sequential logics.

Unit 03 : VHDL and Finite State Machines (06 Hrs)

Synthesizable and non synthesizable statements, functions, procedures, attributes, configurations, packages. Synchronous and asynchronous machines, Finite State Machines (FSM), metastability, state diagrams and VHDL codes for FSMs.

Unit 04 : Programmable Logic Devices (PLDs) (06 Hrs)

Need of PLDs. Comparison with ASIC, general purpose processor, DSP processor, microcontroller, memories etc. Features, specifications, detail architectures, application areas, limitations of Complex Programmable Logic Device (CPLD) and Field Programmable Logic Devices (FPGA).

Unit 05 : Digital CMOS Design (06 Hrs)

CMOS INVERTER, CMOS NAND and CMOS NOR, voltage transfer curve, body effect, hot electron effect, velocity saturation. Static and dynamic dissipations. Power delay product. Noise margin. Combinational logic design, comparison of CMOS and NMOS. Comparative study of TTL, ECL, CMOS.

Unit 06 : VLSI Design Applications (06 Hrs)

Barrel shifter, signed and unsigned comparators, Carry ripple and carry look, Ahead address, Fixed- point division, serial data receiver, parallel to serial converter, playing with a seven segment display and key board, signal generators, memory design, Vending - Machine controller.

Text Books:

[T1] Douglas Perry, "VHDL", Tata McGraw Hill.
[T2] John F. Wakerly, "Digital Design, Principles and Practices", Prentice Hall Publication
[T3] Wolf, "Modern VLSI Design", Pearson Education.
[T4] R.P.Jain, "Modern Digital electronics", 3rd edition, Tata McGraw-Hill.
[T5] Donald P. Leach, Albert Paul Malvino, "Digital Principles and Applications", Glencoe Publisher.
[T6] Neil H. Weste and Kamran, "Principles of CMOS VLSI Design", Pearson Publication.

Reference Books:

[R1] Charles H. Roth, "Digital System Design Using VHDL", PWS Publishing Company (Thomson Learning) 2.
[R2] Sung-Mo(Steve) Kang, Yusuf Leblebici, "CMOS Digital Integrated Circuits", Tata McGraw Hill Publication.
[R3] J. Bhaskar, "VHDL Primer", 3rd Edition, Addison Wesley Longman Singapore Pte Ltd.
[R4] Volner A. Dedroni, "Circuit Design with VHDL", PHI Publications
[R5] Xilinx Data Manual "The Programmable Logic Data Book".
[R6] LizyKurian John, "Principles of Digital Systems Design and VHDL" Paperback – 2008 .
[R7] Peter J. Ashenden (Author), Jim Lewis, " VHDL-2008: Just the New Stuff", (Systems on Silicon) Paperback – Import, 7 Dec 2007.
[R8] Data Sheets of PLDs.

Unit	Text Books	Reference Books
1	T2,T4,T5	R3, R6
2	T1,T3	R3, R4, R7
3	T2,T1	R1, R6
4	T2	R5, R8
5	T6	R2
6	T2,T3	R6

403151: Project II

Teaching Scheme	Credits	Examination Scheme [150 Marks]		
Tutorial : 06 Hrs./Week	06	Oral	:	50 Marks
		Term work	:	100 Marks

Course Objectives:

- To explore and to acquire specified skill in areas related to Electrical Engineering
- To develop skills for carrying literature survey and organize the material in proper manner.
- To provide opportunity of designing and building complete system/subsystem based on their knowledge acquired during graduation.
- To understand the needs of society and based on it to contribute towards its betterment and to learn to work in a team.
- To ensure the completion of given project such as fabrication, conducting experimentation, analysis, validation with optimized cost.
- Present the data and results in report form
- Communicate findings of the completed work systematically.

Course outcomes: Students will be able to

- Work in team and ensure satisfactory completion of project in all respect.
- Handle different tools to complete the given task and to acquire specified knowledge in area of interest.
- Provide solution to the current issues faced by the society.
- Practice moral and ethical value while completing the given task.
- Communicate effectively findings in verbal and written forms.

Guidelines :

The student shall complete the remaining part of the project which is an extension of the work carried out in VIIth Semester. For exceptional cases, change of topic has to be approved by Internal Assessment Committee consisting of Guide, Project Coordinator and Head of Department.
Student should incorporate suggestions given by examiner in project I.
The student shall complete the remaining part of the project which consists of design, simulation, fabrication of set up required for the project, analysis and validation of results and conclusions.
The student shall prepare duly certified final report of the project work in the standard format in MS Word / LaTex.
Student should maintain Project Work Book.

Audit Course VI : 403153: Energy Storage Systems

Teaching Scheme
Theory : 02 Hrs. / Week
Field visit : 1 Day

Examination Schemes: Audit (P/F)
Written / MCQ / Term paper

Course Objectives:

- To elaborate various energy storage systems
- To be familiar with various aspects such as hybridization, selection and sizing of energy storage systems

Course Outcomes:

On completion of the course, students will be able to:-

- Explain and differentiate various types of energy storage systems

Energy Storage Systems:

1. Introduction to Energy Storage System: need, its types and applications.

a) Battery as an energy storage device, its types, Basic terms related to battery Energy Storage System such as Energy Density, Power Density, Cycle Life, C_{10} Rating, State of Charge (SOC), Depth of Discharge (DOD), its characteristics and analysis of various batteries.

b) Types of Batteries: Characteristics, construction, economics, development status, future trends in batteries such as advanced lead-acid, lithium ion, polymer, Ni-Cd, metal hydride, sodium, and various types of flow batteries (vanadium, zinc, manganese, etc.).

c) Fuel Cell as an energy storage device and its analysis.

d) Supercapacitor as an energy storage device and its analysis.

e) Superconducting Energy Storage as an energy storage device and its analysis.

f) Flywheel as an energy storage device and its analysis.

Hybridization of different energy storage devices.

Sizing and selecting the energy storage technology and its supporting subsystems.

2. Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV) Introduction to energy management strategies used in hybrid and electric vehicles.

Experiments: There shall be a 3-4 exercises based on MATLAB and Simulink related to **Battery** energy storage, **Fuel Cell** energy storage and **Supercapacitor** energy storage.

Industrial Visit: Industrial visit to manufacturing industry of battery/ supercapacitor.

FACULTY OF ENGINEERING

Syllabus

B.E. (Information Technology) 2015 Course

(With effect from Academic Year 2018-2019)

SAVITRIBAI PHULE PUNE UNIVERSITY

The syllabus is prepared by

B.O.S. in Information Technology, Savitribai Phule Pune University

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PROGRAM EDUCATIONAL OBJECTIVES

The students of Information Technology course after passing out will

1. Graduates of the program will possess strong fundamental concepts in mathematics, science, engineering and Technology to address technological challenges with emerging trends.
2. Possess knowledge and skills in the field of Computer Science & Engineering and Information Technology for analyzing, designing and implementing multifaceted engineering problems of any domain with innovative and efficient approaches.
3. Acquire an attitude and aptitude for research, entrepreneurship and higher studies in the field of Computer Science & Engineering and Information Technology.
4. Learn commitment to ethical practices, societal contributions through communities and life-long intellect.
5. Attain better communication, presentation, time management and team work skills leading to responsible & competent professionals and will be able to address challenges in the field of IT at global level.

PROGRAM OUTCOMES

The students in the Information Technology course will attain:

1. An ability to apply knowledge of computing, mathematics including discrete mathematics as well as probability and statistics, science, engineering and technology.
2. An ability to define a problem and provide a systematic solution with the help of conducting experiments, as well as analyzing and interpreting the data.
3. An ability to design, implement, and evaluate a software or a software/hardware co-system, component, or process to meet desired needs within realistic constraints.
4. An ability to identify, formulate, and provide systematic solutions to complex engineering problems.
5. An ability to use the techniques, skills, and modern engineering technologies tools, standard processes necessary for practice as a IT professional.
6. An ability to apply mathematical foundations, algorithmic principles, and Information Technology theory in the modeling and design of computer-based systems with necessary constraints and assumptions.
7. An ability to analyze the local and global impact of computing on individuals, organizations and society.
8. An ability to understand professional, ethical, legal, security and social issues and responsibilities.
9. An ability to function effectively as an individual or as a team member to accomplish a desired goal(s).
10. An ability to engage in life-long learning and continuing professional development to cope up with fast changes in the technologies/tools with the help of electives, professional organizations and extra-curricular activities.
11. An ability to communicate effectively in engineering community at large by means of effective presentations, report writing, paper publications, demonstrations.
12. An ability to understand engineering, management, financial aspects, performance, optimizations and time complexity necessary for professional practice.
13. An ability to apply design and development principles in the construction of software systems of varying complexity.

B.E. (Information Technology) 2015 Course to be implemented from Academic Year 2018-19

SEMESTER-I

Subject Code	Subject	Teaching Scheme			Examination Scheme					Total Marks	Credits
		Lecture	Practical	Tutorial	In-Sem	TW	PR	OR	End-Sem		
414453	Information and Cyber Security	3	--	--	30	--	--	--	70	100	3
414454	Machine Learning and Applications	4	--	--	30	--	--	--	70	100	4
414455	Software Design and Modeling	3	--	--	30	--	--	--	70	100	3
414456	Elective-I	3	--	--	30	--	--	--	70	100	3
414457	Elective -II	3	--	--	30	--	--	--	70	100	3
414458	Computer Laboratory-VII	--	4	--	--	50	50	--	--	100	2
414459	Computer Laboratory-VIII	--	4	--	--	50	--	50	--	100	2
414460	Project Phase-I	--	--	2	--	--	--	50	--	50	2
414461	Audit Course-V	--	--	--	--	--	--	--	--	Grade	
Total		16	8	2	150	100	50	100	350	750	22
Total of Part-I		26				750					

Abbreviations: TW: Term Work **TH:** Theory **OR:** Oral **PR**: Practical **Sem**: Semester

Computer Laboratory-VII (Information and Cyber Security+ Machine Learning and Application)

Computer Laboratory-VIII (Software Design and Modeling)

Elective I		Elective II	
414456 A	1. Wireless Communications	414457A	1. Software Defined Networks
414456B	2. Natural Language Processing	414457B	2. Soft Computing
414456C	3. Usability Engineering	414457C	3. Software Testing and Quality Assurance
414456D	4. Multicore and Concurrent Systems	414457D	4. Compiler Construction
414456E	5. Business Analytics and Intelligence	414457E	5. Gamification

Audit Course-V	
414461A	1. Emotional Intelligence
414461B	2. Green Computing
414461C	3. Critical Thinking
414461D	4. Statistical Learning model using R.

SEMESTER –II

Subject Code	Subject	Teaching Scheme			Examination Scheme					Total Marks	Credits
		Lecture	Practical	Tutorial	In-Sem	TW	PR	OR	End-Sem		
414462	Distributed Computing System	3	--	--	30	--	--	--	70	100	3
414463	Ubiquitous Computing	3	--	--	30	--	--	--	70	100	3
414464	Elective-III	3	2	--	30	25	--	25	70	150	4
414465	Elective-IV	3	--	--	30	--	--	--	70	100	3
414466	Computer Laboratory-IX	--	4	--	--	50	50	--	--	100	2
414467	Computer Laboratory-X	--	2	--	--	25	--	25	--	50	1
414468	Project Work	--	--	6	--	50	--	100	--	150	6
414469	Audit Course-VI	--	--	--	--	--	--	--	--	Grade	
Total		12	8	6	120	150	50	150	280	750	22
Total of Part-II		26				750					

Abbreviations: TW: Term Work **TH:** Theory **OR:** Oral **PR**: Practical **Sem**: Semester
Computer Laboratory-IX (Distributed Computing System)
Computer Laboratory-X (Ubiquitous Computing)

Elective III		Elective IV	
414464A	1. Internet of Things (IoT)	414465A	1. Rural Technologies and Community Development
414464B	2. Information storage and retrieval	414465B	2. Parallel Computing
414464C	3. Multimedia Techniques	414465C	3. Computer Vision
414464D	4. Internet and Web Programming	414464D	4. Social Media Analytics
414464E	5. Computational Optimization	414465E	5. Open Elective

Audit Course-VI	
414469A	1. IoT – Application in Engineering field
414469B	2. Entrepreneurship
414469C	3. Cognitive Computing
414469D	4. AI and Robotics

SEMESTER-I

Savitribai Phule Pune University Fourth Year of Information Technology (2015 Course) 414453: Information and Cyber Security		
Teaching Scheme: **TH:03 Hours/Week**	**Credits: 03**	**Examination Scheme:** **In-Sem (Paper): 30 Marks** **End-Sem (paper): 70 Marks**

Prerequisites:

1. Data Communication.
2. Computer Network.

Course Objectives:

1. Understand computer, network and information security.
2. To study operating system security and malwares.
3. To study security issues in internet protocols.
4. To study network defence tools.
5. To learn forensics and investigation techniques.

Course Outcomes:

By the end of the course, students should be able to

1. Use basic cryptographic techniques in application development.
2. Apply methods for authentication, access control, intrusion detection and prevention.
3. To apply the scientific method to digital forensics and perform forensic investigations.
4. To develop computer forensics awareness.
5. Ability to use computer forensics tools.

Unit I	SECURITY BASICS	7 Hrs

Information Security Concepts, Security Threats and Vulnerabilities, Security Architectures and Operational Models, Types of Security attacks, Goals of Security, Malicious code, Intrusion detection system (IDS): Need, Types, Limitations and Challenges, security and privacy.

Unit II	SYMMETRIC AND ASYMMETRIC KEY CRYPTOGRAPHY	7Hrs

Introduction, Classical Encryption Techniques, Block Ciphers and Data Encryption standards, Advanced Encryption standard, Public Key Cryptography and RSA, Chinese Remainder Theorem, Diffie-Hellman, Elgamal Curve Arithmetic, Elliptic Curve Arithmetic, Elliptic Curve Cryptography.

Unit III	DATA INTEGRITY ALGORITHMS AND SECURITY REQUIREMENTS	7 Hrs

Cryptographic Hash Functions, requirements and security, SHA-1, SHA-3, Digital Signatures, X.509 Certificate, Kerberos, IP Security: Architecture Protocols IPv4, IPv6, AH, EPS, ISAKMP, Web Security: SSL, HTTPS, Mail Security: PGP, S/MIME

Unit IV	LEGAL, ETHICAL, AND PROFESSIONAL ISSUES IN INFORMATION SECURITY, RISK MANAGEMENT	7 Hrs

Overview, Risk identification, Risk Assessment, Risk Control Strategies, Quantitative vs. Qualitative Risk Control Practices. Risk Management. Laws and Ethics in Information Security, Codes of Ethics, Protecting programs and data.

Unit V	INTRODUCTION TO CYBER LAWS	7 Hrs

Introduction, Definition and origin, Cybercrime and Information security, Classification of Cybercrimes, The legal perspectives- Indian perspective, Global perspective, Categories of Cybercrime, Types of Attacks, a Social Engineering, Cyber stalking, Cloud Computing and Cybercrime.

Unit VI	TOOLS AND METHODS USED IN CYBERCRIME	7 Hrs

Introduction, Proxy servers and Anonymizers, Phishing, Password Cracking, Key-loggers and Spywares, Types of Virus, Worms, Dos and DDoS, SQL injection, Cybercrime and Legal perspectives, Cyber laws- Indian context, The Indian IT Act-Challenges, Amendments, Challenges to Indian Law and cybercrime Scenario in India, Indian IT Act and Digital Signatures. study of any two network security scanners: Nmap, Metasploit, OpenVAS, Aircrack, Snort, Wireshark, Nikito, Samurai, Safe 3 etc.

Text Books

1. William Stallings, Computer Security : Principles and Practices, Pearson 6th Ed, ISBN: 978-0-13-335469-0
2. Nina Godbole, Sunit Belapure , Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiely India Pvt.Ltd, ISBN- 978-81-265-2179-1
3. Bernard Menezes, Network Security and Cryptography, Cengage Learning , ISBN-978-81-315-1349-1
4. Dr. V.K. Pachghare, Cryptography and Information security, PHI, Second edition, ISBN- 978-81-203-5082-3

Reference Books

1. Bruice Schneier , Applied Cryptography- Protocols, Algorithms and Source code in C, Algorithms, Wiely India Pvt Ltd, 2nd Edition, ISBN 978-81-265-1368-0.
2. Nina Godbole , Information Systems Security , Wiley India Pvt. Ltd, ISBN -978-81-265-1692-6
3. CK Shyamala et el., Cryptography and Security, Wiley India Pvt. Ltd, ISBN-978-81-265-2285-9.
4. Berouz Forouzan, Cryptography and Network Security, TMH, 2 edition, ISBN -978-00-707-0208-0.
5. Mark Merkow, Information Security-Principles and Practices, Pearson Ed., ISBN- 978-81-317-1288-7.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414454: Machine Learning and Applications

Teaching Scheme:	Credits: 04	Examination Scheme:
TH:04 Hours/Week		In-Sem (Paper): 30 Marks End-Sem (paper): 70 Marks

Prerequisites:

Linear Algebra and Calculus, Probability Basics

Course Objectives:

1. Understanding Human learning aspects.
2. Understanding primitives and methods in learning process by computer.
3. Understanding nature of problems solved with Machine Learning.

Course Outcomes:

By the end of the course, students should be able to

1. Model the learning primitives.
2. Build the learning model.
3. Tackle real world problems in the domain of Data Mining and Big Data Analytics, Information Retrieval, Computer vision, Linguistics and Bioinformatics.

Unit I	INTRODUCTION TO MACHINE LEARNING	8 Hrs

Introduction: What is Machine Learning, Examples of Machine Learning applications, Training versus Testing, Positive and Negative Class, Cross-validation.
Types of Learning: Supervised, Unsupervised and Semi-Supervised Learning.
Dimensionality Reduction: Introduction to Dimensionality Reduction, Subset Selection, Introduction to Principal Component Analysis.

Unit II	CLASSIFICATION	8 Hrs

Binary and Multiclass Classification: Assessing Classification Performance, Handling more than two classes, Multiclass Classification-One vs One, One vs Rest Linear Models: Perceptron, Support Vector Machines (SVM), Soft Margin SVM, Kernel methods for non-linearity

Unit III	REGRESSION AND GENERALIZATION	8 Hrs

Regression: Assessing performance of Regression – Error measures, Overfitting and Underfitting, Catalysts for Overfitting, VC Dimensions
Linear Models: Least Square method, Univariate Regression, Multivariate Linear Regression, Regularized Regression - Ridge Regression and Lasso
Theory of Generalization: Bias and Variance Dilemma, Training and Testing Curves Case Study of Polynomial Curve Fitting.

Unit IV	LOGIC BASED AND ALGEBRAIC MODELS	8 Hrs

Distance Based Models: Neighbors and Examples, Nearest Neighbor Classification, Distance based clustering algorithms - K-means and K-medoids, Hierarchical clustering.

Rule Based Models: Rule learning for subgroup discovery, Association rules mining – Apriori Algorithm, Confidence and Support parameters.

Tree Based Models: Decision Trees, Minority Class, Impurity Measures – Gini Index and Entropy, Best Split.

Unit V	**PROBABILISTIC MODELS**	**8 Hrs**

Conditional Probability, Joint Probability, Probability Density Function, Normal Distribution and its Geometric Interpretation, Naïve Bayes Classifier, Discriminative Learning with Maximum Likelihood. Probabilistic Models with Hidden variables: Expectation-Maximization methods, Gaussian Mixtures

Unit VI	**TRENDS IN MACHINE LEARNING**	**8 Hrs**

Ensemble Learning: Combining Multiple Models, Bagging, Randomization, Boosting, Stacking

Reinforcement Learning: Exploration, Exploitation, Rewards, Penalties

Deep Learning: The Neuron, Expressing Linear Perceptron as Neurons, Feed Forward Neural Networks, Linear Neurons and their Limitations, Sigmoid, Tanh and ReLU Neurons

Text Books

1. Ethem Alpaydin: Introduction to Machine Learning, PHI 2nd Edition-2013.
2. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.

Reference Books

1. C. M. Bishop: Pattern Recognition and Machine Learning, Springer 1st Edition-2013.
2. Ian H Witten, Eibe Frank, Mark A Hall: Data Mining, Practical Machine Learning Tools and Techniques, Elsevier, 3rd Edition.
3. Parag Kulkarni: Reinforcement Learning and Systemic Machine Learning for Decision Making, IEEE Press, Reprint 2015.
4. Nikhil Buduma: Fundamentals of Deep Learning, O'Reilly Media, June 2017.
5. Hastie, Tibshirani, Friedman: Introduction to Statistical Machine Learning with Applications in R, Springer, 2nd Edition 2012.
6. Kevin P Murphy: Machine Learning – A Probabilistic Perspective, MIT Press, August 2012.

Savitribai Phule Pune University Fourth Year of Information Technology (2015 Course) 414455: Software Design and Modeling		
Teaching Scheme: **TH:03 Hours/Week**	**Credits: 03**	**Examination Scheme:** **In-Sem (Paper): 30 Marks** **End-Sem (paper): 70 Marks**

Prerequisites:

1. Problem Solving & Object-Oriented Programming.
2. Software Engineering and Project Management.
3. Database Management System.

Course Objectives:

1. To teach the student the fundamental aspects of different object oriented methodologies and unified approach along with Unified Modeling Language (UML), in terms of "how to use" it for the purpose of specifying and developing software.
2. Explore and analyze use case modeling, domain/ class modeling.
3. To teach the student Interaction and behaviour modeling.
4. Aware students with design process in software development.
5. Orient students with the software design principles and patterns.
6. Enable students to learn the architectural design guidelines in various type of application development.

Course Outcomes:

By the end of the course, students should be able to

1. Understand object oriented methodologies, basics of Unified Modeling Language (UML).
2. Understand analysis process, use case modeling, domain/class modeling
3. Understand interaction and behavior modeling.
4. Understand design process and business, access and view layer class design
5. Get started on study of GRASP principles and GoF design patterns.
6. Get started on study of architectural design principles and guidelines in the various type of application development.

Unit I	OBJECT ORIENTED METHODOLOGIES, UML	7 Hrs

Views of Software Developments: Traditional System Development Methodology and Object Oriented Analysis and Design, Importance Object –Orientation

Some of the object Oriented Methodology:- Object Oriented Design –Booch, Object Modeling Techniques – Rumbaugh, Object – Oriented Analysis - Cood Yourdon, Object – Oriented Software Engineering – Ivar Jacobson

Unified Approach: Object Oriented Analysis, Object Oriented Design, Iterative Development & Continuous Testing, Modeling Based on UML, Layered Approach,

Unified Modeling Language: Introduction to Modeling & UML, MDA, UML Structure, UML Building Blocks, UML Common Mechanisms, Introduction to all UML Diagram Notational Techniques, 4+1 View.

Unit II	OBJECT ORIENTED ANALYSIS	7 Hrs
Object Oriented Analysis Process, Use Case Modeling: Actor Identification, Actor Classification, Actor Generalization, Use Cases Identification, Communication, Uses/Include and Extend Associations, Writing a Formal Use Cases, Use Case realizations. Domain / Class Modeling: Approaches For Identifying Classes (Noun-Phase Approach, Common Class Pattern Approach, Class Responsibilities Collaboration Approach, Naming Classes, Class Associations and Identification of Associations, Generalization/Specialization Relationship, Aggregation and Composition Relationships, Attributes and Methods Identification.		
Unit III	**INTERACTION AND BEHAVIOR MODELING**	**7 Hrs**
Activity Diagram : Activity and Actions, Initial and Final Activity, Activity Edge, Decision and Merge Points, Fork and Join, Input and Output Pins, Activity Group, Activity Partitions, Constraints on Action, Swim Lanes. Sequence Diagram: Context, Objects and Roles, Links, Object Life Line, Message or stimulus, Activation/Focus of Control, Modeling Interactions. Collaboration Diagram: Objects and Links, Messages and stimuli, Active Objects, Communication Diagram, Iteration Expression, Parallel Execution, Guard Expression, Timing Diagram. State Diagram: State Machine, Triggers and Ports, Transitions, Initial and Final State, Composite States, Submachine States.		
Unit IV	**OBJECT ORIENTED DESIGN**	**7 Hrs**
Object Oriented Design Process Designing Business Layer : Object Oriented Constraints Language (OCL), Designing Business Classes : The Process, Designing Well Defined Class Visibility, Attribute Refinement, Method Design Using UML Activity Diagram, Packaging and Managing Classes. Designing Access Layer: Object Relational Systems, Object Relation Mapping, Table Class Mapping, Table – Inherited Classes Mapping, Designing the Access Layer Classes: The Process, Designing View Layer: View Layer Classes Design, Identifying View Classes by Analyzing Use Cases, Macro-Level Design Process, and Prototyping the User Interface. Component and Deployment Design using Component and Deployment Diagram.		
Unit V	**DESIGN PRINCIPLES AND PATTERNS**	**7 Hrs**
Introduction to Patterns General Responsibility Assignment Software Patterns (GRASP) : Introduction, Creator , Information Expert, Low coupling, Controller, High Cohesion, Polymorphism , Pure fabrication, Indirection, Protected Variations. Gang of Four (GoF): Introduction, Categories of Patterns (Creational, Structural and Behavioral Patterns), Singleton, Adapter, State, and Strategy.		
Unit VI	**ARCHITECTURAL DESIGN**	**7 Hrs**
Overview of software Architecture, Designing Client / Server Software Architectures, Designing Service Oriented Software Architectures, Designing Component Based Software Architectures, Designing Concurrent and Real-Time Software Architectures, Designing Product Line Architectures, Related Case Studies.		
Text Books		

1. Ali Bahrami, Object Oriented System Development: Using Unified Modeling Language, McGraw-Hill, International Editions 1999,ISBN:0-07-116090-6.
2. Craig Larman, Applying UML and Patterns, Pearson Education, Second Edition,ISBN:978-0130925695.
3. Erich Gamma et al, Design Patterns: Elements of Reusable Object, Pearson, First Edition,ISBN:9789332555402, 9332555400.

Reference Books

1. Martin Fowler, UML Distilled, Pearson, Third Edition, ISBN:978-81-317-1565-9
2. Dan Pilone, Neil Pitman, UML in Nutshell, O'reilly Pub.,ISBN:8184040024, 9788184040029.
3. Roger S. Pressman, Software Engineering: A Practitioner's Approach, McGraw Hill, Seventh Edition,ISBN: 9339212088, 9789339212087.
4. Hassan Gomaa, Software Modeling And Design UML, Use Cases, Pattern, & Software Architectures, Cambridge University Press, ISBN: 978-0-521-76414-8.
5. JIM Arlow, Ila Neustadt, UML 2 and the Unified Process, Pearson, Second Edition, ISBN: 9788131700549 Tom Pender, UML 2 Bible, Wiley India, ISBN: 9788126504527.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414456A: Elective-I
Wireless Communications

Teaching Scheme:	Credits: 03	Examination Scheme:
TH:03 Hours/Week		In-Sem (Paper): 30 Marks
		End-Sem (paper): 70 Marks

Prerequisites:

1. Foundations of Communication and Computer network.
2. Computer Network Technology.

Course Objectives:

1. To provide fundamental knowledge that forms the basis for wireless communication systems and Networks.
2. For creating foundation of cellular concepts which will be useful for understanding the fundamentals of cellular mobile communication systems design.
3. To provide knowledge about the Mobile Radio Propagation models and various wireless channel effects.
4. To Study various Multiple Access techniques.
5. Give Students the exposure to recent emerging trends in wireless communication like Software Defined Radio as well.
6. To Provide overview of recent trends like wireless communication like Wi-Fi, Wi-MAX, bee, UWB Radio and Wireless Adhoc Networks.

Course Outcomes:

By the end of the course, students should be able to

1. Understand the basics of propagation of radio signals.
2. Understand the basic concepts of basic Cellular System and the design requirements.
3. Have an understanding of the basic principles behind radio resource management techniques such as power control, channel allocation and handoffs.
4. Gain insights into various mobile radio propagation models and how the diversity can be exploited to improve performance.
5. Gain knowledge and awareness of the technologies for how to effectively share spectrum through multiple access techniques i.e. TDMA, CDMA, FDMA etc.
6. Have in-depth understanding of the design consideration and architecture for different Wireless Systems like GSM, CDMA, GPRS etc.
7. Understanding of the emerging trends in Wireless communication like WiFi, WiMAX, Software Defined Radio (SDR) and related issues and challenges.

Unit I	INTRODUCTION TO WIRELESS COMMUNICATION SYSTEM	7 Hrs

Evolution of mobile communications, Mobile Radio System around the world, Types of Wireless Communication System, Comparison of Common wireless system, Trend in Cellular radio and personal communication. Second generation Cellular Networks, Third Generation (3G) Wireless Networks, Wireless Local Loop(WLL),Wireless Local Area network(WLAN), Bluetooth and

Personal Area Networks		
Unit II	**THE CELLULAR CONCEPT- SYSTEM DESIGN FUNDAMENTALS**	**7 Hrs**
Cellular system, Hexagonal geometry cell and concept of frequency reuse, Channel Assignment Strategies Distance to frequency reuse ratio, Channel & co-channel interference reduction factor, S/I ratio consideration and calculation for Minimum Co-channel and adjacent interference, Handoff Strategies, Umbrella Cell Concept, Trunking and Grade of Service, Improving Coverage & Capacity in Cellular System-cell splitting, Cell sectorization, Repeaters, Micro cell zone concept, Channel antenna system design considerations.		
Unit III	**MOBILE RADIO PROPAGATION MODEL, SMALL SCALE FADING AND DIVERSITY**	**7 Hrs**
Large scale path loss: Free Space Propagation loss equation, Path-loss of NLOS and LOS systems, Reflection, Ray ground reflection model, Diffraction, Scattering, Link budget design, Max. Distance Coverage formula, Empirical formula for path loss, Indoor and outdoor propagation models, Small scale multipath propagation, Impulse model for multipath channel, Delay spread, Feher's delay spread, upper bound Small scale, Multipath Measurement parameters of multipath channels, Types of small scale Fading, Rayleigh and rician distribution, Statistical for models multipath fading channels and diversity techniques.		
Unit IV	**MULTIPLE ACCESS TECHNIQUES**	**7 Hrs**
Access Methods: TDMA (TDD and FDMA); Spread-Spectrum Frequency-Hopping; Direct-Sequence CDMA and CSMA. Comparison of Linearly Amplified BPSK, DQPS and DQPSK and Nonlinearly Amplified (NLA) GMSK, GFSK, 4-FM, and FQPSK Radio Equipment (Coherent and Noncoherent). Radio Link Design of Digital Wireless Cellular Systems. Spectrum Utilization in Digital Wireless Mobile Systems. Capacity and Throughput (Message Delay) Study and Comparison of GMSK, GFSK, and FQPSK Modulated Wireless Systems. Time Division Multiple Access Wireless Cellular Systems. Code Division Multiple Access Spread-Spectrum Digital Cellular IS-95 System.		
Unit V	**WIRELESS SYSTEMS**	**7 Hrs**
GSM system architecture, Radio interface, Protocols, Localization and calling, Handover, Authentication and security in GSM, GSM speech coding, Concept of spread spectrum, Architecture of IS-95 CDMA system, Air interface, CDMA forward channels, CDMA reverse channels, Soft handoff, CDMA features, Power control in CDMA, Performance of CDMA System, RAKE Receiver, CDMA2000 cellular technology, GPRS system architecture.		
Unit VI	**RECENT TRENDS**	**7 Hrs**
Introduction to Wi-Fi, WiMAX, ZigBee Networks, Software Defined Radio, UWB Radio, Wireless Adhoc Network and Mobile Portability, Security issues and challenges in a Wireless network.		
Text Books		
1. Rappaport, T.S., "Wireless communications", Second Edition, Pearson Education, 2010. 2. Wireless Communications and Networking, Vijay Garg, Elsevier. 3. Wireless digital communication, KamiloFeher, PHI. 4. Andreas.F. Molisch, "Wireless Communications", John Wiley – India, 20063.		

Reference Books

1. David Tse and PramodViswanath, “Fundamentals of Wireless Communication”, Cambridge University Press, 2005.
2. UpenaDalal, “ Wireless Communication”, Oxford University Press, 2009.
3. Van Nee, R. and Ramji Prasad, “OFDM for wireless multimedia communications”, Artech House, 2000.
4. Mobile Communications Engineering, William C. Y. Lee, McGraw Hill Publications.
5. Mobile and personal Communication system and services by Rajpandya, IEEE press (PHI).
6. Wireless Communications-T.L.Singh-TMH.
7. Adhoc Mobile Wireless network, C.K.Toh Pearson.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414456B: Elective-I
Natural Language Processing

Teaching Scheme:	Credits: 03	Examination Scheme:
TH:03 Hours/Week		In-Sem (Paper): 30 Marks End-Sem (paper): 70 Marks

Prerequisites:

1. Basic understanding of probability theory.
2. Basic knowledge of finite automata.

Course Objectives:

1. To understand the core concepts of Natural language processing and levels of language analysis.
2. To understand the computational properties of natural languages and the commonly used algorithms for processing linguistic information.

Course Outcomes:

By the end of the course, students should be able to

1. Understand automatic processing of human languages using computers.
2. Understand various applications of natural language processing.

Unit I	INTRODUCTION	7 Hrs

Applications of Natural Language Understanding, Evaluating Language Understanding Systems, The Elements of Simple Noun Phrases, Verb Phrases and Simple Sentences, Noun Phrases, Adjective Phrases, Adverbial Phrases.

Unit II	GRAMMARS	7 Hrs

Grammars and Sentence Structure, Top-Down Parser, Bottom-Up Chart Parser, Top-Down Chart Parsing, Finite State Models and Morphological Processing, Feature Systems and Augmented Grammars, Morphological Analysis and the Lexicon, Parsing with Features.

Unit III	EFFICIENT PARSING	7 Hrs

Auxiliary Verbs and Verb Phrases, Noun Phrases and Relative Clauses, Human Preferences in Parsing, Encoding Uncertainty: Shift-Reduce Parsers, A Deterministic Parser, Techniques for Efficient Encoding of Ambiguity, Partial Parsing.

Unit IV	AMBIGUITY RESOLUTION	7 Hrs

Part-of-Speech Tagging, Obtaining Lexical Probabilities, Probabilistic Context-Free Grammars, Best-First Parsing, Semantics and Logical Form, Word Senses and Ambiguity, Encoding Ambiguity in Logical Form, Verbs and States in Logical Form.

Unit V	LINKING SYNTAX AND SEMANTICS	7 Hrs
Semantic Interpretation and Compositionality, Prepositional Phrases and Verb Phrases, Lexicalized Semantic Interpretation and Semantic Roles, Handling Simple Questions, Semantic Interpretation Using Feature Unification, Semantic Filtering Using Selectional Restrictions, Semantic Networks, Statistical Word Sense Disambiguation		
Unit VI	**KNOWLEDGE REPRESENTATION**	**7 Hrs**
Handling Natural Language Quantification, Time and Aspectual Classes of Verbs, Automating Deduction in Logic-Based Representations, Procedural Semantics and Question Answering, Hybrid Knowledge Representations, Using World Knowledge, Establishing Coherence, Matching Against Expectations, Reference and Matching Expectations, Using Knowledge About Action and Casualty.		

Text Books

1. Allen James, Natural Language Understanding, Pearson India, 2nd Edition, ISBN: 9788131708958, 8131708950.
2. James H. Martin, Daniel Jurafsky, Speech and Language Processing,Pearson,1st Edition,ISBN: 9789332518414, 8131716724.

Reference Books

1. M. Christopher, H. Schutze , Foundations of Statistical Natural Language Processing, MIT Press,1st Edition, ISBN:9780262133609.
2. C. Eugene,Statistical Language Learning, MIT Press,1st Edition, ISBN:9780262032162.
3. S. Bird, E. Klein &E. Loper,Natural Language Processing with Python, O' Reilly(Shroff Publishers), 1st Edition,ISBN:9788184047486.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414456C: Elective-I
Usability Engineering

Teaching Scheme:	Credits: 03	Examination Scheme:
TH:03 Hours/Week		In-Sem (Paper): 30 Marks End-Sem (paper): 70 Marks

Prerequisites:

1. Human Computer Interaction.

Course Objectives:

1. To explain usability engineering lifecycle for designing a user-friendly software.
2. Discuss usability design guidelines, their foundations, assumptions, advantages, and weaknesses.
3. To develop usability evaluation skills for software testing.
4. To explain industry standards for designing and evaluating use-interfaces.
5. To make aware of the current trends in usability engineering.

Course Outcomes:

By the end of the course, students should be able to

1. Justify the theory and practice of usability evaluation approaches, methods and techniques.
2. Compare and evaluate strengths and weaknesses of various approaches, methods and techniques for evaluating usability.
3. Design and implement a usability test plan, based on modelling or requirements specification.
4. Choose appropriate approaches, methods and techniques to evaluate the usability of a specified interactive system.

Unit I	INTRODUCTION	7 Hrs

What is Usability: Usability and Other Considerations, Definition of Usability, Example: Measuring the Usability of Icons, Usability Trade-Offs, Categories of Users and Individual User Differences. Generations of User Interfaces: Batch Systems, Line-Oriented Interfaces, Full-Screen Interfaces, Graphical User Interfaces, Next-Generation Interfaces, Long-Term Trends in Usability.

Unit II	THE USABILITY ENGINEERING LIFECYCLE	7 Hrs

The Usability Engineering Lifecycle: Know the User, Competitive Analysis, Goal Setting, Parallel Design, Participatory Design, Coordinating the Total Interface, Guidelines and Heuristic Evaluation, Prototyping, Interface Evaluation, Iterative Design, Follow-Up Studies of Installed Systems, Meta-Methods, Prioritizing Usability Activities, Be Prepared.

Unit III	USABILITY HEURISTICS	7 Hrs

Usability Heuristics: Simple and Natural Dialogue, Speak the Users' Language, Minimize User Memory Load, Consistency, Feedback, Clearly Marked Exits, Shortcuts, Good Error Messages, Prevent Errors, Help and Documentation, Heuristic Evaluation.

Unit IV	USABILITY TESTING	7 Hrs
Usability Testing: Test Goals and Test Plans, Getting Test Users, Choosing Experimenters, Ethical Aspects of Tests with Human, Subjects, Test Tasks, Stages of a Test, Performance Measurement, Thinking Aloud, Usability Laboratories. Usability Assessment Methods beyond Testing: Observation, Questionnaires and Interviews, Focus Groups, Logging Actual Use, User Feedback, Choosing Usability Methods.		
Unit V	**INTERFACE STANDARDS**	**7 Hrs**
Interface Standards: National, International and Vendor Standards, Producing Usable In-House Standards. International User Interfaces: International Graphical Interfaces, International Usability Engineering Guidelines for Internationalization Resource Separation, Multi-locale Interfaces.		
Unit VI	**FUTURE DEVELOPMENTS**	**7 Hrs**
Future Developments: Theoretical Solutions, Technological Solutions, CAUSE Tools: Computer-Aided Usability Engineering, Technology Transfer, Ubiquitous Computing, Intelligent User-interfaces, Simulation and Virtual Reality. Case Study: Usability Issues in Organizations, Organizational Roles and Structures, Ethics of Usability, Web Analytics.		

Text Books

1. Jakob Nielsen, "Usability Engineering", Morgan Kaufmann, An Imprint of Academic Press, Harcourt Science and Technology Company

Reference Books

1. Rosson, M. B., & Carroll, J. M. (2001), "Usability Engineering: Scenario-Based development of human-computer interaction", Elsevier.
2. Mayhew, D. (1999), "The Usability Engineering Lifecycle: A Practitioner's Handbook for user interface design", Morgan Kaufmann.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414456D: Elective-I
Multicore and Concurrent Systems

Teaching Scheme:	Credits: 03	Examination Scheme:
TH:03 Hours/Week		In-Sem (Paper): 30 Marks End-Sem (paper): 70 Marks

Prerequisites:

1. Computer Architecture and Organization.
2. Processor Architecture and Interfacing.
3. Operating System.
4. Programming Language and Problem Solving.

Course Objectives:

1. To understand the multicore and concurrent systems.
2. To understand the multicore and concurrent programming aspects.
3. To understand concept of distributed and shared memory programming.
4. To recognize differences in between different concurrent processing approaches and identifying correct one according to architectural and application needs.
5. To know the applications of multicore and concurrent systems and use its programming concepts for new application development.
6. To explore recent trends in multicore and concurrent system programming.

Course Outcomes:

By the end of the course, students should be able to

1. Know types of parallel machine and to know multicore and concurrent systems in detail.
2. Know the ways to measure the performance of multicore systems.
3. Understand need of multicore and concurrent system programming.
4. Know the different approaches for multicore and concurrent programming.
5. Use and apply the approaches learned, for application development.
6. Understand and explore recent trends in multicore and concurrent system programming.

Unit I	INTRODUCTION	7 Hrs

Information Security Concepts, Security Threats and Vulnerabilities, Security Architectures and Operational Models, Types of Security attacks, Goals of Security, Malicious code, Intrusion detection system (IDS): Need, Types, Limitations and Challenges, security and privacy.

Unit II	MULTICORE AND CONCURRENT PROGRAM DESIGN	7 Hrs

The PCAM methodology, Decomposition patterns: Task parallelism, Divide-and-conquer decomposition.

Geometric decomposition, Recursive data decomposition, Pipeline decomposition, Event-based coordination decomposition, Program structure patterns: Single-program, multiple-data, Multiple-program, multiple-data, Master-worker, Map-reduce, Fork/join, Loop parallelism, Matching decomposition patterns with program structure patterns.

Unit III	SHARED-MEMORY PROGRAMMING: THREADS	7 Hrs

Threads, Design concerns, Semaphores, Applying semaphores in classical problems, Monitors, Applying monitors in classical problems, Dynamic vs. static thread management, Debugging multithreaded applications, Higher-level constructs: multithreaded programming without threads: Concurrent Map, Map-Reduce, Concurrent filter, Filter-reduce.

Unit IV	SHARED-MEMORY PROGRAMMING: OPENMP	7 Hrs

Introduction, OpenMP integration V.0: manual partitioning, OpenMP integration V.1: manual partitioning without a race condition, OpenMP integration V.2: implicit partitioning with locking, OpenMP integration V.3: implicit partitioning with reduction, Loop-level parallelism, Task parallelism, Synchronization constructs, Correctness and optimization issues.

Unit V	DISTRIBUTED MEMORY PROGRAMMING	7 Hrs

Communicating processes, MPI, Core Concepts, Program architecture, Point-to-Point communication, Buffered communications, Non-blocking communications, Error reporting and handling, Collective communications, Communicating objects, Node management: communicators and groups, One-sided communications, I/O considerations, Combining MPI processes with threads, Timing and performance measurements, Debugging and proiling MPI programs, The Boost MPI library.

Unit VI	GPU PROGRAMMING	7 Hrs

CUDA's programming model: threads, blocks, and grids, CUDA's execution model: streaming multiprocessors and warps, CUDA compilation process, Memory hierarchy, Optimization techniques, Dynamic parallelism, Debugging CUDA programs, Proiling CUDA programs, CUDA and MPI.

Text Books

1. Gerassimos Barlas, "Multicore and GPU Programming An Integrated Approach", Morgan Kaufmann, 2015.
2. Max Domeika, "Software Development for Embedded Multi-core Systems: A Practical Guide Using Embedded Intel® Architecture", Elsevier Inc., 2008.
3. Jean Bacon, Janet Van Der Linden, "Concurrent Systems: An Integrated Approach to Operating Systems, Distributed Systems and Database", Addison-Wesley, Edition 2000

Reference Books

1. John L. Hennessey and David A. Patterson, " Computer Architecture – A quantitative approach", Morgan Kaufmann / Elsevier, 4th. Edition.
2. David E. Culler, Jaswinder Pal Singh, "Parallel Computing Architecture : A hardware/ software approach", Morgan Kaufmann / Elsevier. 3. Darryl Gove, "Multicore Application Programming for Windows, Linux, and Oracle Solaris", Pearson, 2011.
3. William Stallings, "Computer Organization and Architecture – Designing for Performance", Pearson Education, Seventh Edition.
4. Dezso Sima, Terence Fountain, Peter Kacsuk "Advanced Computer Architectures" A Design space approach, Pearson Education.
5. Advanced Computer Architecture Parallelism, Scalability – Kai Hwang, Programmability, Tata McGrawhill.
6. 4. Michael J Quinn, "Parallel programming in C with MPI and OpenMP", Tata McGraw

Hill, 2003.
7. Shameem Akhter and Jason Roberts, “Multi-core Programming”, Intel Press, 2006.
8. Roscoe A.W., “Understanding Concurrent Systems”, Springer-Verlag, 2010.

Savitribai Phule Pune University
Fourth Year of Information Technology Engineering (2015 Course)
414456E: Elective-I
Business Analytics and Intelligence

Teaching Scheme:	Credits: 03	Examination Scheme:
TH:03 Hours/Week		In-Sem (Paper): 30 Marks End-Sem (paper): 70 Marks

Prerequisites:

1. Fundamentals of Database Management System.
2. Fundamentals of Discrete mathematics.

Course Objectives:

1. Apply conceptual knowledge on how business intelligence is used within organizations.
2. Evaluate organization's abilities to create and mobilize corporate knowledge.
3. Select software tools for knowledge management systems in business organizations
4. Suggest design systems to provide business intelligence.

Course Outcomes:

By the end of the course, students should be able to

1. Comprehend the Information Systems and development approaches of Intelligent Systems.
2. Evaluate and rethink business processes using information systems.
3. Propose the Framework for business intelligence.
4. Get acquainted with the Theories, techniques, and considerations for capturing organizational intelligence.
5. Align business intelligence with business strategy.
6. Apply the techniques for implementing business intelligence systems.

Unit I	Decision Making and Decision Support Systems	7 Hrs

The role of computerized support for decision making and its importance. Types of decisions managers face, and the process through which they make decisions. Decision making styles, the four stages of Simon's decision making process, and common strategies and approaches of decision makers. The role of Decision Support Systems (DSS), its main components, the various DSS types and classification, and how DSS have changed over time. How DSS supports each phase of decision making and summarize the evolution of DSS applications, and on how they have changed over time.

Unit II	Business Intelligence Concepts and Platform Capabilities	7 Hrs

Definition of business intelligence (BI), BI architecture, and its components, and relation with DSS. The main components of BI platforms, their capabilities, and the competitive landscape of BI platforms. The building blocks of business reports, the types of business reports, and the components and structure of business reporting systems. Role of Mathematical model in BI, Factors Responsible for successful BI Project, Obstacle to Business Intelligence in an Organization Different types of OLAP and their applications, and the differences between OLAP and OLTP.

Unit III	Data Visualization and Dashboard Design	7 Hrs
The top job responsibilities of BI analysts by focusing on creating data visualizations and dashboards. The importance of data visualization and different types of data that can be visually represented. The types of basic and composite charts. This will help you to determine which visualization is most effective to display data for a given data set, and to identify best practices for designing data visualizations. Common characteristics of dashboard, the types of dashboards, and the list attributes of metrics usually included in dashboards. The guidelines for designing dashboard and the common pitfalls of dashboard design.		
Unit IV	**Business Performance Management Systems**	**7 Hrs**
This module focuses on how BI is used for Business Performance Management (BPM). The main components of BPM as well as the four phases of BPM cycle and how organizations typically deploy BPM. The purpose of Performance Measurement System and how organizations need to define the key performance indicators (KPIs) for their performance management system. Four balanced scorecards perspectives and the differences between dashboards and scorecards. The benefits of using balanced scorecard versus using Six Sigma in a performance measurement system.		
Unit V	**Role of Business Intelligence and Analytics in Business**	**7 Hrs**
The role of visual and business analytics (BA) in BI and how various forms of BA are supported in practice. ERP and Business Intelligence, BI Applications in CRM, BI Applications in Marketing, BI Applications in Logistics and Production, Role of BI in Finance, BI Applications in Banking, BI Applications in Telecommunications, BI Applications in Fraud Detection, BI Applications in Retail Industry		
Unit VI	**BI Maturity, Strategy and Modern Trends in BI**	**7 Hrs**
BI maturity and strategy. Different levels of BI maturity, the factors that impact BI maturity within an organization, and the main challenges and the potential solutions for a pervasive BI maturity within an organization. The critical success factors for implementing a BI strategy, BI framework, and BI implementation targets. Open Source BI. Big Data systems. Social BI systems, Geographic BI systems. Customer Experience based BI.		

Text Books

1. Sabherwal, R. and Becerra-Fernandez, I.(2011). Business Intelligence: Practices, Technologies and Management. John Wiley.
2. Turban,E. and Volonino, L.(2011). Information Technology for Managment: Improving Strategic and Operational Performance. 8th edn.Wiley.

Reference Books

1. Avison, D. and Fitzgerald, G. (2006). Information Systems development: Methodologies, techniques and tools. 4th ed. McGraw-Hill.
2. Anderson-Lehman, R., Watson, H.J., Wixom, B.H., & Hoffer, J.A., 2004, Continental Airlines Flies High with Real-Time Business Intelligence, MIS Quarterly Executive, 3, 4, pp 163-176
3. Gangadharan, G.R., & Swami, N., 2004, Business Intelligence Systems: Design and Implementation Strategies, Proceedings of the 2nd International conference on Technology Interfaces, June 7-10, Cavtat, Croatia, pp 139-144

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414457A: Elective-II
Software Defined Networks

Teaching Scheme:	Credits: 03	Examination Scheme:
TH:03 Hours/Week		In-Sem (Paper): 30 Marks End-Sem (paper): 70 Marks

Prerequisites:

1. Prior knowledge of fundamentals of computer network.

Course Objectives:

1. To understand the limitations of the current technology and need and evolution of SDN.
2. To comprehend role of data, control, and management planes and their separation.
3. To recognize how SDN is coupled with the Open Flow protocol and how green ICT can help improve environmental Sustainability.
4. To understand network virtualization and network function virtualization.
5. To know in detail data and control plane in SDN.
6. To study use-cases of SDN.

Course Outcomes:

By the end of the course, students should be able to

1. Acquire fundamental knowledge of SDN exploring the need, characteristics, and architecture of SDN.
2. Recognize OpenFlow protocols and its forwarding, pipeline model.
3. Understand different methodologies for sustainable SDN.
4. Comprehend IT Infrastructure for SDN.
5. Acquiring knowledge of OpenFlow protocols, visualization.

Unit I	INTRODUCTION TO SDN: AN OVERVIEW	7 Hrs

Introduction: The Modern Data Center, Roles and Separation of data, control and management Planes, Advantages and Disadvantages. Need of SDN, Genesis of SDN.
Working of SDN: Fundamental characteristics, SDN Devices, SDN controllers, Applications.

Unit II	OPEN FLOW PROTOCOLS	7 Hrs

Introduction: Definition, OpenFlow architecture, Flow & Group Tables, types,Hybrid Approaches, The OpenFlow forwarding and pipeline model. OpenFlow Advantages and Limitations, OpenFlow Protocol. Use Case:FloodLight, Mininet,

Unit III	NETWORK VIRTUALIZATION (NV)	7 Hrs

Definition, Concepts, Benefits of Network Virtualization, Components of a Virtual Network, Applications, Existing Network Virtualization Framework (VMWare and others), Network as a Service (NaaS).

Unit IV	CONTROL PLANE	7 Hrs
Control Plane: Overview, Existing SDN Controllers including Floodlight and Open Daylight projects. Customization of Control Plane: Switching and Firewall Implementation using SDN Concepts.		
Unit V	**DATA PLANE**	**7 Hrs**
Data Plane: Software-based and Hardware-based; Programmable Network, Hardware. Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs.		
Unit VI	**NETWORK FUNCTIONS VIRTUALIZATION (NFV)**	**7 Hrs**
Introduction: Concepts, Comparison of NFV and NV, Implementation and Applications. Data Center Networks: Packet, Optical and Wireless Architectures, Network Topologies.		

Text Books

1. Thomas D. Nadeau, Ken Gray, SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies, O'Reilly Media, ISBN:10:1-4493-4230-2, 978-1-4493-4230-2.
2. Paul Goransson and Chuck Black, Software Defined Networks: A Comprehensive Approach, Morgan Kaufmann, ISBN: 9780124166752, 9780124166844.

Reference Books

1. Vivek Tiwari, SDN and OpenFlow for Beginners ,Digital Services,10: 1-940686-00-8 13: 978-1-940686-00-4
2. Fei Hu, Network Innovation through OpenFlow and SDN: Principles and Design,CRC Press,ISBN:10: 1466572094
3. Open Networking Foundation (ONF)Documents, https://www.opennetworking.org
4. OpenFlow standards, http://www.openflow.or
5. Online Reading, http://www.nec-labs.com/~lume/sdn-reading-list.html,

Savitribai Phule Pune University

Fourth Year of Information Technology (2015 Course)

414457B: Elective-II

Soft Computing

Teaching Scheme:	Credits: 03	Examination Scheme:
TH:03 Hours/Week		In-Sem (Paper): 30 Marks End-Sem (paper): 70 Marks

Prerequisites:

1. Linear Algebra and Calculus.
2. Probability Theory.

Course Objectives:

1. Identifying Soft computing techniques and their roles in problem solving.
2. Generate an ability to build neural networks for solving real life problems.
3. Conceptualize fuzzy logic and its implementation for various real world applications.
4. Apply evolutionary algorithms and Fuzzy logic to solve the problems.
5. Design soft computing systems by hybridizing various other techniques.

Course Outcomes:

By the end of the course, students should be able to

1. Tackle problems of interdisciplinary nature.
2. Find an alternate solution, which may offer more adaptability, resilience and optimization.
3. Gain knowledge of soft computing domain which opens up a whole new career option.
4. Tackle real world research problems.

Unit I	INTRODUCTION	7 Hrs

Basic concepts of Soft Computing, Historical Developments and Definitions, Soft Computing Characteristics and Problem Solving– Strengths and Weaknesses, Constitutes of Soft Computing : Neural Computing, Fuzzy Logic and Computing, Evolutionary Computing and Genetic Algorithms, Probabilistic Reasoning.

Unit II	NEURAL NETWORKS OVERVIEW	7 Hrs

Fundamentals: Biological Neurons and Model of Artificial Neuron. Neural Network Architectures: Single Layer Network, Multi-Layer Feed Forward Neural Networks, and Feedback Networks. Perceptron Model and Learning in Perceptron, Limitation of Learning in Perceptron, Error Back Propagation learning in Multilayer FFNN. Performance Issues of EBP algorithm for MLFFNN.

Unit III	NEURAL NETWORK ARCHITECTURES	7 Hrs

Complex Architectures Learning: Competitive Learning-Self Organizing Maps, Hebbian Learning-Hopfield Networks, Boltzmann Machines, Adaptive Resonance Theory (ART) Networks, Bayesian Neural Networks, Deep Learning Architecture of Neural Networks, Applications of Neural Networks.

Unit IV	FUZZY LOGIC AND FUZZY SYSTEMS	7 Hrs

Fuzzy Logic, Fuzzy Sets and Operations, Fuzzy Relations, Fuzzy Arithmetic and Fuzzy Measures. Fuzzy to Crisp Conversions: Lambda Cuts for fuzzy sets, Fuzzy Relations, Defuzzification Methods. Fuzzy Rules and Reasoning, Fuzzy Inference Systems, Mamdani Fuzzy Models – Sugeno Fuzzy Models, Applications of Fuzzy Modeling for Decision Making.

Unit V	GENETIC ALGORITHMS	7 Hrs

Introduction, Encoding, Operators of Genetic Algorithm, Basic Genetic Algorithm, Simple GA, Crossover and Mutation, Multi-objective Genetic Algorithm (MOGA). Genetic algorithms in search and optimization, Ant colony optimization (ACO), Particle Swarm Optimization (PSO). Applications of GA for Clustering.

Unit VI	ADVANCES IN SOFT COMPUTING	7 Hrs

Soft Computing Paradigms and Hybrid Approaches. Neuro-Fuzzy modeling, Genetic Algorithm Based Backpropagation Network, Fuzzy logic based Backpropagation, Fuzzy Logic Controlled Genetic Algorithms, Simplified Fuzzy ARTMAP.

Text Books

1. S. N. Sivanandam, S. N. Deepa,Principles of Soft Computing,Wiley publications,2nd Edition, ISBN: 9788126527410.
2. J. S. R. Jang, C. T. Sun, E. Mizutani, Neuro-Fuzzy and Soft Computing- A computational approach to Learning and Machine Intelligence, PHI,1st Edition, ISBN:978-8131792469.

Reference Books

1. David E. Goldberg, Genetic Algorithms, Pearson Education, 2nd Edition, ISBN: 9788120322431, ISBN: 9780201157673.
2. Satish Kumar, Neural Networks - A Classroom Approach, Tata McGraw Hill,2nd Edition, ISBN:1259006166.
3. Timothy J. Ross, Fuzzy Logic with Engineering Applications, Wiley India, 3rd Edition, ISBN: 9788126531264.
4. Samir Roy, Udit Chakroborthy,Introduction to soft computing - neuro-fuzzy and genetic algorithm ,Person Education, 1st Edition.

Savitribai Phule Pune University Fourth Year of Information Technology (2015 Course) 414457C: Elective-II Software Testing and Quality Assurance		
Teaching Scheme: **TH:03 Hours/Week**	**Credits: 03**	**Examination Scheme:** **In-Sem (Paper): 30 Marks** **End-Sem (paper): 70 Marks**

Prerequisites:

1. Software Engineering.

Course Objectives:

1. Learn to apply the testing strategies and methodologies in projects.
2. To understand test management strategies and tools for testing.
3. A keen awareness on the open problems in software testing and maintenance.
4. To explain quality assurance and various tools used in quality management.
5. To learn in detail about various quality assurance models.
6. To understand the audit and assessment procedures to achieve quality.

Course Outcomes:

By the end of the course, students should be able to

1. Test the software by applying testing techniques to deliver a product free from bugs.
2. Investigate the scenario and to select the proper testing technique.
3. Explore the test automation concepts and tools and estimation of cost, schedule based on standard metrics.
4. Understand how to detect, classify, prevent and remove defects.
5. Choose appropriate quality assurance models and develop quality.
6. Ability to conduct formal inspections, record and evaluate results of inspections.

Unit I	SOFTWARE TESTING BASICS	7 Hrs

Testing as an engineering activity, Role of process in software quality, Testing as a process, Basic definitions, Software testing principles, The tester’s role in a software development organization, Origins of defects, Defect classes, The defect repository and test design, Defect examples, Developer / Tester support for developing a defect repository.

Unit II	TESTING TECHNIQUES AND LEVELS OF TESTING	7 Hrs

Using White Box Approach to Test design - Static Testing Vs. Structural Testing, Code Functional Testing, Coverage and Control Flow Graphs, Using Black Box Approaches to Test Case Design, Random Testing, Requirements based testing, Decision tables, State-based testing, Cause-effect graphing, Error guessing, Compatibility testing, Levels of Testing -Unit Testing, Integration Testing, Defect Bash Elimination. System Testing - Usability and Accessibility Testing, Configuration Testing, Compatibility Testing.

Unit II	TESTING TECHNIQUES AND LEVELS OF TESTING	7 Hrs

Using White Box Approach to Test design - Static Testing Vs. Structural Testing, Code Functional Testing, Coverage and Control Flow Graphs, Using Black Box Approaches to Test Case Design,

Random Testing, Requirements based testing, Decision tables, State-based testing, Cause-effect graphing, Error guessing, Compatibility testing, Levels of Testing -Unit Testing, Integration Testing, Defect Bash Elimination. System Testing - Usability and Accessibility Testing, Configuration Testing, Compatibility Testing.

Unit III	SOFTWARE TEST AUTOMATION AND QUALITY METRICS	

Software Test Automation, Skills needed for Automation, Scope of Automation, Design and Architecture for Automation, Requirements for a Test Tool, Challenges in Automation Tracking the Bug, Debugging. Testing Software System Security - Six-Sigma, TQM - Complexity Metrics and Models, Quality Management Metrics, Availability Metrics, Defect Removal Effectiveness, FMEA, Quality Function Deployment, Taguchi Quality Loss Function, Cost of Quality.

Unit IV	FUNDAMENTALS OF SOFTWARE QUALITY ASSURANCE	7 Hrs

SQA basics, Components of the Software Quality Assurance System, software quality in business context, planning for software quality assurance, product quality and process quality, software process models, 7 QC Tools and Modern Tools.

Unit V	QUALITY ASSURANCE MODELS	7 Hrs

Models for Quality Assurance, ISO-9000 series, CMM, CMMI, Test Maturity Models, SPICE, Malcolm Baldrige Model- P-CMM.

Unit VI	SOFTWARE QUALITY ASSURANCE TRENDS	7 Hrs

Software Process- PSP and TSP, OO Methodology, Clean-room software engineering, Defect Injection and prevention, Internal Auditing and Assessments, Inspections & Walkthroughs, Case Tools and their Affect on Software Quality.

Text Books

1. Srinivasan Desikan, Gopalaswamy Ramesh,Software Testing: Principles and Practices Pearson.
2. Daniel Galin, Software Quality Assurance: From Theory to Implementation, Pearson Addison Wesley.

Reference Books

1. Aditya P. Mathur, Foundations of Software Testing, Pearson.
2. Paul Ammann, Jeff Offutt, Introduction to Software Testing, Cambridge University Press.
3. Paul C. Jorgensen, Software Testing: A Craftsman's Approach, Auerbach Publications.
4. William Perry, Effective Methods of Software Testing, Wiley Publishing, Third Edition.
5. Renu Rajani, Pradeep Oak, Software Testing – Effective Methods, Tools and Techniques, Tata McGraw Hill.
6. Stephen Kan, Metrics and Models in Software Quality, Addison – Wesley, Second Edition.
7. S.A.Kelkar, Software quality and Testing, PHI Learing, Pvt, Ltd.
8. Watts S Humphrey, Managing the Software Process ,Pearson Education Inc.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414457D: Elective-II
Compiler Construction

Teaching Scheme:	Credits: 03	Examination Scheme:
TH:03 Hours/Week		In-Sem (Paper): 30 Marks End-Sem (paper): 70 Marks

Prerequisites:

1. Fundamentals of System Programming.
2. Computer Organization and architecture.
3. Processor Architecture and Interfacing.
4. Fundamentals of Data Structures, Data Structures and Files.
5. Theory of Computation: DFA, NFA, Regular expressions, Grammars

Course Objectives:

1. The aim of this module is to show how to apply the theory of language translation introduced in the prerequisite courses to build compilers and interpreters.
2. It covers the building of translators both from scratch and using compiler generators. In the process, the module also identifies and explores the main and advanced issues of the design of translators.
3. The construction of a compiler/interpreter for a small language is a necessary component of this module, so students can obtain the necessary skills

Course Outcomes:

By the end of the course, students should be able to

1. Understand the structure of compilers.
2. Understand the basic and advanced techniques used in compiler construction.
3. Understand the basic data structures used in compiler construction such as abstract syntax.
4. Cognitive skills (thinking and analysis)- Design and implement a compiler using a software engineering approach.
5. Communication skills (personal and academic).
6. Practical and subject specific skills (Transferable Skills) - Use generators (e.g. Lex and Yacc).

Unit I	FUNDAMENTALS OF COMPILATION	7 Hrs

Lexical Analysis: Input buffering, Regular Expression, Automata; Parsing: [Limited to] Context free grammar, Predictive parser, LR parsing, Parser generator, error recovery; Syntax and semantics analysis: [Limited to] S and L attributes, dependency graph, DAG and Activation records.

Unit II	MEMORY UTILIZATION	7 Hrs

Intermediate representations, translation into trees, canonical trees, taming conditional branches, algorithms for instruction selection; Register allocation: coloring by simplification, coalescing, precolored nodes, graph coloring implementation, register allocation for trees;

Garbage collection: Mark-and-sweep collection, copying, generational collection, incremental collection, Baker's algorithm, Interface to the compiler.		
Unit III	**OBJECT ORIENTED AND FUNCTIONAL PROGRAMMING LANGUAGE**	**7 Hrs**
Classes, single inheritance of data field, multiple inheritance, testing class membership, private fields and methods, classless languages, optimizing object oriented programs; Functional Language: closure, Immutable variables, Inline expansion, closure conversion, efficient tail recursion, lazy evaluation.		
Unit IV	**POLYMORPHIC TYPES AND DATA FLOW ANALYSIS**	**7 Hrs**
Representation of polymorphic variables, parametric polymorphism, type inference, resolution of static overloading, Data flow analysis: Intermediate representation for flow analysis, various data flow analysis, transformations using data flow analysis, methods/mechanisms for speeding up data flow analysis, alias analysis.		
Unit V	**STATIC SINGLE ASSIGNMENT FORM**	**7 Hrs**
Loop Optimization: Dominators, loop invariant computations, induction variables, array-bounds check, loop unrolling; SSA: Definition of SSA, Informal Semantics of SSA, Comparison with Classical Data-flow Analysis, SSA in Context, Benefits of SSA, Fallacies about SSA, Properties: Preliminaries, Def-Use and Use-Def Chains, Minimality, Optimization algorithms using SSA, converting to and back from SSA form, control dependency.		
Unit VI	**PIPELINING AND SCHEDULING**	**7 Hrs**
Loop scheduling without resource bound, resource bounded loop pipelining, branch prediction, cache organization and block alignment, loop interchange, blocking and garbage collection. Modern Compiler in ML: ML-Lex, ML-YACC,Tiger Compiler.		

Text Books

1. Andrew W Appel, Modern compiler implementation in C, Cambridge University, Press,4TH, ISBN:0 521 58390 X.

Reference Books

2. J. Singer,Static Single Assignment Book, Springer,1st Edition.
3. Russell Jesse **,** Static Single Assignment Form, Springer, ISBN: 10: 5508387455.
4. B. Alpern, M. N. Wegman, and F. K. Zadeck, Detecting Equality of Variables in Programs. Proceedings of the Fifteenth Annual ACM Symposium on Principles of Programming Languages, ACM.
5. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, Compilers Principles, Techniques and Tools, Addison Wesley, Low Price Edition, ISBN: 981–235–885 – 4.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414457E: Elective-II
Gamification

Teaching Scheme:	Credits: 03	Examination Scheme:
TH:03 Hours/Week		In-Sem (Paper): 30 Marks End-Sem (paper): 70 Marks

Prerequisites:

1. Discrete Structures.

Course Objectives:

1. To develop problem solving abilities using gamification.
2. Students will understand gamification paradigm.

Course Outcomes:

By the end of the course, students should be able to

1. Write programs to solve problems using gamification and open source tools.
2. Apply gamification for Mobile and Web Applications.
3. Solve problems for multi-core or distributed, concurrent/Parallel environments.

Unit I	Gaming Foundations	7 Hrs

Introduction: Definition of Gamification, Why Gamify, Examples and Categories, Gamification in Context, Resetting Behavior, Replaying History, Gaming foundations: Fun Quotient, Evolution by loyalty, status at the wheel, the House always wins.

Unit II	Developing Thinking	7 Hrs

Re-framing Context: Communicology, Apparatus, and Post-history, Concepts Applied to Video games and Gamification, Rethinking 'playing the game' with Jacques Henriot, To Play Against: Describing Competition in Gamification, Player Motivation: Powerful Human Motivators, Why People Play, Player types, Social Games, Intrinsic verses Extrinsic Motivation, Progression to Mastery. Case studies for Thinking: Tower of Hanoi.

Unit III	Opponent Moves in Gamification	7 Hrs

Reclaiming Opposition: Counter gamification, Gamed Agencies: Affectively Modulating Our Screen-and App-Based Digital Futures, Remodeling design, Game Mechanics, Designing for Engagement, Case study of Maze Problem.

Unit IV	Game Design	7 Hrs

Game Mechanics and Dynamics: Feedback and Re-enforcement, Designing for engagement Game Mechanics in depth, Putting it together, Case study of 8 queen’s problem.

Unit V	Advanced tools, techniques	7 Hrs

Gamification case Studies, Coding basic game Mechanics

Unit VI	Applications	7 Hrs

Instant Gamification Platforms, Mambo.io (Ref:http://mambi.io), Installation and use of BigDoor (OpenSourcehttp://bigdoor.com),ngageoint/gamification-server(ref:https://github.com/ngageoint/ gamification-server).

Text Books

1. Mathias Fuchs, Sonia Fizek, Paolo Ruffino, Niklas Schrape, Rethinking Gamification.
2. http://meson.press/books/rethinking-gamification, Meson Press, First Edition,ISBN:978-3-95796-001-6.
3. Gabe Zechermann, Christopher Cunningham Gamification by Design, Oreilly media, First, ISBN: 978-1-449-39767-8.

Reference Books

1. Susan Jacobs, Getting Gamification Right, The eLearning Guild, First.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414458: Computer Laboratory VII

Teaching Scheme:	Credits:02	Examination Scheme:
Practical:04 Hours/Week		TW:50 Marks PR: 50 Marks

Prerequisites:

Knowledge of Programming Languages

1. Java.
2. R.
3. Python.
4. C++.

Course Objectives:

1. To Understand the Security issues in networks and Applications software.
2. To understand the machine learning principles and analytics of learning algorithms.

Course Outcomes:

By the end of the course, students should be able to

1. The students will be able to implement and port controlled and secured access to software systems and networks.
2. The students will be able to build learning software in various domains.

List of Laboratory Assignments
PART –A (ICS) – (All Mandatory)

Assignment 1

Write a program in C++ or Java to implement RSA algorithm for key generation and cipher verification.

Assignment 2

Develop and program in C++ or Java based on number theory such as Chinese remainder.

Assignment 3

Write a program in C++ or java to implement SHA1 algorithm using libraries (API)

Assignment 4

Configure and demonstrate use of vulnerability assessment tool such as Snort tool for intrusion or SSL Web security.

PART –B (MLA) (Any Six)

Assignment 1

Study of platform for Implementation of Assignments

Download the open source software of your interest. Document the distinct features and functionality of the software platform. You may choose WEKA and R and Python

Assignment 2

Supervised Learning - Regression (Using R) Generate a proper 2-D data set of N points. Split the data set into Training Data set and Test Data set. i) Perform linear regression analysis with Least Squares Method. ii) Plot the graphs for Training MSE and Test MSE and comment on Curve Fitting and Generalization Error. iii) Verify the Effect of Data Set Size and Bias-Variance Tradeoff. iv) Apply Cross Validation and plot the graphs for errors. v) Apply Subset Selection Method and plot the graphs for errors. vi) Describe your findings in each case
Assignment 3
Create Association Rules for the Market Basket Analysis for the given Threshold. (Using R)
Assignment 4
Implement K-Means algorithm for clustering to create a Cluster on the given data.(Using Python)
Assignment 5
Implement SVM for performing classification and find its accuracy on the given data. (Using Python)
Assignment 6
Creating & Visualizing Neural Network for the given data. (Using Python)
Assignment 7
On the given data perform the performance measurements using Simple Naïve Bayes algorithm such as Accuracy, Error rate, precision, Recall, TPR,FPR,TNR,FPR etc. (Using Weka API through JAVA)
Assignment 8
Principal Component Analysis-Finding Principal Components, Variance and Standard Deviation calculations of principal components.(Using R)
Reference Books
1. Open source software-WEKA and R and Python. 2. JAVA 6.1 or more (for RJava Package). 3. Dr. Mark Gardener, Beginning R The Statistical Programming Language, ISBN: 978-81-2654120-1, Wiley India Pvt. Ltd. 4. Jason Bell, “Machine Learning for Big Data Hands-On for Developers and Technical Professionals”, ISBN: 978-81-265-5337-2-1, Wiley India Pvt. Ltd.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414459: Computer Laboratory VIII

Teaching Scheme:	Credits:02	Examination Scheme:
Practical:04 Hours/Week		TW:50 Marks OR: 50 Marks

Prerequisites:
1. Problem Solving & Object-Oriented Programming.
2. Software Engineering and Project Management.

Course Objectives:
1. To teach the student Unified Modeling Language (UML 2.0), in terms of "how to use" it for the purpose of specifying and developing software.
2. To teach the student how to identify different software artifacts at analysis and design phase.
3. To explore and analyze use case modeling.
4. To explore and analyze domain/ class modeling.
5. To teach the student Interaction and Behavior Modeling.
6. To Orient students with the software design principles and patterns.

Course Outcomes:
By the end of the course, students should be able to
1. Draw, discuss different UML 2.0 diagrams, their concepts, notation, advanced notation, forward and reverse engineering aspects.
2. Identify different software artifacts used to develop analysis and design model from requirements.
3. Develop use case model.
4. Develop, implement analysis model and design model.
5. Develop, implement Interaction and behavior Model.
6. Implement an appropriate design pattern to solve a design problem.

List of Laboratory Assignments

Assignment 1: Write Problem Statement for System / Project

Identify Project of enough complexity, which has at least 4-5 major functionalities.
Identify stakeholders, actors and write detail problem statement for your system.

Assignment 2: Prepare Use Case Model

Identify Major Use Cases, Identify actors.
Write Use Case specification for all major Use Cases.
Draw detail Use Case Diagram using UML2.0 notations.

Assignment 3: Prepare Activity Model

Identify Activity states and Action states.
Draw Activity diagram with Swim lanes using UML2.0 Notations for major Use Cases

Assignment 4: Prepare Analysis Model-Class Model

Identify Analysis Classes and assign responsibilities.
Prepare Data Dictionary.

Draw Analysis class Model using UML2.0 Notations. Implement Analysis class Model-class diagram with a suitable object oriented language
Assignment 5: Prepare a Design Model from Analysis Model
Study in detail working of system/Project. Identify Design classes/ Evolve Analysis Model. Use advanced relationships. Draw Design class Model using OCL and UML2.0 Notations. Implement the design model with a suitable object-oriented language.
Assignment 6: Prepare Sequence Model.
Identify at least 5 major scenarios (sequence flow) for your system. Draw Sequence Diagram for every scenario by using advanced notations using UML2.0 Implement these scenarios by taking reference of design model implementation using suitable object-oriented language.
Assignment 7: Prepare a State Model
Identify States and events for your system. Study state transitions and identify Guard conditions. Draw State chart diagram with advanced UML 2 notations. Implement the state model with a suitable object-oriented language
Assignment 8: Identification and Implementation of GRASP pattern
Apply any two GRASP pattern to refine the Design Model for a given problem description Using effective UML 2 diagrams and implement them with a suitable object oriented language
Assignment 9: Identification and Implementation of GOF pattern
Apply any two GOF pattern to refine Design Model for a given problem description Using effective UML 2 diagrams and implement them with a suitable object oriented language
Reference Books
1. UML2 Bible by Tom Pender, Wiley India Pvt. Limited 2011 2. Applying UML and Patterns Second Edition by Craig Larman, Pearson Education 3. UML 2 and the Unified Process, Second Edition, JIM Arlow, Ila Neustadt, Pearson 4. Design Patterns: Elements of Reusable Object Oriented Software, Erich Gamma, Pearson 5. Design Patterns in Java Second Edition by Steven John Metsker, Pearson All the assignments should be conducted on Latest version of Open Source Operating Systems, tools and Multi-core CPU supporting Virtualization and Multi-Threading.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414460: Project Phase-I

Teaching Scheme:	Credits:02	Examination Scheme:
TUT:02 Hours/Week		OR:50 Marks

Prerequisites:

1. Project Based Seminar.

Course Objectives:

1. Student should be able implement their ideas/real time industrial problem/ current applications from their engineering domain.
2. Students should be able to develop plans with help of team members to achieve the project's goals.
3. Student should be able to break work down into tasks and determine appropriate procedures.
4. Student should be able to estimate and cost the human and physical resources required, and make plans to obtain the necessary resources.
5. Student should be able allocate roles with clear lines of responsibility and accountability and learn team work ethics.
6. Student should be able to apply communication skills to effectively promote ideas, goals or products.

Course Outcomes:

By the end of the course, students should be able to

1. To show preparedness to study independently in chosen domain of Information Technology and programming languages and apply their acquired knowledge to variety of real time problem scenarios.
2. To function effectively as a team to accomplish a desired goal.
3. An understanding of professional, ethical, legal, security and social issues and responsibilities related to Information Technology Project.

Contents

Project Based Seminar (PBS) helped students to gather, organize, summarize and interpret technical literature with the purpose of formulating a project proposal in third year. Students had also submitted a technical report summarizing state-of-the-art on an identified domain and topic in third year. B.E. Projects can be application oriented and/or will be based on some innovative/ theoretical work. In Project Phase-I the student will undertake project over the academic year, which will involve the analysis, design of a system or sub system in the area identified earlier in the field of Information Technology and Computer Science and Engineering. In some cases; if earlier identified project is not feasible; a new topic must be formulated in consultation with the guide and project coordinator. The project will be undertaken preferably by a group of 3-4 students who will jointly work and Implement the project. The group will select a project which is based on seminar delivered in relevant domain in Project based Seminar activity with approval from a committee formed by the department of senior faculty to check the feasibility and approve the topic.

Guidelines for Students and Faculty

- The Head of the department/Project coordinator shall constitute a review committee for project group; project guide would be one member of that committee by default.
- There shall be two reviews in Project phase –I in semester-I by the review committee.
- The Project Review committee will be responsible for evaluating the timely progress of the projects.
- As far as possible Students should finalize the same project title taken for Project Based Seminar (PBS).
- Student should Identify Project of enough complexity, which has at least 4-5 major functionalities
- Student should identify stakeholders, actors and write detail problem statement for system
- Review committee should revisit "Feasibility Review" conducted by Examiners during Oral examination in Third year in first week after commencement of the term.
- Review committee should finalize the scope of the project.
- If change in project topic is unavoidable then the students should complete the process of
- Project approval by submitting synopsis along with the review of important papers. This new
- Project topic should be approved by review committee.
- The students or project group shall make presentation on the progress made by them before the committee.
- The record of the remarks/suggestions of the review committee should be properly maintained and should be made available at the time of examination.
- Each student/group is required to give presentation as part of review for 10 to 15 minutes followed by a detailed discussion.
- Students should Revisit and Reassess the problem statement mentioned in the project-based seminar activity.

Review 1: Synopsis –

Deliverables:

1. The precise problem statement/title based on literature survey and feasibility study.
2. Purpose, objectives and scope of the project.
3. List of required hardware, software or other equipment for executing the project, test Environment/tools, cost and human efforts in hours.
4. System overview- proposed system and proposed outcomes.
5. Architecture and initial phase of design (DFD).
6. Project plan 1.0.

Review 2: SRS –

Deliverables:

1. SRS and High level design
2. Detail architecture/System design/algorithms/techniques
3. At least 30-40% coding documentation with at least 3 to 4 working modules
4. Test Results
5. Project plan 2.0

One paper should be published in reputed International conference/International journal based on project work done.

Project report contains the details as Follows:
Contents
List of Abbreviations
List of Figures
List of Graphs
List of Tables

1. Introduction and aims/motivation and objectives
2. Literature Survey
3. Problem Statement/definition
4. Project Requirement specification
5. Systems Proposed Architecture
6. High level design of the project(DFD/UML)
7. System implementation-code documentation-algorithm, methodologies, protocols used.
8. GUI/Working modules/Experimental Results
9. Project Plan
10. Conclusions
11. Bibliography in IEEE format

Appendices

A. Plagiarism Report of Paper and Project report from any open source tool
B. Base Paper(s)
C. Tools used
D. Papers Published/Certificates

- Use appropriate plagiarism tools, reference managers, Latex Lyx/latest Word for efficient and effective project writing.

Term Work:

- The term work will consist of a report and presentation prepared by the student on the project allotted to them.

Reference Books

1. UML2 Bible by Tom Pender, Wiley India Pvt. Limited 2011
2. Applying UML and Patterns Second Edition by Craig Larman, Pearson Education
3. UML 2 and the Unified Process, Second Edition, JIM Arlow, Ila Neustadt, Pearson
4. Design Patterns: Elements of Reusable Object Oriented Software, Erich Gamma, Pearson
5. Design Patterns in Java Second Edition by Steven John Metsker, Pearson

All the assignments should be conducted on Latest version of Open Source Operating Systems, tools and Multi-core CPU supporting Virtualization and Multi-Threading

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414461: Audit Course-V

In addition to credits, it is recommended that there should be audit course in preferably in each semester from second year to supplement their knowledge and skills. Student will be awarded the bachelor‘s degree if he/she earns credits and clears all the audit courses specified in the syllabus. The student may opt for one of the audit courses per semester, starting in second year first semester. Though not mandatory, such a selection of the audit courses helps the learner to explore the subject of interest in greater detail resulting in achieving the very objective of audit course's inclusion. List of options offered is provided. Each student has to choose one audit course from the list per semester. Evaluation of audit course will be done at institute level itself. Method of conduction and method of assessment for audit courses are suggested.

Criteria

The student registered for audit course shall be awarded the grade PP and shall be included such grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory in-semester performance and secured a passing grade in that audit course. No grade points are associated with this 'PP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA.

Guidelines for Conduction and Assessment (Any one or more of following but not limited to)

1. Lectures/ Guest Lectures
2. Visits (Social/Field) and reports
3. Demonstrations
4. Surveys
5. Mini Project
6. Hands on experience on Specific focused topic

Guidelines for Assessment (Any one or more of following but not limited to)

1. Written Test
2. Demonstrations/ Practical Test
3. Presentations
4. IPR/Publication
5. Report

Audit Course V Options

Course Code	Audit Course Title
414461A	1. Emotional Intelligence
414461B	2. Green Computing
414461C	3. Critical Thinking
414461D	4. Statistical Learning model using R.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414461A: Audit Course-V
Emotional Intelligence

This Emotional Intelligence (EI) training course will focus on the five core competencies of emotional intelligence: self-awareness, self-regulation, motivation, empathy and interpersonal skills. Participants will learn to develop and implement these to enhance their relationships in work and life by increasing their understanding of social and emotional behaviors, and learning how to adapt and manage their responses to particular situations. Various models of emotional intelligence will be covered.

Course Objectives:

1) To develop an awareness of EI models.
2) To recognize the benefits of EI.
3) To understand how you use emotion to facilitate thought and behaviour.
4) To know and utilize the difference between reaction and considered response.

Course Outcomes:

By the end of the course, students should be able to,

1) Expand your knowledge of emotional patterns in yourself and others.
2) Discover how you can manage your emotions, and positively influence yourself and others.
3) Build more effective relationships with people at work and at home.
4) Positively influence and motivate colleagues, team members, and managers.
5) Increase your leadership effectiveness by creating an atmosphere that engages others.
6) Apply EI behaviours and supports high performance.

Unit I	Introduction to Emotional Intelligence (EI)

Emotional Intelligence and various EI models, The EQ competencies of self-awareness, self-regulation, motivation, empathy, and interpersonal skills, Understand EQ and its importance in life and the workplace

Unit II	Know and manage your emotions

Emotions, The different levels of emotional awareness, Increase your emotional knowledge of yourself, Recognize 'negative' and 'positive' emotions. The relationship between emotions, thought and behavior, Discover the importance of values, The impact of not managing and processing 'negative' emotions, Techniques to manage your emotions in challenging situations.

Unit III	Recognize Emotions in others

The universality of emotional expression, Learn tools to enhance your ability to recognize and appropriately respond to others' emotions, Perceiving emotions accurately in others to build empathy 4

Unit IV	Relate to others

Applying EI in the workplace, the role of empathy and trust in relationships, Increase your ability to create effective working relationships with others (peers, subordinates, managers, clients, Find out how to deal with conflict, Tools to lead, motivate others and create a high performing team.

Books

1) Daniel Goleman," Emotional Intelligence – Why It Matters More Than IQ," Bantam Books.

2) ISBN-10: 055338371X13: 978-0553383713 2. Steven Stein, “The EQ Edge”, Jossey-Bass, ISBN: 978-0-470-68161-9.
3) Drew Bird, “The Leader’s Guide to Emotional Intelligence”, ISBN: 9781535176002.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414461B: Audit Course-V
Green Computing

Green computing is the study and practice of using computing resources efficiently. Green computing or green IT, refers to environmentally sustainable computing or IT. The goals of green computing are similar to green chemistry; reduce the use of hazardous materials, Maximize energy efficiency during the product's lifetime, and promote the recyclability or biodegradability of defunct products and factory waste.

Course Objectives:

1) To acquire knowledge to adopt green computing practices to minimize negative impacts on the environment.
2) To examine technology tools that can reduce paper waste and carbon footprint by user.
3) To understand how to minimize equipment disposal requirements.
4) To gain skill in energy saving practices in their use of hardware.

Course Outcomes:

By the end of the course, students should be able to,

1) Understand the concept of green IT and relate it to sustainable development.
2) Apply the green computing practices to save energy.
3) Discuss how the choice of hardware and software can facilitate a more sustainable operation.
4) Use methods and tools to measure energy consumption.

Unit I	**Fundamentals of Green IT**

Green IT Fundamentals: Business, IT, and the Environment – Green computing: carbon foot Print - Measuring, Details, reasons to bother, Plan for the Future, Cost Savings: Hardware, Power.

Unit II	**Green Assets and Power Problems**

Green Assets: Buildings, Data Centers, Networks, and Devices, Green Information Systems : Design and Development Models, Monitoring Power Usage, Servers, Low-Cost Options, Reducing Power Use, Data De-Duplication, Low-Power Computers and peripheral devices.

Unit III	**Green Information Systems**

Initial Improvement Calculations, Selecting Metrics, Tracking Progress, Change Business Processes, Customer Interaction, Paper Reduction, Green Supply Chain, Improve Technology Infrastructure, Reduce PCs and Servers, Shared Services, Hardware Costs, Cooling.

Unit IV	**Green Grid Framework**

Virtualizing of IT systems, Role of electric utilities, Telecommuting, teleconferencing and teleporting, Materials recycling, Best ways for Green PC, Green Data center Case Studies, Applying Green IT Strategies and Applications to a Home Hospital, Packaging Industry and Telecom Sector.

Reference Books

1. Woody Leonhard, Katherrine Murray, “Green Home computing for dummies”, August2009, ISBN: 978-0-470-46745-9

2. Alvin Galea, Michael Schaefer, Mike Ebbers, “Green Data Center: steps for the Journey”,

Shoff/IBM rebook, 2011. ISBN: 10: 1-933742-05-4; 13: 978-1-933742-05-2
3. John Lamb, "The Greening of IT", Pearson Education, 2009, ISBN 10: 0137150830
4. Jason Harris, "Green Computing and Green IT- Best Practices on regulations & industry",Lulu.com, 2008, ISBN: 1558604898.
5. Bud E. Smith, "Green Computing Tools and Techniques for Saving Energy, Money and Resources", CRC Press, 2014, 9781466503403

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414461C: Audit Course-V
Critical Thinking

Thinking about one's thinking in a manner designed to organize and clarify, raise the efficiency of, and recognize errors and biases in one's own thinking. Critical thinking is not 'hard' thinking nor is it directed at solving problems (other than 'improving' one's own thinking). Critical thinking is inward-directed with the intent of maximizing the rationality of the thinker. One does not use critical thinking to solve problems—one uses critical thinking to improve one's process of thinking.

Course Objectives:

1) Critical thinking is considered among the most important “higher order cognitive skills” expected from students graduating with professional degrees (e.g. engineering, management, etc.)
2) This course will make you a better thinker; it will sharpen your mind, clarify your thoughts, and help you make smarter decisions (especially about your career). It will help you argue assertively and hence make you a forceful communicator – both in public speaking and in one-on-one situations.
3) Most employers complain that fresh graduates need too much of direction and they are incapable of “independent decision making”. We intend to overcome this shortcoming

Course Outcomes:

By the end of the course, students should be able to,

1) If students whole-heartedly participate in the course, they can expect to be smarter, stronger and more confident thinkers.
2) They can embark on a life-long journey of “self-directed learning”.

Unit I	**Introduction to Critical Thinking**

What is Critical Thinking o It’s role in problem solving o The difference between a critical thinker and one who is not, Barriers that prevent us from thinking critically

Unit II	**Importance of being logical**

Key concepts of “Thinking fast and slow” - Logical fallacies & Mistakes we make when do not think “statistically”

Unit III	**Pattern in deductive logic**

Hypothetical syllogism - Categorical syllogism(Set theory concepts), Argument by elimination, based on maths, based on definition, Evaluating deductive arguments validity & soundness

Unit IV	**Argumentation – Foundation of Critical Thinking**

Recognizing arguments and their structural components & indicator words Analysis of arguments, Categorical logic - VENN Diagrams to test logical “validity”, Propositional logic - Complex statements & arguments, Truth Tables – to test validity of complex statements

Reference Books

1) “Thinking Fast and Slow”- Daniel Kahneman – Penguin Books.
2) “Critical Thinking – Students Introduction” - Bassham, Irwin, Nardone, Wallace – McGraw Hill.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414461D: Audit Course-V
Statistical Learning Model using R

Statistical learning theory is a framework for machine learning drawing from the fields of statistics and functional analysis Statistical learning theory deals with the problem of finding a predictive function based on data. Statistical learning theory has led to successful applications in fields such as computer vision, speech recognition, bioinformatics and baseball.

Course Objectives:

1) To get familiar with the explosion of “Big Data” problems, statistical learning /machine learning has become a very hot field.
2) To learn statistical learning and modelling skills which are in high demand also cover basic concepts of statistical learning / modelling methods that have widespread use in business and scientific research.
3) To get hands on the applications and the underlying statistical / mathematical concepts that are relevant to modelling techniques. The course are designed to familiarize students in implementing the statistical learning methods using the highly popular statistical software package R.

Course Outcomes:

By the end of the course, students should be able to,

1) Students will be familiar with concepts related to “data science”, ”analytics”, “machine learning”, etc. These are important topics, and will enable students to embark on highly rewarding careers.
2) Students will capable of learning “big data” concepts on their own

Unit I	**Introduction to Statistical Learning**
What is Statistical Learning, Various issues to consider while “modeling”	
Unit II	**Getting started with R programming**
Introduction to the R-Studio, user-interface, Basic commands, Data Structures in R, Graphics, Reading data into R.	
Unit III	**Linear Regression models including Lab**
Instructor should select a problem statement and design the assignment for Linear Regression.	
Unit IV	**Classification models (Logistic Regression and LDA) with Lab**
Instructor should select a problem statement and design the assignment for Logistic Regression and LDA.	
Unit VI	**Tree based methods (regression trees, classification tree) with Lab**
Instructor should select a problem statement and design the assignment for Tree based methods (regression trees, classification tree) with lab.	

Reference Books

1) An Introduction to Statistical Learning with Applications in R Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani – 6th edition- Springer Publications.

SEMESTER-II

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414462: Distributed Computing System

Teaching Scheme:	Credits: 03	Examination Scheme:
TH:03 Hours/Week		In-Sem (Paper): 30 Marks End-Sem (paper): 70 Marks

Prerequisites:

1. Web Technology.
2. Computer Network Technology.
3. Operating System.

Course Objectives :

1. To understand the fundamentals and knowledge of the architectures of distributed systems.
2. To gain knowledge of working components and fault tolerance of distributed systems
3. To make students aware about security issues and protection mechanism for distributed environment.

Course Outcomes :

By the end of the course, students should be able to

1. Understand the principles and desired properties of distributed systems based on different application areas.
2. Understand and apply the basic theoretical concepts and algorithms of distributed systems in problem solving.
3. Recognize the inherent difficulties that arise due to distributed-ness of computing resources.
4. Identify the challenges in developing distributed applications

UNIT I	FUNDAMENTALS AND ARCHITECTURES	7 Hrs

Introduction: Characteristics and examples of distributed systems, Design goals, Types of distributed systems, Trends in distributed systems, Focus on Resource Sharing, Challenges. Architectures: Architectural styles, middleware and middleware organization, system architectures, Example architectures.

Case Study: The World Wide Web

UNIT II	COMMUNICATION AND COORDINATION	7 Hrs

Communication: Introduction, Layered protocols , Types of communication, Inter-process Communication, Remote Procedure Call (RPC), Message oriented communication, Multicast Communication, Network Virtualization: Overlay Network Coordination: Clock Synchronization, Logical Clocks, Mutual Exclusion, Election algorithms, Distributed event matching, Gossip Based coordination

Case Study: IBM's Websphere Message-Queuing System

UNIT III	REPLICATION AND FAULT TOLERANCE	7 Hrs

Replication: Reasons for replication, Replica management, Failure masking and replication, Consistency protocols, Catching and replication in web,Fault Tolerance: Introduction, Failure models, Fault systems with arbitrary failures, Reliable client server communication, Reliable group communication, Distributed commit, Recovery, Checkpoints.

Case Study: Catching and Replication in Web

UNIT IV	DISTRIBUTED FILES AND MULTIMEDIA SYSTEMS	7 Hrs

Distributed File Systems: Introduction, File System Architecture, Sun Network File System, and HDFS. Name Services: Introduction, Name Services and the Domain Name System, Directory Services.

Case Study- 1: The Global Name Service, 2. The X.500 Directory Service.

Distributed Multimedia Systems: Characteristics of Multimedia Data, Quality of Service Management, Resource management, Stream Adaptation.

Case Study: BitTorrent and End System Multicast.

UNIT V	DISTRIBUTED WEB BASED SYSTEM	7 Hrs

Architecture of Traditional Web-Based Systems, Apache Web Server, Web Server Clusters, Communication by Hypertext Transfer Protocol, Synchronization, Web Proxy Caching, Replication for Web Hosting Systems, Replication of Web Applications, Fault Tolerance in distributed web based systems, Security Concerns.

Case Study: HyperText Transfer Protocol (HTTP)

UNIT VI	SECURITY IN DISTRIBUTED SYSTEMS	7 Hrs

Introduction to Security: Security Threats, Policies, and Mechanisms, Design Issues, Cryptography.

Secure Channels: Authentication, Message Integrity and Confidentiality, Secure Group Communication,

Access Control: General Issues in Access Control, Firewalls, Secure Mobile Code, Denial of Service (DOS).

Security Management: Key Management, Secure Group Management, Authorization Management.

Emerging Trends In Distributed Systems: Grid Computing, Service Oriented Architectures (SOA).

Case Study: Kerberos.

Text Books

1. Maarten van Steen, Andrew S. Tanenbaum, Distributed Systems , PHI, 3rd Edition Version 3.01, ISBN: 978-15-430573-8-6(Printed).
2. Andrew S. Tanenbaum, Maarten van Steen, Distributed Systems – Principles and Paradigms, PHI, 2nd Edition, ISBN: 978-0130888938.

Reference Books

1. George Coulouris, Distributed Systems: Concepts and Design,Pearson, 5th edition, Jean Dollimore, Tim Kindberg, Gordon Blair, ISBN:13: 978-0132143011, ISBN:10: 0132143011.
2. Abhijit Belapurkar, Anirban Chakrabarti, Harigopal Ponnapalli, Niranjan Varadarajan, Srinivas Padmanabhuni, Srikanth Sunderrajan, Distributed System Security: Issues, Processes and solutions, Willey online Library, ISBN: 978-0-470-51988-2.
3. Sunita Mahajan, Seema Shah, Distributed Computing, Oxford University Press, 2nd Edition, ISBN-13: 978-0198093480.

Savitribai Phule Pune University Fourth Year of Information Technology (2015 Course) 414463: Ubiquitous Computing		
Teaching Scheme: **TH:03 Hours/Week**	**Credits:03**	**Examination Scheme:** **In-Sem (Paper): 30 Marks** **End-Sem (paper): 70 Marks**

Prerequisites:

1. Human Computer Interaction.
2. Computer Network Technology.

Course Objectives :

1. To describe ubiquitous computing, its properties applications and architectural design.
2. To explain various smart devices and services used in ubiquitous computing.
3. To teach the role of sensors and actuators in designing real time applications using Ubicomp.
4. To explore the concept of human computer interaction in the context of Ubicomp.
5. To explain Ubicomp privacy and challenges to privacy.
6. To describe Ubicomp network with design issues and Ubicomp management.

Course Outcomes:

By the end of the course, students should be able to

1. Demonstrate the knowledge of design of Ubicomp and its applications.
2. Explain smart devices and services used Ubicomp.
3. Describe the significance of actuators and controllers in real time application design.
4. Use the concept of HCI to understand the design of automation applications.
5. Classify Ubicomp privacy and explain the challenges associated with Ubicomp privacy.
6. Get the knowledge of ubiquitous and service oriented networks along with Ubicomp management.

UNIT I	**INTRODUCTION TO UBIQUITOUS COMPUTING**	**7 Hrs**

Concept of Ubiquitous Computing and Advantages, Ubiquitous Computing Applications and Scope, Properties of Ubiquitous Computing, Modelling the Key Ubiquitous Computing Properties. Ubiquitous System Environment Interaction. Architectural Design for UbiCom Systems: Smart DEI Model.

UNIT II	**UBIQUITOUS COMPUTING SMART DEVICES AND SERVICES**	**7 Hrs**

Smart Devices and Service properties, Smart mobile devices and Users, Mobile code, Smart Card Devices and Networks, Service Architecture Models. Service Provision Life-Cycle. Virtual Machines and Operating Systems, OS for Mobile Computers and Communicator Devices.

UNIT III	**ACTUATION AND CONTROL**	**7 Hrs**

Tagging the Physical World, Sensors and Networks, Micro- Electro-Mechanical Systems (MEMS), Embedded Systems and Real-Time Systems. Programmable and PID type control system, Robots.

UNIT IV	**HUMAN COMPUTER INTERACTION**	**7 Hrs**

User Interfaces and Interaction for devices, Abstract user interface through Basic Smart Wearable and Implanted Devices. Human- Centered Design (HCD).

User Models: Direct and indirect user input and modelling, modelling users' planned tasks and multiple tasks-based computing.

UNIT V	UBIQUITOUS COMPUTING PRIVACY	7 Hrs

Ubiquitous computing privacy definition, Solove's taxonomy of privacy, legal background, Interpersonal privacy, Ubicomp challenges to privacy: Collection scale, manner and motivation, data types, data accessibility; Case study of privacy solution such as Protecting RFID tags, ways of addressing privacy in Ubicomp.

UNIT VI	UBIQUITOUS COMMUNICATION AND MANAGEMENT	7 Hrs

Data Networks, Audio Networks, Wireless Data Networks, Ubiquitous Networks, Service oriented networks, network design issues; Configuration and Security management, Service oriented computer and information management, Context awareness.

Text Books

1. Stefan Poslad, Ubiquitous Computing, Wiley, Student Edition, ISBN:9788126527335
   John Krumm, Ubiquitous Computing Fundamentals.

Reference Books

1. Yin-Leng Theng and Henry B. L. Duh, Ubiquitous Computing, IGI, 2nd Edition, ISBN: 9781599046938.
2. Adam Greenfield, Everyware the Drawing age of Ubiquitous Computing, AIGA, 1st Edition, ISBN: 9780321384010.
3. Laurence T. Yeng, Evi Syukur and Seng W. Loke, Handbook on Mobile and Ubiquitous Computing, CRC, 2nd Edition, ISBN: 9781439848111.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414464A: Elective III
Internet of Things (IoT)

Teaching Scheme:	Credits:04	Examination Scheme:
TH:03 Hours/Week		In-Sem (Paper): 30 Marks End-Sem (paper): 70 Marks

Prerequisites:

1. Fundamentals of Communication and Computer Network.
2. Computer Network Technology.

Course Objectives :

1. To understand what is Internet of things.
2. Describe architecture, Design, underlying technologies, platforms and cloud interface.

Course Outcomes:

By the end of the course, students should be able to

1. Explain what is internet of things.
2. Explain architecture and design of IoT.
3. Describe the objects connected in IoT.
4. Understand the underlying Technologies.
5. Understand the platforms in IoT.
6. Understand cloud interface to IoT.

UNIT I	INTRODUCTION TO INTERNET OF THINGS	8 Hrs

What is the Internet of Things? Internet of Things Definitions and Frameworks : IoT Definitions, IoT Architecture, General Observations, ITU-T Views, Working Definition, IoT Frameworks, Basic Nodal Capabilities, Physical Design of IoT: IoT Protocols, Logical Design of IoT: Functional block, communication Model, Communication API's, IoT Enabling Technologies: WSN, cloud computing, Big data Analytics, communication Protocols, Embedded systems, IoT levels and Deployment templates: Level 1 to Level 5.

UNIT II	IoT NETWORK ARCHITECTURE AND DESIGN	8 Hrs

The one M2M IoT Standardized Architecture, The IoT World Forum (IoTWF) Standardized Architecture, A Simplified IoT Architecture, IoT protocol stack, The Core IoT Functional Stack, IoT Data Management and Compute Stack: Fog Computing, Edge Computing, The Hierarchy of Edge, Fog, and Cloud IoT and M2M: Introduction to M2M, Difference between IoT and M2M, SDN and NFV for IoT.

UNIT III	SMART OBJECTS: THE "THINGS" IN IoT	8 Hrs

Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects: Communications Criteria, IoT Access Technologies: IEEE 802.15.4, IEEE 802.15.4g and 802.15.4e, IEEE 1901.2a, LoRaWAN.

UNIT IV	ADDRESSING TECHNIQUES FOR THE IoT	8 Hrs

Address Capabilities, IPv6 Protocol Overview, IPv6 Tunneling, IPsec in IPv6, Header Compression Schemes, Quality of Service in IPv6, Migration Strategies to IPv6, Mobile IPV6 technologies for the IoT: Protocol Details, IPv6 over low-power WPAN (6LoWPAN).		
UNIT V	**IoT PLATFORMS**	**8 Hrs**
What is an IoT Device, Exemplary Devices: Raspberry Pi, Raspberry Pi Interfaces, Other IoT Devices: pcDuino, Beagle Bone Black, CubieBoard, ARDUINO.		
UNIT VI	**IoT PHYSICAL SERVERS AND CLOUD OFFEREINGS**	**8 Hrs**
Introduction to cloud storage models and communication API's, WAMP-AutoBahn for IoT, Python web application framework, Designing a RESTful web API, AMAZON web services for IoT, SkyNet IoT messaging platform, IoT case studies: Home Automation, Cities, Environment.		

Text Books

1. Internet of Things: A Hands-On Approach Arshdeep Bahga, Vijay Madisetti VPT – Paperback 2015 978- 0996025515 628/- 2.
2. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things David Hanes, Gonzalo Salgueiro, Patrick Grossetete Cisco Press – Paperback – 16 Aug 2017 978-1- 58714-456- 1 599.
3. Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications Daniel Minoli Willy Publication s - 2013 978-1-118- 47347-4, 466.

Reference Books

1. Smart Internet of things projects Agus Kurniawan Packt - Sep 2016 978-1- 78646- 651-8 2 The Internet of Things Key Olivier Willy Publication 2nd Edition 978
2. Applications and protocols Hersent s 119- 99435-0, 3 The Internet of Things Connecting Objects to the Web Hakima Chaouchi, Willy Publications 978-1- 84821- 140-7.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414464A: Elective III
Internet of Things Laboratory

Teaching Scheme:	Credits:04	Examination Scheme:
Practical:02 Hours/Week		TW:25 Marks OR: 25 Marks

Prerequisites:

1. Computer Network Technology.
2. Processor Architecture and Interfacing.

Course Objectives:

1. To study IoT platforms such as Raspberry-Pi/Beagle board/Arduino.
2. To study operating systems for platforms such as Raspberry-Pi/Beagle board/Arduino.
3. To get knowledge for communicating with objects.
4. To explore cloud environment for IoT.
5. To provide knowledge for IoT related protocols such as MQTT / CoAP etc.
6. To design the web interface for IoT.

Course Outcomes:

By the end of the course, students should be able to

1. To understand IoT platforms such as Raspberry-Pi/Beagle board/Arduino.
2. To understand operating systems for platforms such as Raspberry-Pi/Beagle board/Arduino.
3. To communicate with objects using IoT platforms such as Raspberry-Pi/Beagle board/Arduino.
4. To interface cloud environment for IoT application.
5. To implement IoT related protocols such as MQTT / CoAP etc.
6. To implement the web interface for IoT

Guidelines for Instructor

1. The faculty member should choose a suitable IoT platform from Raspberry-Pi, Beagle board, Arduino for study and implementation.
2. The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant

List of Assignments

Assignment 1

Study of Raspberry-Pi, Beagle board, Arduino.

Assignment 2

Study of different operating systems for Raspberry-Pi/Beagle board/Arduino. Understanding the process of OS installation on Raspberry-Pi/Beagle board/Arduino.

Assignment 3

Open source prototype platform- Raspberry-Pi/Beagle board/Arduino -Simple program digital read/write using LED and Switch -Analog read/write using sensor and actuators.

Assignment 4

Upload data from environmental sensor to cloud server (You can use any public cloud IBM Watson IoT cloud or Google or AWS etc.).

Assignment 5

Introduction to MQTT/ CoAP and sending sensor data to cloud using Raspberry-Pi/Beagle board/Arduino.

Assignment 6

Design a web interface to control connected LEDs remotely using Raspberry-Pi/Beagle board/Arduino.

Assignment 7

Install, configure XMPP server and deployed an application on Raspberry Pi/Beagle board/Arduino. Write client applications to get services from the server application.

Assignment 8

Install, configure APACHE server and deployed an application on Raspberry Pi/Beagle board/Arduino. Write client applications to get services from the server application.

Reference Books

1. The Internet of Things Key applications and protocols Olivier Hersent Willy Publications 2nd Edition 978-1-119- 99435-0.
2. The Internet of Things Connecting Objects to the Web Hakima Chaouchi, Willy Publications 978-1-84821- 140-7.
3. The Internet of Things Donald Norris TAB 4 Smart Internet of Things Projects Agus Kurniawan PACKT.
4. Getting Started with the Internet of Things Cuno Pfister SPD O'REILL Y IOT.

Savitribai Phule Pune University Fourth Year of Information Technology (2015 Course) 414464B: Elective III Information Storage and Retrieval		
Teaching Scheme: **TH:03 Hours/Week**	**Credits:04**	**Examination Scheme:** **In-Sem (Paper): 30 Marks** **End-Sem (paper): 70 Marks**

Prerequisites:

1. Data Structures and Files.
2. Database management systems.

Course Objectives :

1. To understand information retrieval process.
2. To understand concepts of clustering and how it is related to Information retrieval.
3. To deal Storage, Organization & Access to Information Items.
4. To evaluate the performance of IR system and understand user interfaces for searching.
5. To understand information sharing on semantic web.
6. To understand the various applications of Information Retrieval giving emphasis to multimedia and distributed IR, web Search.

Course Outcomes :

By the end of the course, students should be able to

1. Understand the concept of Information retrieval.
2. Deal with storage and retrieval process of text and multimedia data.
3. Evaluate performance of any information retrieval system.
4. Design user interfaces.
5. Understand importance of recommender system.
6. Understand concept of multimedia and distributed information retrieval.

UNIT I	INTRODUCTION	8 Hrs

Basic Concepts of IR, Data Retrieval & Information Retrieval, text mining and IR relation, IR system block diagram.

Automatic Text Analysis: Luhn's ideas, Conflation Algorithm, Indexing and Index Term Weighing, Probabilistic Indexing

Inverted file, Suffix trees & suffix arrays, Signature Files, Scatter storage or hash addressing, Clustered files, Hypertext and XML data structures.

UNIT II	CLASSIFICATOIN AND RETRIEVAL SEARCH STRATEGIES	8 Hrs

Retrieval strategies: Vector Space model, Probabilistic retrieval strategies, Language models, Inference networks, Extended Boolean retrieval, Latent semantic indexing, neural networks, Fuzzy set retrieval.

Retrieval utilities: Relevance feedback, Cluster Hypothesis, Clustering Algorithms: Single Pass Algorithm, Single Link Algorithm.

UNIT III	RETRIEVAL PERFORMANCE EVALUATION AND VISUALISATION	8 Hrs

Performance evaluation: Precision and recall, MRR, F-Score, NDCG, user oriented measures, cross fold evaluation.
Visualisation in Information System: Starting points, document context, User relevance judgement, Interface support for search process.

UNIT IV	DISTRIBUTED AND MULTIMEDIA IR	8 Hrs

Distributed IR: Introduction, Collection Partitioning, Source Selection, Query Processing, web issues.
MULTIMEDIA IR: Introduction, Data Modeling, Query languages, Generic multimedia indexing approach, One dimensional time series, two dimensional color images, Automatic feature extraction.

UNIT – V	WEB SEARCHING	8 Hrs

Searching the Web: Challenges, Characterizing the Web, Search Engines, Browsing, Mata-searchers, Web crawlers, Meta-crawler, Web data mining, Finding needle in the Haystack, Searching using Hyperlinks, Page ranking algorithms: Pagerank, Rank SVM.

UNIT VI	ADVANCED INFORMATION RETRIEVAL	8 Hrs

Semantic Search systems: G Semantic Web Google knowledge graphs, Ontology, Searching across ontologies, semantic web search.
Recommendation system: Collaborative Filtering and Content Based Recommendation of Documents and Products.
Information Extraction and Integration: Extracting Data from Text. Collecting and Integrating Specialized Information on the web.

Text Books

1. Yates & Neto, Modern Information Retrieval, Pearson Education, ISBN:81-297-0274-6
2. C.J. Rijsbergen, Information Retrieval, (www.dcs.gla.ac.uk)., 2ndISBN:978- 408709293.
3. David Grossman, Ophir Frieder, Information Retrieval - Algorithms and Heuristics, Springer International Edition, ISBN: 978-1-4020-3004-8.
4. Grigoris Antoniou and Frank van Harmelen, A semantic Web Primer, Massachusetts Institute of Technology, ISBN: 978-0-262-01242-3.
5. Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph, Foundations of Semantic Web Technologies, Chapman & Hall/CRC, ISBN: 9781420090505.
6. Hang Li, Learning to Rank forInformation Retrievaland Natural Language.
7. Processing, Morgan & Claypool, ISBN: 9781608457076.

Reference Books

1. Christopher D. Manning, Prabhakar Raghavan and HinrichSchutzen, Introduction to Information Retrieval, Cambridge University Press, Online book, ISBN:978-0-521-86571-5
2. Robert Korfhage, Information Storage and Retrieval, John Wiley & Sons,1 Edition, ISBN:9788126507702.
3. Kowalski, Gerald, Maybury, Mark, Information Storage and Retrieval Systems :Theory and Implementation, Springer US, 2nd Edition,ISBN:978-0-7923-7924-9.
4. Zhang, Jin, Visualization for Information Retrieval, Springer-Verlag Berlin Heidelberg,1st Edition,ISBN:978-3-642-09442-2Mark leven, Introduction to search engines and web navigation, John Wiley and sons Inc, 2nd Edition,ISBN 9780-170-52684-2.
5. V. S. Subrahamanian, Satish K. Tripathi , Multimedia information System,Kulwer Academic Publisher.
6. ChabaneDjeraba, Multimedia mining A highway to intelligent multimedia documents, Kulwer Academic Publisher, ISBN:1-4020-7247-3.

7. Ricci, F, Rokach, L. Shapira, B.Kantor, Recommender Systems Handbook.
8. Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, Information Retrieval Implementing and Evaluating Search Engines, The MIT Press, Cambridge.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414464B:
Information Storage and Retrieval Laboratory

Teaching Scheme:	Credits:04	Examination Scheme:
Practical:02 Hours/Week		TW:25 Marks OR: 25 Marks

Prerequisites:

1. Data Structures and Files.
2. Database management systems.

Course Objectives:

1. To understand information retrieval process.
2. To understand concepts of clustering and how it is related to Information retrieval.
3. To deal with Storage, Organization & Access to Information Items.
4. To evaluate the performance of IR system and understand user interfaces for searching.
5. To understand information sharing on semantic web.
6. To understand the various applications of Information Retrieval giving emphasis to multimedia and distributed IR, web Search.
7. To apply the gained knowledge in recent fields of advancements in the subject.

Course Outcomes:

By the end of the course, students should be able to,

1. Understand the concept, data structure and preprocessing algorithms of Information retrieval.
2. Deal with storage and retrieval process of text and multimedia data.
3. Evaluate performance of any information retrieval system.
4. Design user interfaces.
5. Understand importance of recommender system (Take decision on design parameters of recommender system).
6. Understand concept of multimedia and distributed information retrieval.
7. Map the concepts of the subject on recent developments in the Information retrieval field.

Guidelines for Instructor

Faculty member should frame Practical Assignments based on below given list of assignments. Students will submit term work in the form of journal containing handwritten write-ups/ source code and output. Staff incharge should maintain a record of continuous assessment and produced at the time of oral examination.

List of Assignments

Assignment 1

To implement Conflation Algorithm using File Handling.

Assignment 2

To implement single pass algorithm for clustering.

Assignment 3

To implement a program Retrieval of documents using inverted files.
Assignment 4
To implement a program for feature extraction in 2D colour images (any features like colour, texture etc
Assignment 5
To implement a simple Web Crawler in Java.
Assignment 6
Extract features from input image and plot histogram for the features.
Assignment 7
Write a program to recommend a product / learning course based on person preferences / education details.
Assignment 8
Consider set of 25 to 30 documents on 5 to 7 distinct topics. Define 5 queries and map the document that will be retrieved for every query. Write a program using any algorithm to retrieve documents. Evaluate the algorithm using all evaluation methods.
Assignment 9
Case study on Image retrieval for ADAS (Advanced Driver Assistance System) (Here students are expected to research the topics like Lane Change Assist (LCA), Driver Drowsiness and inattentiveness, Lane Change Assist, Automatic Parking, ACC etc.)
Reference Books
1. Yates & Neto, "Modern Information Retrieval", Pearson Education. 2. C.J. Rijsbergen, "Information Retrieval", (www.dcs.gla.ac.uk). 3. R. C. Gonzalez, R. E. Woods, “Digital Image Processing”, Pearson Education. 4. Zhang, Jin, “Visualization for Information Retrieval”, Springer-Verlag Berlin Heidelberg. 5. V. S. Subrahamanian, Satish K. Tripathi, “Multimedia information System”, Kulwer Academic Publisher. 6. Ricci, F, Rokach, L. Shapira, B.Kantor, “Recommender Systems Handbook”.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414464C: Elective III
Multimedia Techniques

Teaching Scheme:	Credits:04	Examination Scheme:
TH:03 Hours/Week		In-Sem (Paper): 30 Marks End-Sem (paper): 70 Marks

Prerequisites:

1. Data Structures and Files.
2. Basics of computer graphics and animation.

Course Objectives :

1. To learn basic components of multimedia (text, image, audio, video and animation).
2. To learn compression techniques for various multimedia components.
3. To learn rendering.
4. To learn animation and gaming.
5. Become acquainted with some advanced topics in multimedia.

Course Outcomes :

By the end of the course, students should be able to

1. To create own file formats for specific application.
2. To do some projects based on current trends in multimedia.
3. To use open sources for authoring tool for animation and presentations.
4. Understand some research areas of current multimedia techniques.

UNIT I	INTRODUCTION TO MULTIMEDIA	8 Hrs

Goals, objectives, and characteristics of multimedia, Multimedia building blocks, Multimedia architecture, Multimedia Applications Media Entertainment, Media consumption, web-based applications, e-learning and education

UNIT II	TEXT AND IMAGE PROCESSING	8 Hrs

Text: Text file formats: TXT, DOC; RTF, PDF, PS
Text compression: Huffman coding, LZ & LZW
Image: Basic Image fundamentals, Image File formats - (BMP, TIFF, JPEG, GIF)
Image processing cycle- Image acquisition, storage, Communication, and display, Image Enhancement, Image Compression: **Types of Compression**: Lossless & Lossy
Lossless: RLE, Shannon - Fano algorithm, Arithmetic coding.
Lossy: Vector quantization, Fractal Compression Technique, Transform coding and Hybrid: JPEG-DCT

UNIT III	AUDIO AND VIDEO PROCESSING	8 Hrs

AUDIO: Nature of sound waves, characteristics of sound waves, psycho-acoustic, MIDI, digital audio, CD formats.
Audio file formats: WAV, AIFF, VOC, AVI, MPEG Audio File formats, RMF, WMA
Audio compression techniques: DM, ADPCM and MPEG
Video: Video signal formats, Video transmission standards: EDTV, CCIR, CIF, SIF, HDTV,

digitization of video,

Video file formats: MOV, Real Video, H-261, H-263, Cinepack, Nerodigtal,Video editing, DVD formats, MPEG.

UNIT IV	ANIMATION AND VIRTUAL REALITY	8 Hrs

Animation: Basics of animation, types of animation, principles of animation, Methods of controlling animation, frame-by-frame animation techniques, real-time animation techniques, Programming aspects in creating simple animation,

OpenGL: Open GL over windows/Linux, Extension.

Virtual Reality: Concept, Forms of VR, VR applications, VR devices: Hand Gloves, Head mounted tracking system, VR chair, CCD, VCR, 3D Sound system, Head mounted display

UNIT – V	RENDERING	8 Hrs

Introduction, Basics of illumination and shading models, Transparency, Shadows and textures, Ray tracing from the light source, cone, beam and pencil tracing. Point based rendering, Mesh Simplification, Spatial partitioning, Solid Modeling

UNIT – VI	ADVANCES IN MULTIMEDIA	8 Hrs

Multimedia Communication and applications, Study of Multimedia networking, Quality of data transmission, Multimedia over IP, Media on Demand.

Multimedia in Android: Android Multimedia Framework Architecture

Gaming: Facial Recognition, Voice Recognition, Gesture Control, High-Def Displays, Augmented Reality, Mobile Gaming, Cloud Gaming, On-Demand Gaming.

Text Books

1. Ralf Steinmetz and Klara Nahrstedt "Multimedia Computing, Communication and Applications", Pearson Education.
2. K.R. Rao, “Multimedia Communication Systems: Techniques, Standards, and Networks”, TMH.
3. Ranjan Parekh, "Principles of Multimedia", 2/E, Tata McGraw-Hill, ISBN: 1259006506
4. David F. Rogers, "Procedural Elements for Computer Graphics", 2nd Ed - Tata McGraw Hill Edition.
5. "OpenGL Programming Guide: The Official Guide to Learning OpenGL", Mason Woo, Jackie, Tom Davis, Version 2.1, 6th Edition, Pearson Education, ISBN 978-81-317-2184-1.

Reference Books

1. Ashok Banerji, AnandaGhosh, “Multimedia Technologies”, ISBN: 9780070669239.
2. Gonzalez, Woods, "Digital Image Processing" Addison Wesley.
3. Ze-Nian Li, Marks S. Drew, "Fundamentals of Multimedia", Pearson Education.
4. Edward Angel, “OpenGL: A Primer”, Addison-Wesley.
5. Parag Havaldar, Gerard Medioni, “Multimedia Systems”, Cengage Learning.
6. Hill, Kelly, "Computer Graphics using OpenGL", 3rd Ed, Eastern Economy Edition.
7. Alan H. Watt and Mark Watt,"Advanced Animation and Rendering Techniques: Theory and Practice", Addison-Wesley, ACM Press, ISBN: 0201544121.
8. Foley, Dam, Feiner, Hughes,"Computer Graphics Principles & Practice", 2nd Ed, Pearson Education.
9. Introduction to Game Development Using Processing, by J. R. Parker , Mercury Learning & Information; Pap/Com edition.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414464C: Multimedia Techniques Laboratory

Teaching Scheme:	Credits:04	Examination Scheme:
Practical:02 Hours/Week		TW:25 Marks OR: 25 Marks

Prerequisites:

1. Data Structures and Files.
2. Basics of computer graphics and animation.

Course Objectives:

1. To learn basic components of multimedia (text, image, audio, video and animation).
2. To learn compression techniques for various multimedia components.
3. To learn rendering.
4. To learn animation and gaming.
5. Become acquainted with some advanced topics in multimedia.

Course Outcomes:

By the end of the course, students should be able to

1. To create own file formats for specific application.
2. To do some projects based on current trends in multimedia.
3. To use open sources for authoring tool for animation and presentations.

List of Assignments

Assignment 1

Write a program to open and display Images in Python or Java using OpenCV tool.

Assignment 2

Write a program for generating Huffman codes for a gray scale 8-bit image

Assignment 3

Write a program for implementation of ray-tracing algorithm in Java.

Assignment 4

Create a simple animation using OpenGL

Assignment 5

Study of any virtual reality tool/software. (3DS MAX, BLENDER, GOOGLE VR)

Assignment 6

Write a Program to compress image using Python

Assignment 7

Create a short movie clip using open source tool

Assignment 8

Build a Virtual Reality web application using open source tool

Assignment 9

Write a Program to implement basic game in Python

Reference Books

1. Ralf Steinmetz and Klara Nahrstedt "Multimedia Computing, Communication and Applications", Pearson Education.
2. K.R. Rao, “Multimedia Communication Systems: Techniques, Standards, and Networks”, TMH.
3. Ranjan Parekh, "Principles of Multimedia", 2/E, Tata McGraw-Hill, ISBN: 1259006506.
4. David F. Rogers, "Procedural Elements for Computer Graphics", 2nd Ed - Tata McGraw Hill Edition.
5. "OpenGL Programming Guide: The Official Guide to Learning OpenGL", Mason Woo, Jackie, Tom Davis, Version 2.1, 6th Edition, Pearson Education, ISBN 978-81-317.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414464D: Elective III
Internet and Web Programming

Teaching Scheme:	Credits:04	Examination Scheme:
TH:03 Hours/Week		In-Sem (Paper): 30 Marks End-Sem (paper): 70 Marks

Prerequisites Courses :

1. Internet and Web Programming.

Course Objectives :

1. To understand Internet and Web Programming basic concepts.
2. To develop client side web programming skills.
3. To develop server side web programming skills.
4. To understand Web Services and Content Management System.
5. To understand mobile web development and develop mobile web development skills.
6. To understand web security and cyber ethics.

Course Outcomes :

By the end of the course, students should be able to

1. Demonstrate static website using basic tools.
2. Develop client side programming skills.
3. Develop server side programming skills.
4. Understand web services and handle content management tools.
5. Develop mobile website using mobile web development tools.
6. Understand aspects of web security and cyber ethics.

UNIT I	INTERNET AND WEB PROGRAMMING ESSENTIALS	8 Hrs

The Internet, Introduction Basic Internet Protocol, The World Wide Web, Introduction to Web Programming, Web Clients, Web Servers, Browser and Search Engines.

Markup Languages : Introduction to HTML, Static and dynamic HTML, Structure of HTML documents, HTML Elements, Linking in HTML, Anchor Attributes, Image Maps, Meta Information, Image Preliminaries, Layouts, Backgrounds, Colors and Text, Fonts, Tables, Frames and layers, Audio and Video Support with HTML Database integration, , Forms Control, Form Elements, Applying Styles, values, selectors, class, ids, inheritance, layout, backgrounds, borders, margin, padding, lists, fonts, text formatting, positioning. HTML5. Introduction to Style Sheet, Inserting CSS in an HTML page, CSS selectors, Introduction to XML, XML key component, Transforming XML into XSLT, DTD: Schema, elements, attributes, Introduction to JSON.

UNIT II	CLIENT SIDE PROGRAMMING	8 Hrs

JavaScript: Overview of JavaScript, using JS in an HTML (Embedded, External), Data types, Control Structures, Arrays, Functions and Scopes, Objects in JS, DOM: DOM levels, DOM Objects and their properties and methods, Manipulating DOM, JQuery: Introduction to JQuery, Introduction to AJAX, Working of AJAX, AJAX processing steps, coding AJAX script. Introduction to Angular JS.

UNIT III	SERVER SIDE PROGRAMMING	8 Hrs

Introduction to Server Side technology and TOMCAT, Servlet: Introduction to Servlet, need and advantages, Servlet Lifecycle, Creating and testing of sample Servlet, session management. JSP: Introduction to JSP, advantages of JSP over Servlet, elements of JSP page: directives, comments, scripting elements, actions and templates, JDBC Connectivity with JSP. PHP: Introduction to PHP, Features, PHP script, PHP syntax, conditions & Loops, Functions, String manipulation, Arrays & Functions, Form handling, Cookies & Sessions, using MySQL with PHP.

UNIT IV	**WEB SERVICES AND CONTENT MANAGEMENT SYSTEMS**	**8 Hrs**

Introduction to Web Services, Web Services Architecture, XML Messaging, SOAP, WSDL, UDDI, REST, Java Web Services, Amazon Web Services, DevOps, Introduction to Content Management System (CMS), Wordpress / Joomla, Advanced Technology: Bootstrap, JSF, Spring.

UNIT V	**MOBILE WEB DEVELOPMENT**	**8 Hrs**

What is Mobile Web? Understanding Mobile Devices, Mobile Data Usage, Mobiles and Desktops, Building an HTML page, Getting jQuery Mobile, Implementing jQuery Mobile, Working with data attributes, Working with jQuery Mobile Pages, Enhancing Pages with Headers, Footers, and Toolbars; Working with Lists, Building a Simple Mobile Website, Working with Forms and jQuery Mobile, Creating Modal Dialogs and Widgets, Creating Grids, Panels, and Other Widgets; jQuery Mobile Configuration, Utilities, and JavaScript Methods; Working with Events.

UNIT VI	**WEB SECURITY AND CYBER ETHICS**	**8 Hrs**

Overview of Web Security: Need of Web Security, Breach of Web Security, What need to be Secure on Web? Can Web be secure? Aspects of Web Security, Purpose of Web Security, A Security Equation, Defining Security Equation, Common Threats on Web, User level Security, Server Level Security, Cyber ethics, Issues in Cyber ethics.

Text Books

1. Kogent Learning Solutions Inc,Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, XML and AJAX, Blackbook, Dreamtech Press, Second Edition ,ISBN:9788177228496.
2. Raymond Camden, Andy Matthews, jQuery Mobile Web Development Essentials, Packt Publishing, Second Edition, 9781782167891.
3. Ethan Cerami, Web Services Essentials, O'Reilly Media, First Edition, 0-596-00224-6.
4. Shweta Bhasin, Web Security Basics, Premier Press, First Edition, ISBN: l978-1592000067.

Reference Books

1. Dr.Hiren Joshi, Web Technology and Application Development, DreamTech, First,ISBN:978-93- 5004-088-1.
2. Santosh Kumar K., DT Editorial Services,Black Book, JDBC 4.2, Servlet 3.1 & JSP 2.3,Dreamtech Press, Second Edition, ISBN:978-8177228700.
3. Steven M. Schafer, “HTML, XHTML and CSS”, Wiley India Edition, Fourth Edition, 978-81-265-1635-3.
4. B. V. Kumar, S. Sangeetha, S.V. Subrahmanya, J2EE Architecture, an illustrative gateway to enterprise solutions, Tata McGraw Hill Publishing Company, Second Edition, ISBN:978-0-070-621-633.
5. Ivan Bayross,”Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP,BPB Publications,4th Edition,ISBN:978-8183330084.
6. Brain Fling, Mobile Design and Development, O'REILLY, First Edition, ISBN: 13:978-81-8404-817-9.

7. Jason Hunter, Java Servlet Programming, O'reilly Publications, 2nd Edition, ISBN: 978-0-596-00040-0.
8. Adam Bretz & Colin J Ihrig, Full Stack Javascript Development with MEAN, SPD, First Edition, ISBN:978-0992461256.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414464D: Internet and Web Programming Laboratory

Teaching Scheme:	Credits:04	Examination Scheme:
Practical:02 Hours/Week		TW:25 Marks OR: 25 Marks

Prerequisites:

1. Basic Programming Skills.

Course Objectives:

1. Making Student familiar with client server architecture.
2. To develop ability for making web application using JavaScript.
3. To develop web applications using Angular JS.
4. To design and implement web services with content management.
5. To understand use of Content Management Tolls in Website Development.

Course Outcomes:

By the end of the course, students should be able to

1. Use fundamental skills to develop and maintain website and web application.
2. Apply scripting skills for Server side and Client-side Programming.
3. Develop web services to transfer data and add interactive components to website.
4. Combine multiple web technologies to create advanced web components.

Guidelines for Instructor's Manual

The instructor’s manual is to be developed as hands - on resource and reference. The instructor's manual need to include prologue (about University/program/ institute/ department/foreword/ preface etc), University syllabus, conduction & Assessment guidelines, topics under consideration - concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory-Concept/technology/tool in brief, design, test cases, conclusion/analysis. Program codes with sample output of all performed assignments are to be submitted as softcopy. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory

Guidelines for Assessment

Continuous assessment of laboratory work is done based on overall performance and laboratory assignments performance of student. Each laboratory assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness

Guidelines for Practical Examination

Both internal and external examiners should jointly set problem statements. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at the time of evaluation to test the student's for advanced learning, understanding of the fundamentals, effective and efficient implementation. So encouraging efforts, transparent evaluation and fair approach of the evaluator will not create any uncertainty or doubt in the minds of the students. So adhering to these principles will consummate our team efforts to the promising start of the student's academics.

Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications. Encourage students for appropriate use of Hungarian notation, proper indentation and comments. Use of open source software is to be encouraged. In addition to these, instructor may assign one real life application in the form of a mini-project based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus.

List of Assignments

Assignment 1

1.1 Using HTML5 layout tags develop informative page with sections which include various images, links to other pages for navigation, make use of all possible formatting (for example font, color etc.).

1.2 Apply CSS properties Border, margins, Padding, Navigation, dropdown list to page created in first assignment.

Assignment 2

Design an online registration form for any application and validate it using JQuery.

Assignment 3

Design Login Application using PHP and add essence of Ajax in it.

Assignment 4

Create any Java Web Service and integrate it with any suitable application.

Assignment 5

Create JSP login page and validate it. Make use of Servlets.

Assignment 6

Create an application for bill payment using Angular JS.

Assignment 7

Develop website using any CMS tool which falls into one of the categories blog, social networking, News updates, Wikipedia, E-commerce store. Website must include home page, and at least 3.

Assignment 8

Develop Mini Project using any front end tool with database connectivity.
Reference Books
1. Aleksa Vukotic and James Goodwill, “Apache Tomcat 7”, Apress, 2011, ISBN: 10: 1430237236. 2. Bryan Basham, Kathy Sierra, Bert Bates, “JSP: Passing the Sun Certified Web Component Developer Exam”, O'Reilly Media ISBN: 978-0-596-51668-0. 3. Chirag Rathod, Jonathan Wetherbee, Peter Zadrozny, and Raghu R. Kodali, “Beginning EJB 3: Java EE 7 Edition”, Apress, 2013, ISBN: 9781430246923. 4. Richard Monson-Haefel, “J2EE Web Services”, Addison-Wesley Professional, First Edition, 2004, ISBN: 10: 0321146182. 5. Chuck Cavaness, “Programming Jakarta Struts”, O’relly Media, second edition 2004, ISBN: 978- 0-596-00651-8. 6. Michael Morrison, Lynn Beighley, “Head First PHP & MySQL: A Brain-Friendly Guide”, O’relly Media, second edition 2008, ISBN: 13: 9788184046588. 7. Dan Rahmel, “Advanced Joomla!” Apress, First Edition, 2013, ISBN: 13: 9781430216285. 8. Iwein Fuld, Marius Bogoevici, Mark Fisher, Jonas Partner”, Spring Integration in Action”, Manning, 2012, ISBN: 13: 9781935182436.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414464E: Elective III
Computational Optimization

Teaching Scheme:	Credits :04	Examination Scheme:
TH:03 Hours/Week		In-Sem (Paper): 30 Marks End-Sem (paper): 70 Marks

Prerequisites Courses :

1. Mathematical preliminaries like Linear algebra, matrices, Elements of probability theory & Elementary multivariable calculus.
2. Design and Analysis of Algorithms.
3. Genetic Algorithms.

Course Objectives :

1. To enable the student to learn and acquire mathematical methods in engineering disciplines.
2. To introduce the methods of optimization to solve a linear programming problem by various methods.
3. To introduce few advanced optimization techniques.

Course Outcomes :

By the end of the course, students should be able to

1. Learn and implement various optimization techniques.
2. Learn model real-world problems in optimization framework.
3. Apply various optimization models to solve optimization problems in computer-science & IT Engineering.

UNIT I	INTRODUCTION	8 Hrs

Overview, Operation Research Modeling Approach and Various Real Life Situations, Linear Programming Problems (LPP): Basic LPP and Applications; Various Components of LP Problem Formulation, Solving Linear Programming Problems: Using Simultaneous Equations and Graphical Method; Simplex Method; Duality Theory; Charnes' Big – M Method. Transportation Problems and Assignment Problems, 0/1 knapsack problem using brute force and dynamic approach.

UNIT II	NETWORK ANALYSIS	8 Hrs

Shortest Path: Dijkstra Algorithm; Floyd Algorithm; Maximal Flow Problem (Ford-Fulkerson); PERT-CPM, network design algorithms.

UNIT III	INVENTORY CONTROL	8 Hrs

Introduction; Economic Order Quantity (EOQ) models, Deterministic and probabilistic Models, Safety Stock, Buffer Stock, Inventory Model of Central Warehouse.

UNIT IV	GAME THEORY	8 Hrs

Introduction ; 2- person Zero – sum Game; Saddle Point ; Mini-Max and Maxi-Min Theorems, Games without saddle point ; Graphical Method ; Principle of Dominance.

UNIT V	QUEUING THEORY	8 Hrs

Introduction; Basic Definitions and Notations; Axiomatic Derivation of the Arrival & Departure (Poisson Queue). Pure Birth and Death Models; Poisson Queue Models: M/M/1: ∞ /FIFO and M/M/1: N/ FIFO.

UNIT VI	ADVANCED OPTIMIZATION TECHNIQUES	8 Hrs

Direct and indirect search methods, Evolutionary algorithms for optimization and search, Concepts of multi-objective optimization, genetic algorithms and simulated annealing, optimization of machine learning algorithms, ant colony optimization, Applications of IT Engineering: Search Engine Optimization, Smart Grid Optimization.

Text Books

1. H.A. Taha, "Operations Research", Fifth Edn. Macmillan Publishing Company, 1992.
2. K. Deb, "Optimization for Engineering Design- Algorithms and Examples", Prentice-Hall Of India Pvt. Ltd., New Delhi, 1995.
3. Hadley G., "Linear Programming" Narosa Publishers, 1987.
4. Mital : Optimization Methods, New Age International.
5. Kalyanmoy Deb, Mulitobjective Optimization –An evolutionary Algorithmic Approcach, John Wiley & Sons, New York.

Reference Books

1. V.K.Kapoor – "Operations Research".
2. Kanti Swaroop – "Operations Research".
3. Hillier F.& Liebermann G.J., "Operations Research", Holder Day Inc, 1974.
4. Mustafi : Operations Research, New Age International.
5. Shenoy : Operations Research for Management , New Age International.
6. Mahapatra : Introduction to System Dynamics Modelling, Universities Press.
7. Rao : Engineering Optimization , New Age International.
8. Schaum Outline Series – "Operations Research", TMH.
9. Introduction to Optimization – Edwin K P Chong, Stainslaw H Zak.
10. Nonlinear programming – Dimitry Bertsekas.
11. J.C.Pant, Introduction to Optimization, Jain Brothers, New Delhi, 1983.
12. kershenbaum A., " Telecommunication network design algorithms", TMH

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414464E: Computational Optimization Laboratory

Teaching Scheme:	Credits:04	Examination Scheme:
Practical:02 Hours/Week		TW:25 Marks OR: 25 Marks

Prerequisites:

1. Optimization Algorithms.
2. Basics of Problem Solving.
3. Fundamentals of Design and Analysis of Algorithms.

Course Objectives:

1. To understand how to solve knapsack problem by brute force method.
2. Understand different problem-solving algorithms.

Course Outcomes:

By the end of the course, students should be able to

1. Understand Transportation problem.
2. Learn different measures in shortest path algorithms.
3. Understand and learn Queuing Model.

Guidelines for Instructor

Instructor should design and implement at least 08 assignments and 2 study assignments on Computational Optimization

List of Assignments

Assignment 1

Write a program to solve Transportation problem.

Assignment 2

Write a program to solve Assignment problem.

Assignment 3

Write a program to solve 0/1 knapsack problem using brute force method.

Assignment 4

Write a program to solve 0/1 knapsack problem using dynamic programming.

Assignment 5

Write a program to solve Duality problem.

Assignment 6

Write a program to solve optimization problem using Simplex method.

Assignment 7

Write a program to solve Dijkstra’s and Floyd shortest path algorithm.

Assignment 8

Design and implement Maximal flow problem.

Assignment 9

Write a program to solve PERT/CPM problem.

Assignment 10

Design and implement Mini-Max and Maxi-Min theorem.
Study Assignments
Assignment 1
EOQ Models
Assignment 2
Safety stock and buffer stock
Assignment 3
M/M/1:∞/FIFO
Assignment 4
M/M/1:N/FIFO

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414465A: Elective IV
Rural Technologies and Community Development

Teaching Scheme:	Credits:03	Examination Scheme:
TH:03 Hours/Week		In-Sem (Paper): 30 Marks End-Sem (paper): 70 Marks

Course Objectives :

1. Understand theories and practices in the rural development model.
2. Learn and analyse rural life and rural economy.
3. Understand different measures in rural development.
4. Learn different technologies used in upliftment of rural life.
5. To participate in visits and case studies for better understanding for rural development and its impact on overall economy.

Course Outcomes :

By the end of the course, students should be able to

1. Understand rural development model.
2. Learn different measures in rural development and its impact on overall economy.
3. Understand and learn importance of technologies in rural and community development.
4. Understand challenges and opportunities in rural development.

UNIT I	INTRODUCTION	7 Hrs

RURAL DEVELOPMENT - Concepts and connotations, Basic Elements, Growth Vs. Development, Why rural development, Rising expectations and development, Development and Change, Human beings as cause and consequences of development.

RURAL ECONOMY OF INDIA - Introduction, size and structure, The characteristics of rural sector, The role of agricultural sub-sector, The role of non-agricultural sub-sector, Challenges and opportunities.

UNIT II	RURAL DEVELOPMENT - MEASURES AND PARADIGMS	7 Hrs

MEASURES OF DEVELOPMENT - Introduction, Measures of level of rural development, Measures of income distribution, Measures of development simplified, Concepts and measures of rural poverty.

PARADIGMS OF RURAL DEVELOPMENT - Introduction, The modernization theory, The dependency theory of Marxist School, Rosenstein- Rodan's theory of 'Big Push', Lewis' model of economic development, The human capital model of development, The Gandhian Concept of Rural Development theories from other social sciences.

UNIT III	TECHNOLOGIES FOR RURAL DEVELOPMENT	7 Hrs

Using Water Resources - The water cycle, Drinking Water, Water quality testing, Water filtering ,Extraction from Groundwater ,Pumps Rope and washer pump ,Manuel pumps, Treadle pump, Irrigation for agriculture, Channel systems, Sprinkler systems, Drip systems Water diversion ,Water storage

Building Infrastructures and Creating Energy - Basic energy uses , Energy Sources - Firewood, Solar Energy, Hydroelectricity, Hydromechanical, Wind Energy, Energy Storage,Connecting to the Electrical Network, Environmental Considerations

Use of ICT in Rural and agricultural development - Education, Healthcare, Agriculture, Business, Resource Mapping, Digital and Social Media Marketing Decision Support Systems for soil conservation and farm management Waste Management and Sanitation.

UNIT IV	COMMUNITY DEVELOPMENT	7 Hrs

DEVELOPING COMMUNITIES - Introduction, Service Learning and community development, Theory and practice of community development, Community development issues. The diverse meaning of community development, The knowledge base of community development, International community development.

UNIT V	COMMUNITY DEVELOPMENT - RURAL ENTREPRENEURSHIP	7 Hrs

Different forms of Rural Entrepreneurship, Significance , Business planning for a new venture: the concept of planning paradigm, Forms of business enterprises-Sole proprietorship, partnership and corporations, Product and Process development, Marketing analysis and competitive analysis, strategies; Financial resources; debt financing, banks and financial institutions and other non-bank financial sources; Government programmes : direct loan assistance and subsidies; Industrial and legal issues for rural enterprises.

UNIT VI	CASE STUDIES AND FIELD VISIT	7 Hrs

Role of Micro-Finance institutions in rural development, Use of ICT in Rural development, Watershed Management - Water-Cup Competition by Paani Foundation, Community Safe Water Solutions, Visit to a ‘Woman Self help group’ nearby and study of its functioning and its role in development. Visit to model villages in nearby region - Ralegan-Siddhi, Dist - Ahemadnagar, Hiware Bazar Dist - Ahemadnagar, Tikekarwadi - Dist. - Pune, Buchekarwadi Dist- Pune etc.

Text Books

1. “Rural Development: Principles, Policies and Management” - Katar Singh , Sage Publications.
2. “Introduction to Community Development - Theory, Practice and Service Learning”, Edited by J W Robinson, Sage Publications.
3. G. N. Tiwari, Solar Energy: Fundamentals, Design, Modeling and Applications, Narosa, 2002.
4. “Fundamentals of Entrepreneurship”, H. Nandan, Third Edition, PHL Learning Pvt. Ltd.,
5. “Monetary Economics-Institutions, Theory and Policy” , First Edition, S B Gupta, S Chand Publications, ISBN – 9788121904346.

Reference Books

1. “KURUKSHETRA” - A Journal on Rural Development.
2. “Energy conversion”, R. Y. Goswami, Frank Kreith, CRC Press, 2007.
3. “Solar Energy: Fundamental and Application” , H. P. Garg and S. Prakash,Tata McGraw Hill, 1997.
4. “Technologies for Sustainable Rural Development: Having Potential of Socio Economic. Upliftment” , TSRD 2014 , edited by Jai Prakash Shukla, Allied Publishers Pvt. Ltd.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414465B: Elective IV
Parallel Computing

Teaching Scheme:	Credits:03	Examination Scheme:
TH:03 Hours/Week		In-Sem (Paper): 30 Marks End-Sem (paper): 70 Marks

Prerequisites Courses :

1. System Programming.
2. Operating System.

Course Objectives :

1. Understand theories and practices in parallel computing.
2. Learning hardware concepts and various languages used in parallel computing.
3. Understand different challenges in parallel computing.

Course Outcomes :

By the end of the course, students should be able to

1. Understand fundamentals in parallel computing.
2. Understand and learn importance of technologies including different hardware structures used in parallel computing.
3. Understand challenges and opportunities in parallel computing.

UNIT I	FUNDAMENTALS OF PARALLEL COMPUTING	7 Hrs

Need for Parallel Computing, Different Parallel Computer Models, ILP, TLP and Data Parallelism, Parallel Programming Overview, Shared Memory Programming, Message Passing Paradigm, Interaction and Communication, Interconnection Networks.

UNIT II	PARALLEL HARDWARE AND LANGUAGES	7 Hrs

Introduction to parallel hardware: Multi-cores and multiprocessors; shared memory and message passing architectures; cache hierarchy and coherence; sequential consistency, Parallel languages and compilers: Language features for parallelism, parallel language constructs, optimizing compilers for parallelism, dependency analysis, code optimization and scheduling, loop parallelization and pipelining

UNIT III	CHALLENGES OF PARALLEL PROGRAMMING	7 Hrs

Identifying Potential Parallelism, Techniques for Parallelizing Programs, Issues, Cache Coherence issues, Memory Consistency Models, Maintaining Memory Consistency, Synchronization Issues, Performance Considerations.

UNIT IV	OPENMP PROGRAMMING	7 Hrs

OpenMP Execution Model, Memory Model and Consistency, Open MP Directives, Run Time Library Routines, Handling Data and Functional Parallelism.

UNIT V	MPI PROGRAMMING AND PROGRAMMING HETEROGENEOUS PROCESSORS	7 Hrs

The MPI Programming Model, Global Operations, Asynchronous Communication , Collective Communication , Other MPI Features ,Performance Issues , Combining OpenMP and MPI, GPU Architecture.

UNIT VI	GPU PROGRAMMING	7 Hrs

Introduction to GPU programming: GPU architecture; Introduction to CUDA programming, CUDA Threads and Memories, Concept of SIMD and SIMT computation; Thread blocks; Warps; Global memory; Shared memory; Thread divergence in control transfer; Example case studies, CUDA Threads and Memories , Application Development. Introduction to OpenCL.

Text Books

1. John L. Hennessey and David A. Patterson, "Computer Architecture, A quantitative approach", Morgan Kaufmann / Elsevier Publishers, 5th. Edition, 2012.
2. Peter S. Pacheco, "An Introduction to Parallel Programming", Morgan Kaufmann, 2011.
3. Michael J Quinn, "Parallel programming in C with MPI and OpenMP", Tata McGraw Hill, 2003.
4. David B. Kirk and Wen,mei W. Hwu, "Programming Massively Parallel Processors", Morgan Kaufmann, 2010.
5. David Culler: Parallel Computer Architecture: A Hardware/Software Approach, Morgan Kaufmann.
6. Jack Dongarra et al., Sourcebook of Parallel Computing, Morgan Kaufman Publishers, San Francisco, CA, 2003.

Reference Books

1. Ananth Grama, George Karypis, Vipin Kumar and Anshul Gupta, "Introduction to Parallel Computing", Second Edition, Pearson Education Limited, 2003.
2. Shameem Akhter and Jason Roberts, "Multi,core Programming", Intel Press, 2006.
3. Ian Foster, "Designing and Building Parallel Programs: Concepts and Tools for Parallel Software Engineering", Addison Wesley Longman Publishing Co., USA, 1995.
4. David E. Culler, Jaswinder Pal Singh, "Parallel Computing Architecture: A hardware Software approach", Morgan Kaufmann / Elsevier Publishers, 1999.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414464C: Elective IV
Computer Vision

Teaching Scheme: TH:03 Hours/Week	Credits:03	Examination Scheme: In-Sem (Paper): 30 Marks End-Sem (paper): 70 Marks

Prerequisites Courses :

1. Students should know vectors, linear algebra (i.e., matrix operations, solution of linear equations).
2. Programming language (e.g., Matlab and/or C).

Course Objectives :

1. To review image processing techniques for computer vision.
2. To understand shape and region analysis.
3. To understand three-dimensional image analysis techniques.
4. To understand Object detection and tracking.
5. To study some applications of computer vision algorithms.

Course Outcomes :

By the end of the course, students should be able to

1. Implement fundamental image processing techniques required for computer vision.
2. Implement boundary tracking techniques.
3. Apply Hough Transform for line, circle, and ellipse detections.
4. Implement motion related techniques.
5. Develop skills to develop applications using computer vision techniques.

UNIT I	FUNDAMENTALS OF DIGITAL IMAGE PROCESSING	7 Hrs

Review of image processing techniques, classical filtering operations, Thresholding techniques, edge detection techniques, corner and interest point detection, mathematical morphology and textures.

UNIT II	SHAPES AND REGIONS	7 Hrs

Binary shape analysis – connectedness – object labeling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments.

UNIT III	HOUGH TRANSFORM	7 Hrs

Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line localization – line fitting – RANSAC for straight line detection – HT based circular object detection – accurate center location – speed problem – ellipse detection –
Applications and case study: Human Iris location – hole detection – generalized Hough Transform – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation.

UNIT IV	3D VISION AND MOTION	7 Hrs

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations –

point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline based motion – optical flow – layered motion.

UNIT V	OBJECT DETECTION AND TRACKING	7 Hrs

Introduction to Motion Detection , Applications of Motion Detection and Tracking, Background Subtraction (BGS), Basic BGS Algorithms, Mixture of Gaussians (MoG), Block matching for object tracking. Single object and multi-object tracking.

UNIT VI	COMPUTER VISION APPLICATIONS	7 Hrs

Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians.

Text Books

1. Simon J. D. Prince, "Computer Vision: Models, Learning, and Inference", Cambridge University Press, 2012.

Reference Books

1. R. Davies, "Computer & Machine Vision", Fourth Edition, Academic Press, 2012.
2. R. Szeliski, "Computer Vision: Algorithms and Applications", Springer 2011.
3. Mark Nixon and Alberto S. Aquado, "Feature Extraction & Image Processing for Computer Vision", Third Edition, Academic Press, 2012.
4. D. L. Baggio et al., "Mastering OpenCV with Practical Computer Vision Projects", Packt Publishing, 2012.
5. Jan Erik Solem, "Programming Computer Vision with Python: Tools and algorithms for analyzing images", O'Reilly Media, 2012.
6. Sudha Challa, "Fundamentals of Object Tracking", Cambridge University Press, 2011.

ONLINE REFERENCES

1. http://kercd.free.fr/linksKCD.html
2. http://www.cs.ubc.ca/spider/lowe/vision.html
3. http://www.teiath.gr/seyp/optics/Vision.htm
4. http://www.visionscience.com/

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414464D: Elective IV
Social Media Analytics

Teaching Scheme:	Credits:03	Examination Scheme:
TH:03 Hours/Week		In-Sem (Paper): 30 Marks End-Sem (paper): 70 Marks

Prerequisites Courses :

1. Basic knowledge of Graphs.
2. Data mining.
3. Data Analysis.

Course Objectives :

1. To understand foundations of Social Media Analytics.
2. To Visualize and understand the data mining aspects in social networks.
3. To solve mining problems by different algorithms.
4. To understand network measures for social data.
5. To understand behavioral part of web applications for Analysis.
6. To analyze the data available on any social media applications.

Course Outcomes :

By the end of the course, students should be able to

1. Understand the basics of Social Media Analytics.
2. Explain the significance of Data mining in Social media.
3. Demonstrate the algorithms used for text mining.
4. Apply network measures for social media data.
5. Explain Behavior Analytics techniques used for social media data.
6. Apply social media analytics for Face book and Twitter kind of applications.

UNIT I	ANALYTICS IN SOCIAL MEDIA AND TYPES OF ANALYTICS TOOLS	7 Hrs

The foundation for analytics, Social media data sources, Defining social media data, data sources in social media channels, Estimated Data sources and Factual Data Sources, Public and Private data, data gathering in social media analytics.

UNIT II	VISUALIZING SOCIAL NETWORKS	7 Hrs

Introduction, A Taxonomy of Visualization, The convergence of Visualization, Interaction and Analytics. Data mining in Social Media: Introduction, Motivations for Data mining in Social Media, Data mining methods for Social Media, Related Efforts.

UNIT III	TEXT MINING IN SOCIAL NETWORKS	7 Hrs

Introduction, Keyword search, Classification Algorithms, Clustering Algorithms-Greedy Clustering, Hierarchical clustering, k-means clustering, Transfer Learning in heterogeneous Networks, Sampling of online social networks, Comparison of different algorithms used for mining, tools for text mining.

UNIT IV	NETWORK MEASURES	7 Hrs

Centrality: Degree Centrality , Eigenvector Centrality, Katz Centrality , PageRank, Betweenness Centrality, Closeness Centrality ,Group Centrality ,Transitivity and Reciprocity, Balance and Status, Similarity: Structural Equivalence, Regular Equivalence

UNIT V	BEHAVIOR ANALYTICS	7 Hrs

Individual Behavior: Individual Behavior Analysis, Individual Behavior Modeling, Individual Behavior **Prediction Collective Behavior**: Collective Behavior Analysis, Collective Behavior Modeling, Collective Behavior Prediction

UNIT VI	**CASE STUDY**	**7 Hrs**

Mining Twitter: Overview, Exploring Twitter's API, Analyzing 140 Characters

Mining Facebook: Overview, Exploring Facebook's Social Graph API's, Analyzing Social Graph Connections.

Text Books

1. Reza Zafarani Mohammad Ali Abbasi Huan Liu, Social Media Mining, Cambridge University Press, ISBN: 10: 1107018854.
2. Charu C. Aggarwal, Social Network Data Analytics, Springer, ISBN: 978-1-4419-8461-6.

Reference Books

1. Marshall Sponder, Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics, McGraw Hill Education, 978-0-07-176829-0.
2. Matthew A. Russell, Mining the Social Web, O'Reilly, 2nd Edition, ISBN:10: 1449367615.
3. Jiawei Han University of Illinois at Urbana-Champaign Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann, 2nd Edition, ISBN: 13: 978-1-55860-901-3 ISBN: 10: 1-55860-901-6.
4. Bing Liu, Web Data Mining : Exploring Hyperlinks, Contents and Usage Data, Springer, 2nd Edition, ISBN: 978-3-642-19459-7.

Savitribai Phule Pune University Fourth Year of Information Technology(2015 Course) 414465E: Elective IV Open Elective		
Teaching Scheme: TH:03 Hours/Week	**Credits:03**	**Examination Scheme: In-Sem (Paper): 30 Marks End-Sem (paper): 70 Marks**
In this subject, a student can opt from other branch of engineering (preferably *Computer Engineering* and *Electronics & Telecommunication*). An institution may design the syllabus of a subject in consultation with a reputed software company/industry. This syllabus should be approved by the University board of Studies (Information Technology) and academic council of SPPU authorities and then students can opt for the same as an open elective.		

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414466: COMPUTER LABORATORY-IX

Teaching Scheme:	Credits:02	Examination Scheme:
Practical:04 Hours/Week		TW:50Marks PR: 50Marks

Prerequisites:

1. Operating Systems.
2. Computer Network Technology.

Course Objectives :

1. The course aims to provide an understanding of the principles on which the distributed systems are based; their architecture, algorithms and how they meet the demands of Distributed applications.
2. The course covers the building blocks for a study related to the design and the implementation of distributed systems and applications.

Course Outcomes :

Upon successful completion of this course student will be able to

1. Demonstrate knowledge of the core concepts and techniques in distributed systems.
2. Learn how to apply principles of state-of-the-Art Distributed systems in practical application.
3. Design, build and test application programs on distributed systems.

Guidelines:

This Computer Laboratory-IX course has Distributed Systems as a core subject. The problem statements should be framed based on first six assignments mentioned in the syllabus. The teachers will frame the problem statements with due consideration that students have three hours to complete that. The practical examination will comprise of implementation and related theory. All assignments to be performed in Java 9.

Assignment 1

To develop any distributed application through implementing client-server communication programs based on Java Sockets and RMI techniques.

Assignment 2

To develop any distributed application using Message Passing Interface (MPI).

Assignment 3

To develop any distributed application with CORBA program using JAVA IDL.

Assignment 4

To develop any distributed algorithm for leader election.

Assignment 5

To create a simple web service and write any distributed application to consume the web service.

Assignment 6

To develop any distributed application using Messaging System in Publish-Subscribe paradigm.

Assignment 7

To develop Microservices framework based distributed application.

Term work:

Staff in-charge will suitably frame the above assignments and flexibility may be incorporated. Students will submit term work in the form of journal. Each assignment has to be well documented with problem definition, code documented with comments. Staff in-charge will assess the assignments continuously and grade or mark each assignment on completion date. All the assignments should be conducted on Latest version of Open Source Operating Systems, tools and Multi-core CPU supporting Virtualization and Multi-Threading.

Reference books:

1. George Coulouris, Jean Dollimore, Tim Kindberg & Gordon Blair,Distributed Systems – Concept and Design,Pearson,5th Edition ,ISBN:978-13-214301-1.
2. Nancy Ann Lynch, Distributed Algorithms, Morgan Kaufmann Publishers, illustrated, reprint, ISBN: 9781558603486.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414467: COMPUTER LABORATORY-X

Teaching Scheme: Practical:02 Hours/Week	Credits:01	Examination Scheme: TW:25Marks OR: 25Marks

Prerequisites:
1. Computer Network Technology.
2. Human Computer Interface.

Course Objectives :
1. To design and implement user interfaces for performing database operations.
2. To design applications for accessing smart devices and data generated through sensors and services.
3. To implement authentication protocols for providing security.

Course Outcomes :
Upon successful completion of this course student will be able to
1. Set up the Android environment and explain the Evolution of cellular networks.
2. Develop the User Interfaces using pre-built Android UI components.
3. Create applications for performing CURD SQLite database operations using Android.
4. Create the smart android applications using the data captured through sensors.
5. Implement the authentication protocols between two mobile devices for providing. Security.
6. Analyze the data collected through android sensors using any machine learning algorithm.

Guidelines:
This Computer Laboratory-X course has ubiquitous computing as a core subject. The problem statements should be framed based on first six assignments mentioned in the syllabus. The teachers will frame the problem statements with due consideration that students have three hours to complete that. The practical examination will comprise of implementation and related theory. All assignments to be performed in Java 9.

Tools Required: Android SDK / Android Studio, SQL Lite, Sensors, Ardunio kit.

Assignment 1

Android development environment. Installing and setting up the environment. Hello world application. Running the emulator. Inserting debug messages.

Assignment 2

Android UI Design: Design a User Interface using pre-built UI components such as structured layout objects, UI controls and special interfaces such as dialogs, notifications, and menus. Also make this UI attractive using Android graphics platform OpenGL.

Assignment 3

Android-database Connectivity: Create a SQLite Database for an Android Application and perform CRUD (Create, Read, Update and Delete) database operations.

Assignment 4

Sensors for building Smart Applications: Use any sensors on the device to add rich location and motion capabilities to your app, from GPS or network location to accelerometer, gyroscope, temperature, barometer, and more.
Assignment 5
Develop a Smart Light System (Light that automatically switched on in evening and gets off in morning) using open source Hardware platform like Arduino and some sensors (Light dependent resistor) and actuator (An LED).
Assignment 6
Design and Develop a GUI for FAN regulator that uses Android platform.
Assignment 7
Develop an Android based FAN regulator using open source Hardware platform like NodeMcu and actuator (a SERVO Motor).
Assignment 8
Android and Machine Learning: Mobile multimodal sensing- Draw inferences over the data coming from phone's sensing hardware (e.g. accelerometer, GPS, microphone), and processing these samples with the help of machine learning. (Any Application: Healthcare, Smart City, Agriculture, etc).
Assignment 9
Android API: Implement an application that uses Android APIs like Google Map, recording and playing audio and video, using the built-in camera as an input device.
Assignment 10
Wireless Network: Develop an app for a rolling display program of news on computer display. The input strings are supplied by the mobile phone/ by another computer connected through wireless networks.
Assignment 11
Android Security: Authentication of two mobile devices.
Assignment 12
Case Study: Evolution of cellular networks all the way up to 7G.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414468: Project Work

Teaching Scheme:	Credits:06	Examination Scheme:
TUT:06 Hours/Week		TW:50 Marks OR:100 Marks

Prerequisites:

1. BE-Project Phase I – Semester I.
2. Project Based Seminar.

Course Objectives:

1. The object of Project Work II & Dissertation is to enable the student to extend further the investigative study taken up under Project stage 1, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry.
2. To expose students to product development cycle using industrial experience, use of state of art technologies.
3. To encourage and expose students for participation in National/International paper presentation activities and funding agency for sponsored projects.
4. Exposure to Learning and knowledge access techniques using Conferences, Journal papers and anticipation in research activities.
5. Evaluate the various validation and verification methods.
6. Analyzing professional issues, including ethical, legal and security issues, related to computing projects.

Course Outcomes:

By the end of the course, Students will be able to

1. Learn teamwork.
2. Be well aware about Implementation phase.
3. Get exposure of various types of testing methods and tools.
4. Understand the importance of documentation.

Contents

Review 3:

Based on Implementation (50% implementation expected)

Review 4:

Complete Project and Testing

All the groups should try to overcome all the lacunas identified by the external examiner during Project Phase I exam

The group will submit following at the end of semester II.

1. The Workable project.
2. Project report (in Latex/Lyx/latest Word) in the form of bound journal complete in all respect – 1 copy for the Institute, 1 copy for guide and 1 copy of each student in the group for certification.

The project report contains the details.

1. Problem definition
2. Requirement specification
3. System design details (UML diagrams)
4. System implementation – code documentation – dataflow diagrams/ algorithm, protocols used.
5. Test result and procedure – test report as per ATP.
6. Conclusions.
7. Appendix
   a. Tools used
   b. References
   c. Papers published/certificates
   d. Plagiarism Report of paper and project report from any open source tool

One paper should be published in reputed International conference/International.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414461: Audit Course-VI

In addition to credits, it is recommended that there should be audit course in preferably in each semester from second year to supplement their knowledge and skills. Student will be awarded the bachelor‘s degree if he/she earns credits and clears all the audit courses specified in the syllabus. The student may opt for one of the audit courses per semester, starting in second year first semester. Though not mandatory, such a selection of the audit courses helps the learner to explore the subject of interest in greater detail resulting in achieving the very objective of audit course's inclusion. List of options offered is provided. Each student has to choose one audit course from the list per semester. Evaluation of audit course will be done at institute level itself. Method of conduction and method of assessment for audit courses are suggested.

Criteria

The student registered for audit course shall be awarded the grade PP and shall be included such grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory in-semester performance and secured a passing grade in that audit course. No grade points are associated with this 'PP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA.

Guidelines for Conduction and Assessment (Any one or more of following but not limited to)

1. Lectures/ Guest Lectures
2. Visits (Social/Field) and reports
3. Demonstrations
4. Surveys
5. Mini Project
6. Hands on experience on Specific focused topic

Guidelines for Assessment (Any one or more of following but not limited to)

1. Written Test
2. Demonstrations/ Practical Test
3. Presentations
4. IPR/Publication
5. Report

Audit Course VI Options

Course Code	Audit Course Title
414469A	1. IoT – Application in Engineering Field
414469B	2. Entrepreneurship
414469C	3. Cognitive Computing
414469D	4. AI and Robotics

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414469A: Audit Course-VI
IoT Applications in Engineering Field.

IOT as a game changer in several fields of applications and poised for phenomenal growth. This course introduces Students to IOT applications in various Engineering disciplines: Civil, Chemical, Electrical, E&TC, Mechanical and Metallurgical Engineering This 20 hour course is aimed at covering various components involved in IOT, concepts, definitions and mainly Engineering Applications associated with IOT/IIOT.

Course Objectives:

1. To get the detailed insight of Internet of Things.
2. To learn the IoT terms in Engineering.
3. To understand how IoT concepts can be implement.
4. To know the protocols, Sensors and other elements for IoT implementation.

Course Outcomes:

By the end of the course, students should be able to

1. Expand your knowledge of Internet of Things.
2. Discover how you can use IoT in your Engineering applications.
3. Build more effective hands on with IoT elements.
4. Expand the practical knowledge of using IoT components like sensors, processors.
5. Expand the understanding of using different protocols.

Unit I	**Basics of IOT – Difference between IOT and IIoT**
Overview of System Components of IOT.	
Unit II	**Architecture**
Importance, Advantages & Disadvantages.	
Unit III	**Sensors, Transducers, Special requirements for IIOT sensors, Actuators, Types of Sensors, Actuators**
Sensors, Transducers, Special requirements for IIOT sensors, Actuators, Types of Sensors, Actuators.	
Unit IV	**Protocols - HART, MODBUS-Serial & Parallel, Ethernet, BACNet**
Protocols - HART, MODBUS-Serial & Parallel, Ethernet, BACNet.	
Unit V	**Introduction to IIOT Cloud Platform and Security Aspects Importance and likely Risk Elements**
Introduction to IIOT Cloud Platform and Security Aspects Importance and likely Risk Elements.	
Unit VI	**Quiz, Case Studies and Student Presentations**
Illustrative IIOT applications in Engineering Disciplines – Civil, Chemical, Electrical, E & TC, Mechanical and Metallurgical.	

References

1. Internet of Things (A Hands-on-Approach) ISBN: 978-0996025515 - by ArshdeepBahga and Vijay Madisetti.
2. Inside the Internet of Things (IoT), Deloitte University Press.
3. Internet of Things- From Research and Innovation to Market Deployment; By Ovidiu& Peter; River Publishers Series.
4. Five thoughts from the Father of the Internet of Things; by By Phil Wainewright - Kevin Ashton, who coined the word IoT.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414469B: Audit Course-VI
Entrepreneurship

Today Entrepreneurship & Start -Ups are Key Words. Developing Entrepreneurs & Jobs is National Requirement. Separate PPT - presentation from our EEC Group can be Guideline as Reference Though reference books are available, it is best to see - Google Search videos and films that elaborate most of these concepts. You tube is a rich source of such content on each of these topics. This module also helps students get better prepared for interviews and group discussions.

Course Objectives:

1. To get the detailed about Entrepreneurship.
2. To understand the abilities to become an Entrepreneur.
3. To understand how Business Finance concepts can be implemented.

Course Outcomes:

By the end of the course, students should be able to

1. Expand your knowledge of Entrepreneurship & Startups.
2. Discover how you can use Entrepreneur Qualities.
3. Expand the practical knowledge of Finance, Legal-Patents, Intellectual Property, and Business Associations.
4. Expand the understanding of Deliverables & Achieving Target.

Unit I	**Introduction To Entrepreneurship & Favorable Environment for Startups**

Overview of Entrepreneurship and its need.

Unit II	**Entrepreneur - Qualities, Strengths & Challenges - Govt. Regulations & Taxes**

Qualities and its strength, challenges as well as respective government originations.

Unit III	**Road Map - Goal Setting & Methodology, Case Studies**

Successful case studies and appropriate methodology.

Unit IV	**Skill Sets required- Communication, Linguistic, Analytical & Abstract Thinking Engineering etc.**

Soft skills and hard skills required to become a successful entrepreneur.

References

1. Burns, Paul, 1949- author. Title: Entrepreneurship and small business.
2. Hisrich R D and Peters M P; “Entrepreneurship”; 5th Edition Tata McGraw-Hill.

Savitribai Phule Pune University
Fourth Year of Information Technology(2015 Course)
414469C: Audit Course-VI
Cognitive computing

This course explores the area of cognitive computing and its implications for today's world of big data analytics and evidence-based decision making. Topics covered include: cognitive computing design principles, natural language processing, knowledge representation, Students will have an opportunity to build cognitive applications, as well as explore how knowledge-based artificial intelligence and deep learning are impacting the field of data science.
This course is open to students in Business Intelligence and Analytics, Information Systems, and Masters of Business Administration, or with the permission of the instructor

Course Objectives:

1. To develop algorithms that use AI and machine learning along with human interaction and feedback to help humans make choices/decisions.
2. To get the detailed about appealing new model for application development.
3. To understand how to evaluate patterns and complex relationships in large unstructured data sets.
4. To understand how Cognitive computing supports human reasoning by evaluating data in context and presenting relevant findings along with the evidence that justifies the answers.

Course Outcomes:

By the end of the course, students should be able to

1. Understand and discuss what cognitive computing is, and how it differs from traditional approaches.
2. Plan and use the primary tools associated with cognitive computing.
3. Plan and execute a project that leverages cognitive computing.
4. Understand and discuss the business implications of cognitive computing.

Unit I	**Introduction to Cognitive Systems and computation, Knowledge based AI**

Cognitive systems, Different modes of Computing: Turning machine Lambda, Calculus, Hyper Computing, Super Computing, Pan Computing and Interactive Computing.

Unit II	**Cognitive Functioning**

Learning, Memorising, Adaptation, Self Origination, Control, Thinking, Reasoning, Decision Making & Judgement.

Unit III	**Mental States**

Belief Desire Intention (BDI) emotion and feeting. Computation of Cognitive Functioning in machines: Robotics, Human Robotics Interaction, Hepatic.

Unit IV	**Perception and sensing**

Hardware machines of vision and audition with reference to human and machine.

References

1. Hurwitz, Kaufman, and Bowles, Cognitive Computing and Big Data Analytics, Wiley, Indianapolis, IN, 2005, ISBN: 978-1-118-89662-4.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414469D: Audit Course-VI
AI and Robotics

Robotics is a branch of AI, which is composed of Electrical Engineering, Mechanical Engineering, and Computer Science for designing, construction, and application of robots. The robots have mechanical construction, form, or shape designed to accomplish a particular task. They have electrical components which power and control the machinery. They contain some level of computer program that determines what, when and how a robot does something.

Course Objectives:

1. To get the detailed robotics and rapid development.
2. To understand the robots functions.
3. To understand how mechanical devices converting into intelligent machines through a branch of computer science called artificial intelligence (AI).

Course Outcomes:

By the end of the course, students should be able to

1. The goal of this course is to familiarize the students with the basic concepts of robotics, artificial intelligence and intelligent machines.
2. It will help students to understand and apply principles, methodology and techniques of intelligent systems to robotics.

Unit I	**Intelligent Robotics**

Automation and Robots, Robot Classification, Robot Specifications, Sensory perception, Robot control and Intelligence.

Unit II	**Direct Kinematics**

Coordinate Frames, Rotations, Homogeneous Coordinates, The arm Equation, (DK analysis of - 2 Axis and 3 Axis Planar robot, Four axis SCARA Robot, Five axis Articulated robot).

Unit III	**Inverse Kinematics**

General Properties of Solutions, Tool Configuration, (IK analysis of - 2 Axis and 3 Axis Planar robot, Four axis SCARA Robot, Five axis Articulated robot).

Unit IV	**Workspace Analysis and Trajectory Planning**

Workspace analysis, Work envelope of 4-axis SCARA Robot, Work envelope of 5-axis articulated Robot, Workspace Fixtures, The pick-and-place operation, Continuous-Path Motion, Interpolated Motion, Straight Line Motion.

References:

1. Robotics and AI", Andrew Staugaard, PHI.
2. Fundamentals of Robotics- Analysis and Control", Robert Schilling, Pearson Education.
3. Introduction to Robotics", J. J. Craig, Pearson Education.
4. "Robotics", Fu, Gonzales and Lee, McGraw Hill.
5. "Artificial Intelligence: Structures and Strategies for Complex Problem Solving", George F. Luger, Pearson Education.
6. "Industrial Robotics- Technology, programming, and applications", Groover, Weiss, Nagel and Odrey, McGraw Hill
7. Elaine Rich and Kevin Knight, "Artificial Intelligence", TMH.

Savitribai Phule Pune University

Faculty of Science and Technology

Syllabus for Final Year of Mechanical Engineering

(Course 2015)

Savitribai Phule Pune University, Pune

BE (Mechanical Engineering) (2015 Course) Semester – VII

Code	Subject	Teaching Scheme Hrs / week			Examination Scheme					Total Marks	Credits		
		Lect	Tut	Pract	In-Sem	End-Sem	TW	PR	OR		TH	TW	OR/ PR
402041	Hydraulics and Pneumatics	3	-	2	30	70	25	-	25	150	3	-	1
402042	CAD CAM Automation	3	-	2	30	70	25	50	-	175	3	-	1
402043	Dynamics of Machinery	4	-	2	30	70	25	-	25	150	4	-	1
402044	Elective-I	3	-	2	30	70	25	-	-	125	3	1	-
402045	Elective-II	3	-	-	30	70	-	-	-	100	3	-	-
402046	Project Stage-I	-	-	4	-	-	25	-	25	50	-	1	1
Total		16	-	12	150	350	125	50	75	750	16	2	4
											22		

B. E. (Mechanical Engineering) (2015 Course) Semester – VIII

Code	Subject	Teaching Scheme Hrs / week			Examination Scheme					Total Marks	Credits		
		Lect	Tut	Pract	In-Sem	End-Sem	TW	PR	OR		TH	TW	OR/ PR
402047	Energy Engineering	3	-	2	30	70	25	-	25	150	3	-	1
402048	Mechanical System Design	4	-	2	30 (1.5 hrs)	70 (3 hrs)	25	-	50	175	4	-	1
402049	Elective-III	3		2	30	70	25	-	--	125	3	1	-
402050	Elective-IV	3	-	-	30	70	-	-	-	100	3	-	-
402051	Project Stage-II	-	-	12	-	-	100	-	100	200	-	3	3
Total		13	-	18	120	280	175	-	175	750	13	4	5
											22		

Elective – I		Elective – II	
Code	Subject	Code	Subject
402044 A	Finite Element Analysis	402045 A	Automobile Engineering
402044 B	Computational Fluid Dynamics	402045 B	Operation Research
402044 C	Heating Ventilation and Air Conditioning	402045 C	Energy Audit and Management
		402045 D	Open Elective**
Elective – III		Elective – IV	
402049 A	Tribology	402050 A	Advanced Manufacturing Processes
402049 B	Industrial Engineering	402050 B	Solar & Wind Energy
402049 C	Robotics	402050 C	Product Design and Development
		402050 D	Open Elective**

: Open Elective – Board of studies (BoS) – Mechanical and Automobile Engineering will declare the list of subjects, which can be taken under open electives or any other Electives that are being taught in the current semester, to the same level, as Elective – II and Elective -IV under engineering faculty in the individual college and Industry can define new elective subject with proper syllabus using defined framework of Elective II and Elective IV and ***get it approved from board of studies and other necessary statutory systems in the Savitribai Phule Pune University, Pune, before 30th November* of previous academic year in which the subject to be introduced . Without prior approval from University statutory system, no one can introduce the open elective in curriculum.

Savitribai Phule Pune University
Final Year of Mechanical Engineering (2015 Course)

Course Code : 402041 **Course Name : Hydraulics and Pneumatics**

Teaching Scheme:		Credits		Examination Scheme:				
Theory	**: 03 Hrs Per Week**	**TH**	**: 03**	**Theory**	**In-Sem**	**: 30**	**PR**	**: --**
Practical	**: 02 hrs per week**	**TW**	**: 01**		**End-Sem**	**: 70**	**OR**	**: 25**
							TW	**: 25**

Pre-requisites	: Fluid Mechanics, Manufacturing Processes and Machines, Mechatronics

Course Objectives:

- To study governing laws used in fluid power systems
- To study fluid power applications
- To study working principles of various components
- To study selection of different components
- To study how to design fluid power systems
- To study low cost automation

Course Outcomes:

On completion of the course, students will be able to -

- Understand working principle of components used in hydraulic & pneumatic systems
- Identify various applications of hydraulic & pneumatic systems
- Selection of appropriate components required for hydraulic and pneumatic systems
- Analyse hydraulic and pneumatic systems for industrial/mobile applications
- Design a system according to the requirements
- Develop and apply knowledge to various applications

Course Contents

Unit 1: Basics of Fluid Power and Pumps **6 Hrs**

Fluid power basics, advantages and limitations, fluid power distribution, standard symbols, energy loss in hydraulic systems.

Pumps - types, classification, principle of working and constructional details of vane pumps, gear pumps, radial and axial plunger pumps, screw pumps, power and efficiency calculations, and characteristics curves.

Unit 2: Actuators and Power Unit **6 Hrs**

Linear and rotary actuators- types, construction and characteristics. Cylinder mountings, cushioning of cylinders.

Power units and accessories - types of power units, reservoir assembly, constructional details. Accumulators, Intensifiers, Pressure and Temperature switches /sensors, level sensors.

Unit 3: Fluid Power Control **6 Hrs**

Direction control valves - center positions, methods of actuation, two stage valves, Flow control valves - pressure and temperature compensated. Pressure control valves - pressure reducing valve, sequence valve, unloading valve, brake valve, back pressure valve, counter balance valve, check valves, prefill valve, servo valves, cartridge valves, proportional valves.

Unit 4: Hydraulic Circuits and Contamination Control **6 Hrs**

Hydraulic circuits: Simple reciprocating, regenerative, speed control (meter in, meter out and bleed off), sequencing, synchronization, traverse and feed, automatic reciprocating, fail safe circuit, counter balance circuit, actuator locking, unloading circuit, motor breaking circuit etc.
Contamination control: Contamination, sources of contamination, suction strainer, filters, filtration, filter ratings.

Unit 5: Pneumatics – Components, Control Valves and Circuits **6 Hrs**

Compressors - Types, principle of working and constructional details. Comparison of pneumatic with hydraulic power transmissions. Types of filters, pressure regulators, lubricators, mufflers, dryers, direction control valves, pneumatic actuators, shuttle valve, two pressure valve, quick exhaust valve and time delay valves, electro-pneumatics. Speed regulating methods, pneumatic circuits, reciprocating, cascading time delay etc. Application of pneumatics in low cost automation and in industrial automation.

Unit 6: System Analysis and Design **6 Hrs**

Calculation of piston velocity, thrust under static and dynamic applications, considering friction, inertia loads, design considerations for cylinders, Design of hydraulic/pneumatic circuits for practical application, selection of different components such as reservoir, control elements, actuators, accumulator, intensifier, filters, pumps. (Students are advised to refer manufacturers' catalogues for design and use simulation tool like Automation Studio for analysis).

Books

Text :

1. Esposito A, Fluid Power with application, Prentice Hall
2. Majumdar S.R, Oil Hydraulic system- Principle and maintenance ,Tata McGraw Hill
3. Majumdar S.R, Pneumatics Systems Principles and Maintenance ,Tata McGraw Hill
4. Stewart H. L, Hydraulics and Pneumatics , Taraporewala Publication

References :

1. Pipenger J.J, Industrial Hydraulics, McGraw Hill
2. Pinches, Industrial Fluid Power, Prentice Hall
3. Yeaple, Fluid Power Design Handbook
4. Andrew A. Parr, Hydraulics and Pneumatics, Elsevier Science and Technology Books
5. ISO - 1219, Fluid Systems and components, Graphic Symbols
6. Standard Manufacturer's Catalogues

Term Work shall consist of following experiments and assignments:

1. Test on Gear/Vane/Piston pump and plotting performance characteristics
2. Following experiments to be done on hydraulic trainer (any 3)
   a) Regenerative circuit
   b) Speed control circuit
   c) Sequencing circuit
   d) Traverse and feed circuit etc.
3. Following experiments to be done on pneumatic trainer (any 3)

a) Automatic reciprocating circuit
b) Speed control circuit
c) Pneumatic circuit involving Shuttle valve/ Quick exhaust valve / Two pressure valve
d) Electro pneumatic circuits

4. Test on pressure relief valve/flow control valve
5. Test on linear /rotary actuator
6. Design of simple hydraulic systems used in practice using manufacturers' catalogue and analysis using software.
7. Design of simple pneumatic systems used in practice using manufacturers' catalogue and analysis using software.
8. Industrial visit to study Hydraulic / Pneumatic based Automation systems
9. Assignment: Symbols for different components as per standards
10. Assignment: Trouble shooting procedures
11. Assignment: Standard specifications of hydraulic/ pneumatic components using manufacturer's catalogues.

Savitribai Phule Pune University
Final Year of Mechanical Engineering (2015 Course)

Course Code : 402042 **Course Name : CAD CAM and Automation**

Teaching Scheme:		Credits		Examination Scheme:			
Theory	: 03 Hrs Per Week	TH	: 03	Theory	In-Sem : 30	PR	: 50
Practical	: 02 hrs per week	TW	: 01		End-Sem : 70	OR	: --
						TW	: 25

Pre-requisites	**:** Engineering Graphics, Engineering Mathematics, Numerical Methods & Optimization, Computer Aided Machine Drawing, Strength of Materials, Manufacturing Processes

Course Objectives:

- To apply homogeneous transformation matrix for geometrical transformations of 2D/3D CAD entities
- To model mathematically analytical and synthetic curves, surfaces
- To predict performance of simple mechanical components viz. beam, shafts, plates, trusses using FEA (Mathematical and Software treatment)
- To generate CNC program for appropriate manufacturing techniques viz. turning and milling
- To select and apply suitable Rapid Prototyping techniques for engineering applications
- To study role and components of different Automation strategies.

Course Outcomes:

On completion of the course, students will be able to -

- Apply homogeneous transformation matrix for geometrical transformations of 2D CAD entities for basic geometric transformations.
- Use analytical and synthetic curves and surfaces in part modeling.
- Do real times analysis of simple mechanical elements like beams, trusses, etc. and comment on safety of engineering components using analysis software.
- Generate CNC program for Turning / Milling and generate tool path using CAM software.
- Demonstrate understanding of various rapid manufacturing techniques and develop competency in designing and developing products using rapid manufacturing technology.
- Understand the robot systems and their applications in manufacturing industries.

Course Contents

Unit 1: Computer Graphics **6 Hrs**

Transformations (2D & 3D) : Introduction, Formulation, Translation, Shear, Rotation, Scaling and reflection, Homogeneous representation, Concatenated transformation, Mapping of geometric models, Inverse transformations, Introduction to 3D transformation (Theory + Numerical treatment only for 2D – Max 3 vertices)

Projections : Orthographic, Isometric, Perspective projections (Only theory)

Unit 2: Geometric Modeling **6 Hrs**

Curves – Introduction, Analytical curves (Line, circle, ellipse, parabola, hyperbola), Synthetic curves (Hermite Cubic Spline, Bezier, B-Spline Curve) [Numerical on Line, Circle, Ellipse, Hermite Cubic

Spline, Bezier]

Surfaces – Introduction, Surface representation, Analytic surfaces, Synthetic Surfaces, Hermite bicubic, Bezier, B-Spline, Coons patch surface, Applications in freeform surfaces [only Theory]

Solids - Introduction, Geometry and Topology, Solid Representation, Boundary Representation, Euler's equation, Constructive Solid Geometry (CSG), Boolean operation for CSG [only Theory]

Unit 3: Finite Element Analysis (FEA) 6 Hrs

Introduction : Brief History of FEM, Finite Element Terminology (nodes, elements, domain, continuum, Degrees of freedom, loads and constraints), General FEM procedure, Applications of FEM in various fields, meshing, p and h formulation, Advantages and disadvantages of FEM [Only theory]

One Dimensional Problem: Finite element modeling, coordinate and linear shape function, Assembly of Global Stiffness Matrix and Load Vector, Properties of Stiffness Matrix, Finite Element Equations, Temperature Effects. [Theory + Numerical – composite shaft, spring elements in series and parallel]

Trusses : Introduction, 2D Trusses, Assembly of Global Stiffness Matrix [Numerical limited to 4X4 matrix]

Unit 4: Computer Aided Manufacturing (CAM) 6 Hrs

Introduction to Computer Aided Manufacturing (CAM), Coordinate system, Working principal of CNC Lathe, Turning Centers, Milling Machine, Steps in developing CNC part program, Tool and geometric compensations, subroutine and Do loop using canned cycle. [Only theory – 2 hrs]

CNC Lathe part programming (FANUC) : Linear and circular interpolation, Canned cycles for facing, threading, grooving, etc. [Theory + Program]

CNC Milling part programming (FANUC): Linear and circular interpolation, Pocketing, contouring and drilling cycles. [Theory + Program]

Unit 5: Advanced Manufacturing Method 6 Hrs

Product Life Cycle: Introduction, Need, Components/Elements of PLM, Collaborative Engineering. [Only theory]

Rapid Prototyping : Introduction, classification of RP Processes (SLA, LOM, SLS, FDM, 3D printing), Working principle, features, models & specification of process, application, advantages and disadvantages, Rapid Tooling and STL format, Concept of 4D Rapid Prototyping. [Only theory]

Unit 6: Automation 6 Hrs

Automation : Introduction, Automation strategies, Types of Automation - Hard and Soft Automation, Flexible Manufacturing System – Types, Advantages, Limitations, AGVs and AS/RS [Only theory]

Group Technology: Introduction, Coding Methods, Concepts of Computer Integrated Manufacturing (CIM) and Computer Aided Process Planning (CAPP), Variant & Generative methods of CAPP, advantages of CAPP. [Only theory]

Robotics: RIA definition of Robot, Laws of robotics, Classification of robots, robot anatomy, Point to point and continuous path robotic systems, Joints, End Effectors, Grippers - Mechanical, Magnetic and Pneumatic, Applications. [Only theory]

Books

Text :

1. Ibrahim Zeid and R. Sivasubramanian - CAD/CAM - Theory and Practice Tata McGraw Hill Publishing Co. 2009

2. Chandrupatla T. R. and Belegunda A. D. -Introduction to Finite Elements in Engineering - Prentice Hall India.
3. Nitin S. Gokhale, Practical Finite Element Analysis, Finite To Infinite; First Edition edition, ISBN-10: 8190619500 ISBN-13: 978-8190619509
4. S. K. Sinha, CNC Programming using Fanuc Custom Macro B, McGraw-Hill Professional
5. S. R. Deb, Robotics Technology and Flexible Automation, Tata McGraw Hill.

References :

1. Ibraim Zeid, Mastering CAD/CAM – Tata McGraw Hill Publishing Co. 2000
2. Segerling L. J. - Applied Finite Elements Analysis, John Wiley and Sons
3. Seshu P. Text book of Finite Element Analysis, PHI Learning Private Ltd. New Delhi, 2010
4. Rao P. N., Introduction to CAD/CAM Tata McGraw Hill Publishing Co.
5. B. S. Pabla, M. Adithan, CNC Machines, New Age International, 1994
6. Groover M.P.-Automation, production systems and computer integrated manufacturing' - Prentice Hall of India
7. Ian Gibson, David W. Rosen, Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer
8. Geoffrey Boothroyd, Peter Dewhurst, Winston A. Knight, Product Design for Manufacture and Assembly, Third Edition ,CRC Press
9. Antti Saaksvuori, Anselmi Immonen, Product Life Cycle Management -Springer, 1st Edition, 2003

Term Work shall consist of following experiments and assignments:

1. Demonstration of Application Programming Interface (API).
2. Stress and deflection analysis of Beam (FEA).
3. Stress and deflection analysis of 2D truss (FEA).
4. Stress and deflection analysis of any Mechanical Component using FEA software and validate the results by analytical methods (FEA).
5. Tool path generation and simulation for Turning – Grooving and Threading with help of suitable software.
6. Tool path generation and simulation for Milling – Facing, Pocketing, Contouring and drilling, etc. with help of suitable software.
7. Case study on Rapid Prototyping - Exporting STL files from 3D CAD models, structure of STL files, etc.
8. Case study based on modeling and analysis of structural system (Industry Based)
9. Manufacturing of machine component using additive manufacturing or Using CNC simulator software.
10. Assignment on Robot simulation
11. Industrial Visit Report on Automation and Robotics

Savitribai Phule Pune University
Final Year of Mechanical Engineering (2015 Course)

Course Code : 402043 **Course Name : Dynamics of Machinery**

Teaching Scheme:		Credits		Examination Scheme:		
Theory	: 04 Hrs Per Week	TH	: 04	Theory	In-Sem : 30	PR : --
Practical	: 02 hrs per week	TW	: 01		End-Sem : 70	OR : 25
						TW : 25

Pre-requisites:	Strength of Materials, Engineering Mechanics, Engineering Mathematics and Numerical Methods,

Course Objectives:

- To conversant with balancing problems of machines.
- To understand fundamentals of free and forced vibrations.
- To develop competency in understanding of vibration and noise in Industry.
- To develop analytical competency in solving vibration problems.
- To understand the various techniques of measurement and control of vibration and noise.

Course Outcomes:

On completion of the course, students will be able to -

- Apply balancing technique for static and dynamic balancing of multi cylinder inline and radial engines.
- Estimate natural frequency for single DOF undamped & damped free vibratory systems.
- Determine response to forced vibrations due to harmonic excitation, base excitation and excitation due to unbalance forces.
- Estimate natural frequencies, mode shapes for 2 DOF undamped free longitudinal and torsional vibratory systems.
- Describe vibration measuring instruments for industrial / real life applications along with suitable method for vibration control.
- Explain noise, its measurement & noise reduction techniques for industry and day today life problems.

Course Contents

UNIT 1: Single Degree of Freedom Systems – Free Vibration **10 Hrs**

Fundamentals of Vibration : Elements of a vibratory system, vector representation of S.H.M., degrees of freedom, Introduction to Physical and Mathematical modeling of vibratory systems : Bicycle, Motor bike and Quarter Car. types of vibration, equivalent stiffness and damping, formulation of differential equation of motion (Newton, D'Alembert and energy method)

Undamped free vibrations: Natural frequency for longitudinal, transverse and torsional vibratory systems.

Damped free vibrations: Different types of damping, Viscous damping – over damped, critically damped and under damped systems, initial conditions, logarithmic decrement, Dry friction or coulomb damping - frequency and rate of decay of oscillations.

UNIT 2: Single Degree of Freedom Systems - Forced Vibrations **8 Hrs**

Forced vibrations of longitudinal and torsional systems, Frequency Response to harmonic excitation, excitation due to rotating and reciprocating unbalance, base excitation, magnification factor, Force and Motion transmissibility, Quality Factor. Half power bandwidth method, Critical speed of shaft having single rotor of undamped systems.

UNIT 3: Two Degree of Freedom Systems – Undamped Vibrations **8 Hrs**

Free vibration of spring coupled systems – longitudinal and torsional, torsionally equivalent shafts, natural frequency and mode shapes, Eigen value and Eigen vector by Matrix method, Combined rectilinear and angular motion, Vibrations of Geared systems.

UNIT 4: Balancing **8 Hrs**

Static and dynamic balancing, balancing of rotating masses in single and several planes, primary and secondary balancing of reciprocating masses, balancing in single cylinder engines, balancing in multi-cylinder in-line engines, direct and reverse cranks method -radial and V engines.

UNIT 5: Measurement and Control of Vibration **8 Hrs**

A) Measurement: Vibration Measuring Instruments, Accelerometers, Impact hammer, Vibration shakers, Vibration Analyzer, Vibration based condition monitoring, Analysis of Vibration Spectrum, Standards related to measurement of vibration, Human response to vibrations.

B) Control : Vibration control methods, passive, semi active (Introduction to Electro-Rheological & Magneto-Rheological dampers) and active vibration control, control of excitation at the source, control of natural frequency, Vibration isolators, Tuned Dynamic Vibration Absorbers, Introduction to Torsional Damper

UNIT 6: Introduction to Noise **6 Hrs**

Fundamentals of noise Sound concepts, Decibel Level, white noise, weighted sound pressure level, Logarithmic addition, subtraction and averaging, sound intensity, noise measurement, sound fields, octave band, sound reflection, absorption and transmission, acoustic material & its characteristics, Noise control at the Source, along the path and at the receiver, pass-by-noise, Reverberation chamber, Anechoic Chamber, Human Exposure to Noise and Noise standards.

Books

Text :

1. S. S. Rao, Mechanical Vibrations, Pearson Education Inc. New Delhi.
2. G. K. Grover, Mechanical Vibrations, New Chand and Bros.,Roorkee
3. Wiiliam J Palm III, Mechanical Vibration, Wiley India Pvt. Ltd, New Delhi
4. Uicker J. John, Jr, Pennock Gordon R, Shigley Joseph E., Theory of Machines and Mechanisms, International Version, OXFORD University Press, New Delhi.
5. M L Munjal, Noise and Vibration Control, Cambridge University Press India

References :

1. Weaver, Vibration Problems in Engineering, 5th Edition Wiley India Pvt. Ltd, New Delhi.
2. Bell, L. H. and Bell, D. H., Industrial Noise Control – Fundamentals and Applications‖, Marcel Dekker Inc.
3. Alok Sinha, Vibration of Mechanical System, Cambridge university Press , India
4. Debabrata Nag, Mechanical Vibrations, Wiley India Pvt. Ltd, New Delhi.
5. Kelly S. G., Mechanical Vibrations, Schaums outlines, Tata McGraw Hill Publishing Co. Ltd., New Delhi.

6. Meirovitch, L., Elements of Mechanical Vibrations‖, McGraw Hill.
7. Ver, Noise and Vibration Control Engineering, Wiley India Pvt. Ltd, New Delhi.
8. Bies, D. and Hansen, C., Engineering Noise Control - Theory and Practice, Taylor and Francis.
9. Shrikant Bhave, Mechanical Vibrations Theory and Practice, Pearson, New Delhi

Term Work shall consist of following experiments and assignments:

A] Compulsory Experiments (Sr. No. 1 to 6)

1. Balancing of wheel / rotor on computerized balancing machine OR Experimental verification of dynamic balancing of rotating masses.
2. To determine the natural frequency of damped vibration of single degree freedom system and to find it‘s damping coefficient.
3. To obtain frequency response curves of single degree freedom system of vibration for different amount of damping.
4. To verify natural frequency of torsional vibration of two rotor system and position of node.
5. To determine natural frequency of transverse vibration of beam using vibration analyzer.
6. Noise measurement and analysis using vibration Analyzer.

B] Any Two Experiments from the following :

1. To determine critical speed of shaft with single rotor.
2. Experimental verification of principle of dynamic vibration absorber.
3. Experiment on shock absorbers and to plot its characteristic curve.
4. A case study (Industrial visit / In-house) based on Conditioning Monitoring and Fault Diagnosis.

C] List of Compulsory Assignment :

1. Simulation (using suitable software) of free response of SDOF damped system to demonstrate different damping conditions by solving differential equation numerically.

OR

2. Simulation (using suitable software) of total response of SDOF damped system to harmonic excitation by solving differential equation numerically.

Savitribai Phule Pune University
Final Year of Mechanical Engineering (2015 Course)

Course Code : 402044 A **Course Name : Elective – I Finite Element Analysis**

Teaching Scheme:		Credits		Examination Scheme:			
Theory	: 03 Hrs Per Week	TH	: 03	Theory	In-Sem : 30	PR	: --
Practical	: 02 hrs per week	TW	: 01		End-Sem : 70	OR	: --
						TW	: 25

Pre-requisites	: Fluid Mechanics, Heat transfer, Numerical methods, Programming Languages.

Course Objectives:

- To understand the philosophy and general procedure of Finite Element Method as applied to solid mechanics and thermal analysis problems.
- To familiarize students with the displacement-based finite element method for displacement and stress analysis and to introduce related analytical and computer tools.
- It provides a bridge between hand calculations based on mechanics of materials and machine design and numerical solutions for more complex geometries and loading states.
- To study approximate nature of the finite element method and convergence of results are examined.
- It provides some experience with a commercial FEM code and some practical modeling exercises .

Course Outcomes:

On completion of the course, students will be able to -

- Understand the different techniques used to solve mechanical engineering problems.
- Derive and use 1-D and 2-D element stiffness matrices and load vectors from various methods to solve for displacements and stresses.
- Apply mechanics of materials and machine design topics to provide preliminary results used for testing the reasonableness of finite element results.
- Explain the inner workings of a finite element code for linear stress, displacement, temperature and modal analysis.
- Use commercial finite element analysis software to solve complex problems in solid mechanics and heat transfer.
- Interpret the results of finite element analyses and make an assessment of the results in terms of modeling (physics assumptions) errors, discretization (mesh density and refinement toward convergence) errors, and numerical (round-off) errors.

Course Contents

Unit 1: Fundamental Concepts of FEA **6 Hrs**

Introduction: Solution methodologies to solve engineering problems, governing equations, mathematical modelling of field problems in engineering, discrete and continuous models.

Brief history of FEM, Finite Element terminology (nodes, elements, domain, continuum, degrees of freedom, loads & constraints), general steps involved in FEM, applications of FEM in various fields, advantages and disadvantages of FEM, consistent units system, essential and natural boundary conditions, symmetric boundary conditions.

Introduction to different approaches used in FEA : Direct approach, Variational formulation- Principal of Minimum Potential Energy (PMPE), Galerkin weighted residual method, Principle of Virtual Work, Rayleigh-Ritz method, relation between FEM and Rayleigh-Ritz method

Types of Analysis (Introduction) : Linear static analysis, Non-linear analysis, Dynamic analysis, Linear buckling analysis, Thermal analysis, Fatigue analysis, Crash analysis.

Unit 2: 1D Elements **6 Hrs**

Types of 1D elements, displacement function, global and local coordinate systems, polynomial form of interpolation functions- linear, quadratic and cubic, properties of shape function, primary and secondary variables.

Formulation of elemental stiffness matrix and load vector for bar, truss and beam using any approach, Formulation of load vector due to uniform temperature change (only for bar).

Assembly of global stiffness matrix and load vector, properties of stiffness matrix, half bandwidth, treatment of boundary conditions- elimination approach, stress and reaction forces calculations

Unit 3: 2D Elements **6 Hrs**

Two-Dimensional Stress Analysis: Plane Stress/Strain problems in 2D elasticity, constitutive relations

Constant Strain Triangle(CST), Liner Strain Rectangle (LSR), displacement function, Pascal‘s triangle, compatibility and completeness requirement, geometric isotropy, convergence requirements, strain filed, stress filed, Formulation of element stiffness matrix and load vector for Plane Stress/Strain problems

Assembly of global stiffness matrix and load vector, Boundary conditions, solving for primary variables (displacement), stress calculations

Unit 4: Isoparametric Elements and Numerical Integration **6 Hrs**

Concept of isoparametric elements, Terms isoparametric, super parametric and subparametric.

Coordinate mapping : Natural coordinates, Area coordinates (for triangular elements), higher order triangular and quadrilateral elements (Lagrangean and serendipity elements), geometry associative mesh, quality checks, mesh refinement- p vs h refinements, Uniqueness of mapping - Jacobian matrix.

Numerical integration: Gauss Quadrature in one and two dimension, Order of Gauss integration, full and reduced integration, sub-modeling, substructuring.

Unit 5: 1D Steady State Heat Transfer Problems **6 Hrs**

Introduction, One dimensional steady-state heat transfer problem- Governing differential equation, Finite Element formulation using Galerkin’s approach for composite wall and thin Fin , essential and natural boundary conditions and solving for temperature distribution

Unit 6: Dynamic Analysis **6 Hrs**

Types of dynamic analysis, general dynamic equation of motion, lumped and consistent mass, Mass matrices formulation of bar, truss and beam element.

Undamped-free vibration: Eigenvalue problem, evaluation of eigenvalues and eigenvectors (characteristic polynomial technique).

Books

Text :

1. Daryl L, A First Course in the Finite Element Method,. Logan, 2007.
2. G Lakshmi Narasaiah, Finite Element Analysis, B S Publications, 2008.
3. Y.M.Desai, T.I.Eldho and A.H.Shah, Finite Element Method with Applications in Engineering, Pearson Education, 2011
4. Chandrupatla T. R. and Belegunda A. D., Introduction to Finite Elements in Engineering, Prentice Hall India, 2002.
5. P., Seshu, Text book of Finite Element Analysis, PHI Learning Private Ltd. , New Delhi, 2010.

References :

1. Bathe K. J., Finite Element Procedures Prentice, Hall of India (P) Ltd., New Delhi.
2. R. D. Cook, et al., Concepts and Applications of Finite Element Analysis. Wiley, India
3. Kwon Y. W., Bang H., Finite Element Method using MATLAB, CRC Press, 1997
4. Peter Kattan, MATLAB Guides to Finite Elements- An Interactive Approach, Springer, 2008.
5. S. Moaveni, Finite element analysis, theory and application with Ansys, Prentice Hall
6. Erdogan Madenci and Ibrahim Guven, "The Finite Element Method and Applications in Engineering Using Ansys", Springer, 2006.
7. David V. Hutton, Fundamental of Finite Element Analysis, Tata McGraw-Hill
8. Gokhale N. S., et al., Practical Finite Element Analysis, Finite to Infinite, Pune, 2008.

Term Work shall consist of following assignments:

Practical's to be performed: Minimum 7 including

- Any three practical's *from Practical No. 1 to 4** and
- Any three practical *from Practical No. 5 to 9***
- in Open source or Commercial Software

1. Computer program for stress analysis of 1D bar using linear and quadratic elements. Show the variation of stress and strain within the element for linear and quadratic bar element
2. Computer program for stress analysis of 2-D truss subjected to plane forces
3. Computer programs for (i) modal analysis and, (ii) stress analysis for 1-D beam (simply supported or cantilever beams)
4. Computer program for 1-D temperature analysis
5. Static stress concentration factor calculation for a plate with center hole subjected to axial loading in tension using FEA software
6. Modal analysis of any machine component using FEA software.
7. Stress and deflection analysis of any machine component consisting of 3-D elements using FEA software.
8. Elasto-plastic stress analysis of plate using FEA software
9. Coupled Thermal-Structural Analysis using FEA software

*1 Students can write the program in any of the programming language such as FORTRAN, C, C++, MATLAB, Python, VB.

*2 Minimum number of elements considered should be 10 or more.

*3 Validate results of the program with analytical method or commercial FEA software such as Abaqus, ANSYS, Msc-Nastran, Optistruct / Radioss, Comsol-Multiphysics, etc.

**1 Students should do convergence study for all assignment problems.
**2 Use different element types from element library,
**3 If possible use submodel / symmetry option.

Savitribai Phule Pune University
Final Year of Mechanical Engineering (2015 Course)

Course Code : 402044 B | **Course Name : Elective – I Computational Fluid Dynamics**

Teaching Scheme:		**Credits**		**Examination Scheme:**			
Theory	**: 03 Hrs Per Week**	**TH**	**: 03**	**Theory**	**In-Sem : 30**	**PR**	**: --**
Practical	**: 02 hrs per week**	**TW**	**: 01**		**End-Sem : 70**	**OR**	**: --**
						TW	**: 25**

Pre-requisites	**:** Fluid Mechanics, Heat transfer, Numerical methods, Programming Languages.

Course Objectives:

- Students should be able to model fluid / heat transfer problems and apply fundamental conservation principles.
- Students should be able to do discretize the governing equations by Finite Difference Method and Finite volume Method.
- Students should be able to develop programming skills by in-house code development for conduction, convection and fluid dynamics problems.
- Students should be able to solve basic convection and diffusion equations and understands the role in fluid flow and heat transfer.
- To prepare the students for research leading to higher studies.
- To prepare the students for career in CAE industry using software tools.

Course Outcomes:

On completion of the course, students will be able to -

- Analyze and model fluid flow and heat transfer problems.
- Generate high quality grids and interpret the correctness of numerical results with physics.
- Conceptualize the programming skills.
- Use a CFD tool effectively for practical problems and research.

Course Contents

Unit 1: Introduction to CFD **6 Hrs**

Introduction to Computational Fluid Dynamics, Derivation and physical interpretation of governing equations (conservation of mass, momentum and energy) in differential form, Concept of substantial derivative, divergence and curl of velocity, Mathematical behavior of Governing Equations and boundary conditions.

Unit 2: Solution to Conduction Equation **6 Hrs**

Introduction to FEA, FDM and FVM, Solution of two dimensional steady and unsteady heat conduction equation using finite volume method (Implicit and Explicit) with Dirichlet, Neumann, Robbin boundary conditions, Stability Criteria.

Unit 3: Solution to Advection Equation **6 Hrs**

Solution of two dimensional steady and unsteady heat advection equation using finite volume method (Implicit and Explicit) with Dirichlet BC, Stability Criteria, Introduction to first order upwind, CD, second order upwind and QUICK convection schemes.

Unit 4: Solution to Convection-Diffusion Equation **6 Hrs**

Solution of two dimensional steady and unsteady heat convection-diffusion equation for slug flow using finite volume method (Implicit and Explicit), Stability Criteria, 1-D transient convection-diffusion system, Peclet Number

Unit 5: Solution to Navier – Stokes Equation **6 Hrs**

Solution of Navier-Stoke‘s equation for incompressible flow using SIMPLE algorithms for lid driven cavity flow problem, Introduction to external flow simulation.

Unit 6: Introduction to Turbulence Modeling **6 Hrs**

Introduction to turbulence models, Reynolds Averaged Navier-Stokes equations (RANS), One equation model (Derivation) and two equation model.

Books

Text :

1. John D Anderson: Computational Fluid Dynamics- The Basics with Applications, McGraw-Hill
2. Atul Sharma, Introduction to Computational Fluid Dynamics: Development, Application and Analysis, Wiley
3. Suhas V. Patankar, Numerical Heat Transfer and Fluid Flow, Hemisphere Publishing Corporation
4. A. W. Date, Introduction to Computational Fluid Dynamics, Cambridge Univ. Press, USA.
5. H. Versteeg, and W.Malalasekara, An Introduction to Computational Fluid Dynamics: The Finite Volume Method, Pearson.
6. T. J. Chung, Computational Fluid Dynamics, Cambridge University Press.
7. J. Tu, G.-H. Yeoh and C. Liu: Computational Fluid Dynamics: A practical approach, Elsevier.
8. H. Schlichting and K. Gersten, Boundary-Layer Theory, Springer.

References :

1. H. Tennekes and J. L. Lumley, A First Course in Turbulence, MIT Press.
2. David C. Wilcox, Turbulence Modeling for CFD, DCW Industries

Term Work shall consist of following assignments:

Practical’s to be performed: Minimum 7 including

- Any three practical’s with programming language (*from Practical No. 1 to 8*) and
- Any three practical in Open source or Commercial Software (*from Practical No. 9 to 16*)
- Mini project (*Practical No.16*) in Open source or Commercial Software tool

1. One-dimensional steady state conduction using finite volume method
2. One-dimensional unsteady state conduction using finite volume method
3. Two-dimensional steady state conduction using finite volume method
4. Two-dimensional unsteady state conduction using finite volume method
5. Two-dimensional advection using finite volume method
6. One-dimensional conduction convection problem using finite volume method
7. One-dimensional conduction convection problem using finite volume method
8. Solution of Navier Stokes equation using SIMPLE algorithm for Lid Driven Cavity flow

problem

9. Numerical simulation and analysis of boundary layer over a flat plate (Blausius Equation)
10. Numerical simulation and analysis of boundary layer for a
11. Developing flow through Pipe
12. Fully developed flow through a pipe
13. CFD Analysis of external flow: Circular Cylinder or Airfoil (NACA 0012)
14. CFD analysis of heat transfer in pin fin.
15. Numerical simulation and analysis of 2D square lid driven cavity. Effect of Reynolds number on the vorticity patterns.
16. Mini project on any practical application. Students should take a problem of their choice and verify the CFD solution with experimental data / research paper. (Mandatory)

Savitribai Phule Pune University

Final Year of Mechanical Engineering (2015 Course)

Course Code : 402044 C **Course Name : Elective – I**

Heating, Ventilation, Air Conditioning and Refrigeration Engineering

Teaching Scheme:		**Credits**		**Examination Scheme:**			
Theory	**: 03 Hrs Per Week**	**TH**	**: 03**	**Theory**	**In-Sem : 30**	**PR**	**: --**
Practical	**: 02 hrs per week**	**TW**	**: 01**		**End-Sem : 70**	**OR**	**: --**
						TW	**: 25**

Pre-requisites:	Thermodynamics I and II, Refrigeration and Air Conditioning

Course Objectives:

- To understand the recent vapour compression cycle
- To provide the knowledge of analyze thermal design of refrigeration system components
- To understand practical aspects of vapour compression system
- To provide the knowledge of basic concepts of ventilation, infiltration and space distribution techniques
- To inculcate techniques of estimating building envelop load.
- To understand the working non-conventional air-conditioning systems.

Course Outcomes:

On completion of the course, students will be able to -

- Determine the performance parameters of trans-critical & ejector refrigeration systems
- Estimate thermal performance of compressor, evaporator, condenser and cooling tower.
- Describe refrigerant piping design, capacity & safety controls and balancing of vapour compressor system.
- Explain importance of indoor and outdoor design conditions, IAQ, ventilation and air distribution system.
- Estimate heat transmission through building walls using CLTD and decrement factor &time lag methods with energy-efficient and cost-effective measures for building envelope.
- Explain working of types of desiccant, evaporative, thermal storage, radiant cooling, clean room and heat pump air-conditioning systems.

Course Contents

Unit 1: Advanced Vapour Compression Cycles **4 Hrs**

Review of vapour compression cycle, Trans-critical cycle and their types retical treatment) Ejector refrigeration cycle and their types. Presentation of cycle on P-h and T-s chart.

Unit 2: Thermal Design of Refrigeration System Components **8 Hrs**

Compressor : Characteristic curves of reciprocating & Centrifugal compressors, sizing of reciprocating compressor

Evaporator : Standards & Codes, Performance analysis of Dx evaporator,

Condenser: Standards & Codes, air-cooled condenser, shell & tube condenser and evaporative condenser.

Expansion Devices : Standards & Codes, Operating Characteristics, Liquid Charge in the Sensing Bulb , Hunting of Thermostatic Expansion Valve
Cooling Tower: Types & design of cooling towers, cooling tower thermal performance, tower efficiency.

Unit 3: Practical Aspects of Vapour Compression System **6 Hrs**

Refrigerant Piping : Copper Tubing, Piping Design for Reciprocating Refrigeration Systems, Size of Copper Tube, Refrigeration Load, and Pressure Drop, Sizing Procedure, Suction Line, Discharge Line (Hot-Gas Line), Liquid Line
Capacity Controls : Capacity Controls of reciprocating, centrifugal and scroll compressors
Safety Controls: Low-Pressure and High-Pressure Controls. Low-Temperature Control, Frost Control, Oil Pressure Failure Control. Motor Overload Control.
Vapour compression system balance: Performance characteristics of the condensing unit & compressor-capillary tube.

Unit 4: Ventilation and Infiltration **6 Hrs**

Indoor Design Criteria and Thermal Comfort : Basic parameters, factors affecting thermal comforts, Comfort-Discomfort Diagrams, Indoor Temperature, Relative Humidity, and Air Velocity
Indoor Air Quality : Indoor Air Contaminants, Basic Strategies to Improve Indoor Air Quality,
Outdoor Design Conditions : Outdoor Air Requirements for Occupants, The Use of Outdoor Weather Data in Design, Outdoor Weather Characteristics and Their Influence
Ventilation for cooling : Natural ventilation, mechanical ventilation
Space air distribution: Design of air distribution systems, Types of air distribution devices: Airflow patterns inside conditioned space: Stratified mixing flow: Cold air distribution: Displacement flow: *Spot cooling / heating*: Selection of supply air outlets.

Unit 5: Heat Load Estimation in Building Structures **6 Hrs**

Solar radiation, Heat gain through fenestrations, Space load characteristics, cooling load and coil load calculations, Overall heat transmission coefficient, air spaces, sol-air temperature, Decrement factor & time lag method,, Cooling load Temperature Difference method (CLTD) or Equivalent Temperature Differential (ETD), detailed calculation procedure using CLTD method, Total heat balance.
Energy-efficient and cost-effective measures for building envelope**,** Concept of ECBC

Unit 6: Advanced Air-conditioning Systems **6 Hrs**

Desiccant-Based Air Conditioning Systems : Introduction, Sorbents & Desiccants, Dehumidification, Liquid Spray Tower, Solid Packed Tower, Rotary Desiccant Dehumidifiers, Hybrid Cycles, Solid Desiccant Air-Conditioning (Theoretical treatment)
Evaporative-Cooling Air Conditioning Systems, Thermal Storage Air Conditioning Systems, Clean-Room Air Conditioning Systems, Radiant cooling. (Theoretical treatment)
Heat Pump Systems: Heat Pump Cycle, different heats pump Circuits.

Books

Text :

1. Arora R.C., Refrigeration and Air Conditioning, PHI, India
2. Dossat Ray J., Principal of Refrigeration, Pearson, India
3. Arora C P, Refrigeration and Air Conditioning, Tata McGraw Hill

4. Manohar Prasad, Refrigeration and Air-conditioning, Wiley Eastern Limited, 1983

References :

1. Threlkeld J.L., Thermal Environmental Engineering, Prentice Hall Inc. New Delhi
2. ASHRAE Handbook (HVAC Equipments)
3. Stocker W.F. and Jones J.W., Refrigeration and Air-conditioning, McGraw Hill International editions 1982.
4. Roger Legg, Air conditioning systems: Design, Commissioning and maintenance
5. Shan Wang, Handbook of Refrigeration and Air Conditioning, McGrawHill Publications
6. Wilbert Stocker, Industrial Refrigeration, McGrawHill Publications
7. Keith Harold, Absorption chillers and Heat Pumps, McGrawHill publications
8. ASHRAE, Air Conditioning System Design Manual, IInd edition, ASHRAE.

Term Work shall consist of following assignments:

1. Performance Simulation of Central Air-conditioning plant using Newton Raphson Method.
2. Performance analysis of Counter flow or cross flow cooling tower
3. Building heat load simulation using suitable software (Trace 700, Energy plus etc.)
4. Design of cold storage with process layout.

Savitribai Phule Pune University
Final Year of Mechanical Engineering (2015 Course)

Course Code : 402045 A | **Course Name : Elective – II Automobile Engineering**

Teaching Scheme:		Credits		Examination Scheme:			
Theory	**: 03 Hrs Per Week**	**TH**	**: 03**	**Theory**	**In-Sem : 30**	**PR**	**: --**
Practical	**: --**	**TW**	**: --**		**End-Sem : 70**	**OR**	**: --**
						TW	**: --**

Pre-requisites	**:** I. C. Engines, Theory of Machines, Basics of Electrical and Electronics

Course Objectives:

- To make the student conversant with fundamentals of automobile systems.
- To develop competencies in performance analysis of vehicles.
- To make the student conversant with automobile safety, electrical system and vehicle maintenance.
- To understand the emerging trends of electric vehicles, hybrid electric vehicles and solar vehicles. .

Course Outcomes:

On completion of the course, students will be able to -

- To compare and select the proper automotive system for the vehicle.
- To analyse the performance of the vehicle.
- To diagnose the faults of automobile vehicles.
- To apply the knowledge of EVs, HEVs and solar vehicles

Course Contents

Unit 1: Introduction and Drive Train **6 Hrs**

Introduction: Current scenario in Indian auto/ancillary industries, vehicle specifications and classification.

Chassis and Frames: Types of chassis layout with reference to power plant locations and drive, various types of frames, constructional details.

Drive Train: Types of transmission system, necessity and selection of clutch, necessity of gear box and different types, fluid flywheel, torque convertor, continuous variable transmission, , overdrive, propeller shaft, final drive and differential.

Unit 2: Axles, Wheels and Tyres, Steering System **6 Hrs**

Axles: Purpose, requirement and types of front and rear axle, loads acting on rear axles.

Wheels and tyres: Wheel construction, alloy wheel, wheel balancing, type of tyres, tyre construction, tyre materials, factors affecting tyre life.

Steering system : Steering mechanism, steering geometry, cornering force, slip angle, scrub radius, steering characteristics, steering linkages and gearbox, power steering, collapsible steering, reversibility of steering, four wheel steering, wheel alignment.

Unit 3: Suspension and Brake System **6 Hrs**

Suspension : Types of suspension linkages, types of suspension springs- leaf, coil, air springs, hydro gas, rubber suspension, interconnected suspension, self levelling suspension (active suspension), shock absorbers (hydraulic and air).

Brake systems: Drum, disc, mechanical, hydraulic, air brakes, vacuum, power assisted brakes, hand brake, ABS, EBD.

Unit 4: Vehicle Performance and Safety **6 Hrs**

Vehicle performance: Parameters, vehicle resistances, traction and tractive effort, power requirement for propulsion, road performance curves (numericals), stability of vehicles, vehicle testing on chassis dynamometer.

Vehicle safety: Types of active and passive safety, vehicle interior and ergonomics, NVH in automobiles.

Unit 5: Electrical System and Vehicle Maintenance **6 Hrs**

Batteries : Principles and construction of lead-acid battery, characteristics of battery, rating capacity and efficiency of batteries, various tests on battery condition, charging methods, introduction to lithium batteries.

Electrical system and accessories : Insulated and earth return systems, positive and negative earth systems, electrical fuel pump, speedometer, fuel, oil and temperature gauges, horn, wiper system, automotive sensors and actuators, electronic control unit/module.

Maintenance: Types of vehicle maintenance, servicing/overhauling of clutch, gear box, propeller shaft, differential, axles, steering system, suspension system, break system, electrical system.

Unit 6: Electric and Hybrid Electric Vehicles **6 Hrs**

Introduction: Concept and environmental importance of EVs, HEVs and solar vehicles.

Electric vehicles: Layout, construction and working.

Hybrid electric vehicles: Types, layout, hybridization factor, plug in hybrid electric vehicles, fuel efficiency analysis.

Challenges and future scope of EVs and HEVs.

Books

Text :

1. K. Newton and W. Seeds, T.K. Garrett, “Motor Vehicle”, 13thEdition, Elsevier publications.
2. Hans Hermann Braess, Ulrich Seiffen, “Handbook of Automotive Engineering”, SAE Publications.
3. William H. Crouse., “Automotive Mechanics”, Tata McGraw Hill Publishing House.
4. Joseph Heitner, “Automotive Mechanics”, C.B.S Publishers and Distributors.
5. SAE Manuals and Standards.
6. .N. K. Giri, Automobile Mechanics
7. P. S. Kohali, Automobile Electrical Equipment, Tata McGraw Hill Publishing House.
8. Narang G. B. S, “Automobile Engineering”, S. Chand and Company Ltd.

References :

1. Dr. Kirpal Singh, “Automobile Engineering”, Volume 1, Standard Publishers distributors.
2. Automobile Mechanics, “Crouse/Anglin”, TATA Mcgraw-Hill.
3. R. B. Gupta, Automobile Engineering, Satya Prakashan.

4. Chris Mi, M .Abul Masrur, Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives, ,Willey.
5. Electric and Hybrid Vehicles, Tom Denton, Routledge.
6. Hybrid Electric Vehicle Technology, Automotive Research and Design, American Technical.
7. Husain, Iqbal, Electric and hybrid vehicles, 2 edition, CRC Press.
8. Ron Hodkinson and John Fenton, Butterworth-Heinemann.Lightweight Electric/ Hybrid Vehicle Design,
9. Ehsani, Yimin Gao, Ali Emadi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, Standards media.

Savitribai Phule Pune University
Final Year of Mechanical Engineering (2015 Course)

Course Code : 402045 B | **Course Name : Elective – II Operation Research**

Teaching Scheme:		**Credits**		**Examination Scheme:**		
Theory	**: 03 Hrs Per Week**	**TH**	**: 03**	**Theory**	**In-Sem : 30**	**PR : --**
Practical	**: --**	**TW**	**: --**		**End-Sem : 70**	**OR : --**
						TW : --

Pre-requisites	Mathematics I, II and III

Course Objectives:

- To familiarize the students with the use of practice oriented mathematical applications for optimization functions in an organization.
- To familiarize the students with various tools of optimization, probability, statistics and simulation, as applicable in particular scenarios in industry for better management of various resources.

Course Outcomes:

On completion of the course, students will be able to -

- Apply LPP and Decision Theory to solve the problems
- Apply the concept of transportation models to optimize available resources.
- Decide optimal strategies in conflicting situations.
- Implement the project management techniques.
- Minimize the process time
- Optimize multi stage decision making problems

Course Contents

Unit 1: Introduction: Operation Research **6 Hrs**

Introduction: Definition, Evolution and Classification of Quantitative Methods and Operations Research Techniques, Methodology, Advantages and Limitations. Linear Programming Problem: Introduction, Formulation of LPP, Solution of LPP by Two Phase Method only. Decision Theory: Meaning and Steps in Decision Making, Types of Management Decisions, Decision under Certainty, under Risk, under Uncertainty, Decision Trees

Unit 2: Transportation & Assignment Model **6 Hrs**

Introduction, Formulation, Basic Method of Solving Transportation Problem, Optimization Methods like UV and Stepping Stone Method, Assignment Problem- Hungarian Method to solve Assignment Problem.

Unit 3: Theory of Games and Linear Programming **6 Hrs**

Theory of Games : Introduction, Minimax and Maximin Principle, Solution of Game with Saddle Point, Solution by Dominance, Solution by Graphical Method, m x n size Game Problem, Iterative method, Introduction to formulation of games using Linear Programming.

Replacement Analysis: Replacement of Items that Deteriorate, Replacement of Items that Fail

Suddenly.

Unit 4: Project Management **6 Hrs**

Network Models: Fulkerson‘s rule, concept and types of floats, CPM and PERT, Crashing Analysis and Resource Scheduling. Simulation: Introduction, Monte-Carlo Simulation method, Simulation of Inventory and Queuing Problems.

Unit 5: Queuing Theory and Sequencing Models **6 Hrs**

Queuing Theory: Introduction, Basis Structure, Terminology (Kendal‘s Notations) and Applications. *Queuing Model M/M/1*: /FIFO, M/M/c.

Sequencing models : Solution of sequencing Problem - Processing of n jobs through two machines, Processing of n jobs through three machines, Processing of two jobs through m Machines, Processing of n jobs through m Machines

Unit 6: Integer and Dynamic Programming **6 Hrs**

Integer Programming Introduction to Integer Programming, Cutting plane method and Branch and Bound Method. Dynamic Programming: Introduction, DP Model, Applications of DP Model to shortest route problems. Solution of LPP by Dynamic Programming

Books

Text :

1. Prem Kumar Gupta, D. S. Hira, Problems in Operations Research: Principles and Solutions, S. Chand, 1991
2. J. K. Sharma, Operations Research: Theory and Application, Laxmi pub. India.
3. Operations Research, S. D. Sharma, Kedar Nath Ram Nath-Meerut.
4. L.C.Jhamb,Quantative Techniques Vol. I&II, Everest Publication.
5. Manohar Mahajan, Operation Research, Dhanpatrai Publication

References :

1. Hillier F.S., and Lieberman G.J., Operations Research, Eight Edition, Mc. Tata McGraw Hill, India
2. Ravindran, ―Engineering optimization Methods and Applications‖, 2nd edition, Wiley, India
3. Ravindran, Phillips and Solberg, Operations Research Principles and Practice, Second Edition, Mc. WSE Willey,
4. Operations Research - An introduction, Hamdy A Taha, Pearson Education.

Savitribai Phule Pune University
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Course Code : 402045 C **Course Name : Elective – II**
Energy Audit and Management

Teaching Scheme:		**Credits**		**Examination Scheme:**			
Theory	**: 03 Hrs Per Week**	**TH**	**: 03**	**Theory**	**In-Sem : 30**	**PR**	**: --**
Practical	**: --**	**TW**	**: --**		**End-Sem : 70**	**OR**	**: --**
						TW	**: --**

Pre-requisites:	Thermodynamics, Turbo Machines

Course Objectives:

Following concepts to be taught to the students,

- Importance of Energy Management.
- To Carry out Energy Audit.
- Methods to reduce consumption of energy and save cost.
- To improve energy efficiency of overall system.
- Significance of Waste heat recovery and Cogeneration.

Course Outcomes:

On completion of the course, students will be able to -

- Compare energy scenario of India and World.
- Carry out Energy Audit of the Residence / Institute/ Organization.
- Evaluate the project using financial techniques
- Identify and evaluate energy conservation opportunities in Thermal Utilities.
- Identify and evaluate energy conservation opportunities in Electrical Utilities.
- Identify the feasibility of Cogeneration and WHRUse a CFD tool effectively for practical problems and research.

Course Contents

Unit 1: General Aspects of Energy Management **6 Hrs**

Current energy scenario - India and World, Current energy consumption pattern in global and Indian industry, Concept of energy conservation and energy efficiency, Energy and environment, Need of Renewable energy, Principles of Energy management, Energy policy, Energy action planning, Energy security and reliability, Energy reforms.

Unit 2: Energy Audit **6 Hrs**

Need of Energy Audit, Types of energy audit, Components of energy audit, Energy audit methodology, Instruments used in energy audit, Analysis and recommendations of energy audit, Energy audit reporting, Energy audit software, Current Energy Conservation Act.

Unit 3: Energy Economics **6 Hrs**

Costing of Utilities- Determination of cost of steam, natural gas, compressed air and electricity, Financial Analysis Techniques (Numerical) - Simple payback, Time value of money, Net Present Value(NPV), Return on Investment (ROI), Internal Rate of Return (IRR), Risk and Sensitivity analysis.

Unit 4: Energy Efficiency in Thermal Utilities **6 Hrs**

Energy performance assessment (Numerical) and efficiency improvement of Boilers, Furnaces, Heat exchangers, Cooling tower, DG sets, Fans and blowers, Pumps, Compressors, Compressed air system and HVAC systems. Assessment of steam distribution losses, Steam leakages, Steam trapping, Condensate and flash steam recovery system.

Unit 5: Energy efficiency in Electrical Utilities **6 Hrs**

Electricity billing, Electrical load management and maximum demand control, penalties, Power factor improvement and benefits, Selection and location of capacitors. Distribution and transformer losses, Electrical motors- types, efficiency and selection, Speed control, Energy efficient motors, Introduction of Electricity Act 2003,Lamp types and their features, recommended illumination levels, Lighting system performance assessment and efficiency improvement (Numerical)

Unit 6: Cogeneration and Waste Heat Recovery **6 Hrs**

Cogeneration : Need, applications, advantages, classification, Introduction to Trigeneration, Waste heat recovery- Classification, Application, Concept of Pinch analysis, Potential of WHR in Industries, Commercial WHR devices, saving potential. CDM projects and carbon credit calculations. *Case study*: Energy Audit of Institute/Department.

Books

References :

1. Handbook of Energy Audit, Albert Thumann P.E. CEM, William J. Younger CEM, The Fairmont Press Inc., 7th Edition.
2. Energy Management Handbook, Wayne C. Turner, The Fairmont Press Inc., 5th Edition, Georgia.
3. Handbook on Energy Audit and Environment management, Abbi Y. A., Jain Shashank, TERI, Press, New Delhi, 2006
4. Energy Performance assessment for equipment and Utility Systems.-Vol. 2,3.4 BEE Govt. of India
5. Boiler Operator‘s Guide Fourth Edition, Anthony L Kohan, McGraw Hill
6. Energy Hand book, Second edition, Von Nostrand Reinhold Company - Robert L. Loftness.
7. www.enrgymanagertraining.com
8. http://www.bee-india.nic.in

Savitribai Phule Pune University
Final Year of Mechanical Engineering (2015 Course)

Course Code : 402046 **Course Name : Project – I**

Teaching Scheme:		**Credits**		**Examination Scheme:**		
Theory	**: --**	**TH**	**: --**	**Theory**	**In-Sem : --**	**PR : --**
Practical	**: 04 hrs per week**	**TW**	**: 02**		**End-Sem : --**	**OR : 25**
						TW : 25

Course Objectives:

- To have ideology of the industrial project.
- Hands on working with tools, tackles and machines
- To carry out literature survey
- To do brain storming for mechanical engineering system

Course Outcomes:

On completion of the course, students will be able to -

- Find out the gap between existing mechanical systems and develop new creative new mechanical system.
- Learn about the literature review
- Get the experience to handle various tools, tackles and machines.

Course Contents

INSTRUCTIONS FOR PROJECT REPORT WRITING (Project Stage I)

It is important that the procedures listed below be carefully followed by all the students of B.E. (Mechanical Engineering).

1. Prepare ***Three Spiral Bound Copies*** of your manuscript.
2. Limit your Project Stage I to *25– 30* pages (preferably)
3. The *footer must include* the following:
   Institute Name, B.E. (Mechanical) Times New Roman 10 pt. and centrally aligned.
4. Page number as second line of footer, Times New Roman 10 pt. centrally aligned.
5. Print the manuscript using
   a) Letter quality computer printing.
   b) The main part of manuscript should be Times New Roman 12 pt. with alignment - justified.
   c) Use 1.5 line spacing.
   d) Entire report shall be of 5- 7 chapters
6. Use the paper size 8.5’’ × 11’’ or A4 (210 × 197 mm). Please follow the margins given below.

Margin Location	**Paper 8.5’’ × 11’’**	**Paper A4 (210 × 197 mm)**
Top	1’’	25.4 mm
Left	1.5’’	37 mm
Bottom	1.25’’	32 mm
Right	1’’	25.4 mm

7. All paragraphs will be *1.5 lines spaced with a one blank line between each paragraph*. Each paragraph will begin with *without any indentation*.
8. *Section titles* should be bold with *14 pt.* typed in all capital letters and should be left aligned.
9. *Sub-Section headings* should be aligning at the left with *12 pt.* bold and Title Case (the first letter of each word is to be capitalized).
10. Illustrations (charts, drawings, photographs, figures) are to be in the text. Use only illustrations really pertinent to the text. Illustrations must be sharp, clear, black and white. Illustrations downloaded from internet are not acceptable.
    a) Illustrations should not be more than two per page. One could be ideal
    b) Figure No. and Title at bottom with 12 pt.
    c) Table No. and Title at top with 12 pt.
    d) Legends below the title in 10 pt.
    e) Leave proper margin in all sides
    f) Illustrations as far as possible should not be photo copied.
11. Photographs if any should be of glossy prints
12. Please use SI system of units only.
13. Please number the pages on the front side, centrally below the footer
14. References should be either in order as they appear in the thesis or in alphabetical order by last name of first author
15. Symbols and notations if any should be included in nomenclature section only
16. Following will be the order of report
    i. Cover page and Front page (*as per the specimen on separate sheet*)
    ii. Certificate from the Institute (*as per the specimen on separate sheet*)
    iii. Acknowledgements
    iv. Contents
    v. List of Figures
    vi. List of Tables
    vii. Nomenclature
    viii. Abstract (A brief abstract of the report not more than 150 words. The heading of abstract i.e. word "Abstract" should be bold, Times New Roman, 12 pt. and should be typed at the center. The contents of abstract should be typed on new line without space between heading and contents. Try to include one or two sentences each on motive, method, key-results and conclusions in Abstract

    1. Introduction (2-3 pages) (TNR – 14 Bold)
        1.1 Problem statement (TNR – 12)
        1.2 Objectives
        1.3 Scope
        1.4 Methodology
        1.5 Organization of Dissertation

    2. Literature Review (12-16 pages)
    Discuss the work done so far by researchers in the domain area and their significant conclusions. No derivations, figures, tables, graphs are expected.

    3. This chapter shall be based on your own simulation work (Analytical/ Numerical/FEM/CFD) (8 - 12 pages)

    4. Experimental Validation - This chapter shall be based on your own experimental work

(2 - 3 pages)

5. Concluding Remarks and Scope for the Future Work (1 - 2 pages)
(IF above Chapters 3, 4, 5 not completed please mention the plan for the same and time period for completion and detail activity chart).
References ANNEXURE (if any) (Put all mathematical derivations, Simulation program as Annexure)

17. All section headings and subheadings should be numbered. For sections use numbers 1, 2, 3, …. and for subheadings 1.1, 1.2, …. etc and section subheadings 2.1.1, 2.1.2, …. etc.
18. References should be given in the body of the text and well spread. No verbatim copy or excessive text from only one or two references. If figures and tables are taken from any reference then indicate source / citatation of it. Please follow the following procedure for references

Reference Books :

Collier, G. J. and Thome, J. R., Convective boiling and condensation, 3rd ed., Oxford University Press, UK, 1996, pp. 110 – 112.

Papers from Journal or Transactions :

Jung, D. S. and Radermacher, R., Transport properties and surface tension of pure and mixed refrigerants, *ASHRAE Trans*, 1991, 97 (1), pp. 90 – 98.

Bansal, P. K., Rupasinghe, A. S. and Jain, A. S., An empirical correction for sizing capillary tubes, *Int. Journal of Refrigeration*, 1996, 19 (8), pp.497 – 505.

Papers from Conference Proceedings :

Colbourne, D. and Ritter, T. J., *Quantitative assessment of flammable refrigerants in room air conditioners*, Proc. of the Sixteenth International Compressor Engineering Conference and Ninth International Refrigeration and Air Conditioning Conference, Purdue University, West Lafayette, Indiana, USA, 2002, pp. 34 – 40.

Reports, Handbooks etc. :

United Nations Environmental Programme, Report of the Refrigeration, Air Conditioning and Heat Pumps, Technical Option Committee, 2002, Assessment - 2002.

ASHRAE Handbook: Refrigeration, 1994 (Chapter 44)

Patent :

Patent no, Country (in parenthesis), date of application, title, year.

Internet :

www.(Site) [Give full length URL] *accessed on date*

A Project Stage-I Report on
(TNR, 16pt, centrally aligned)

Title of the Project Report

(TNR, 27pt, Bold, Centrally Aligned, Title Case)

By
(TNR, 16pt, Centrally Aligned)

Mr. Student's 1 Name
(TNR, 16pt, Centrally Aligned)

Mr. Student's 2 Name
(TNR, 16pt, Centrally Aligned)

Mr. Student's 3 Name
(TNR, 16pt, Centrally Aligned)

Mr. Student's 4 Name
(TNR, 16pt, Centrally Aligned)

Guide
Guide's Name
(TNR, 16pt, Centrally Aligned)

Institute Logo

Department of Mechanical Engineering
Name of the Institute
[2018-19]
(TNR, 22pt, Title Case Centrally Aligned)

Name of the Institute

Institute Logo

C E R T I F I C A T E

This is to certify that ***Mr. (Name of the Student)***, has successfully completed the Project Stage – I entitled "(***Title of the Project)*** " under my supervision, in the partial fulfillment of Bachelor of Engineering - Mechanical Engineering of University of Pune.

Date:

Place:

Guide's Name Guide	**Internal Examiner**
HoD Name Head of the Department	**Principal Name** Principal

Seal

Savitribai Phule Pune University
Final Year of Mechanical Engineering (2015 Course)

Course Code : 402047 **Course Name : Energy Engineering**

Teaching Scheme:		Credits		Examination Scheme:			
Theory	: 03 Hrs Per Week	TH	: 03	Theory	In-Sem : 30	PR	: --
Practical	: 02 hrs per week	TW	: 01		End-Sem : 70	OR	: 25
						TW	: 25

Pre-requisites:	Thermodynamics I and II and Heat Transfer

Course Objectives:

- To study the power generation scenario, the components of thermal power plant, improved Rankin cycle, Cogeneration cycle
- To understand details of steam condensing plant, analysis of condenser, the an environmental impacts of thermal power plant, method to reduce various pollution from thermal power plant
- To study layout, component details of hydroelectric power plant, hydrology and elements , types of nuclear power plant
- To understand components; layout of diesel power plant , components; different cycles ; methods to improve thermal efficiency of gas power plant
- To study the working principle , construction of power generation from non-conventional sources of energy
- To learn the different instrumentation in power plant and basics of economics of power generation.

Course Outcomes:

On completion of the course, students will be able to -

- Describe the power generation scenario, the layout components of thermal power plant and analyze the improved Rankin cycle, Cogeneration cycle
- Analyze the steam condensers, recognize the an environmental impacts of thermal power plant and method to control the same
- Recognize the layout, component details of hydroelectric power plant and nuclear power plant
- Realize the details of diesel power plant, gas power plant and analyze gas turbine power cycle
- Emphasize the fundaments of non-conventional power plants
- Describe the different power plant electrical instruments and basic principles of economics of power generation.

Course Contents

Unit 1: Introduction and Thermal Power Plant **6 Hrs**

A) *Power Generation* : global scenario, present status of power generation in India, in Maharashtra, Role of private and governmental organizations, load shedding, carbon credits, pitfalls in power reforms, concept of cascade efficiency.

B) *Thermal Power Plant* : General layout of modern thermal power plant with different circuits, site selection criteria, classification of coal, coal blending, coal beneficiation, selection of coal for thermal power plant, slurry type fuels, pulverized fuel handling systems, fuel burning methods, FBC systems, high pressure boilers, ash handling system, Rankine cycle with reheat and regeneration (Numerical Treatment), steam power plants with process heating (Numerical Treatment)

Unit 2: Steam Condenser and Environmental Impacts of Thermal Power Plant 6 Hrs

A) *Steam Condenser* : Necessity of steam condenser, elements of steam condensing plant, classification, cooling water requirements, condenser efficiency, vacuum efficiency (Numerical Treatment), cooling towers, air leakage and its effects on condenser performance, air pumps (Numerical Treatment for Air Pump capacity)

B) *Environmental impact of thermal power plants* : Different pollutants from thermal power plants, their effects on human health and vegetation, methods to control pollutants such as particulate matter; oxides of sulphur; oxides of nitrogen, dust handling systems, ESP, scrubbers, water pollution, thermal pollution, noise pollution from TPP and its control

Unit 3: Hydroelectric and Nuclear Power Plant 6 Hrs

A) *Hydroelectric Power Plant* : site selection, classification of HEPP (based on head, nature of load, water quantity), criteria for turbine selection, dams, spillways, surge tank and forebay, advantages and disadvantages of HEPP, hydrograph ,flow duration curve ,mass curve, (Numerical Treatment) environmental impacts of HEPP

B) *Nuclear Power Plants* : elements of NPP, types of nuclear reactor (PWR, BWR, CANDU, GCR, LMCR, OMCR, fast breeder, fusion), material for nuclear fuel, cladding, coolants, control rod and shielding, nuclear waste disposal, environmental impacts of NPP

Unit 4: Diesel and Gas Turbine Power plant 6 Hrs

A) *Diesel Power Plants* : applications, components of DPP, different systems of DPP, plant layout, performance of DPP (Numerical Treatment) advantages & disadvantages of diesel power plant, environmental impacts of DPP

B) *Gas Turbine Power Plant* : general layout of GTPP, components of GTPP, open, closed & semi-closed cycle gas turbine plant, Brayton cycle analysis for thermal efficiency, work ratio, maximum & optimum pressure ratio, methods to improve thermal efficiency of GTPP: inter-cooling; reheating & regeneration cycle (numerical treatment), gas and steam turbine combined cycle plant, environmental impacts of GTPP

Unit 5: Non-Conventional Power Plants 6 Hrs

Solar Power Plant based on: flat plate collector, solar ponds, parabolic solar collector, heliostat, solar chimney, SPV cell based plants: working principal, solar photovoltaic systems, applications
Geothermal Plant: superheated steam system, flash type, binary cycle plant.
Tidal Power Plant: components, single basin, double basin systems.
OTEC Plant: principal of working, Claude cycle, Anderson Cycle.
MHD Power Generation : Principal of working, Open Cycle MHD generator, closed cycle MHD generators.
Fuel cell : alkaline, acidic, proton-exchange membrane
Wind Power Plant : wind availability, wind mills and subsystems, classification of wind turbines, operating characteristics, wind solar hybrid power plants, challenges in commercialization of non-conventional power plants, environmental impacts of NCPP

Unit 6: Instrumentation and Economics of Power Plant **6 Hrs**

A) *Power Plant Instruments* : layout of electrical equipment, generator, exciter, generator cooling, short circuits & limiting methods, switch gear, circuit breaker, power transformers, methods of earthling, protective devices & control system used in power plants, measurement of high voltage, current and power, control room

B) *Economics of Power Generation* : cost of electric energy, fixed and operating cost [methods to determine depreciation cost] (Numerical Treatment), selection and type of generation, selection of generation equipment , load curves, performance and operation characteristics of power plants, load division, all terms related to fluctuating load plant (Numerical Treatment)

Books

Text :

1. Domkundwar & Arora, Power Plant Engineering, Dhanpat Rai & Sons, New Delhi
2. Domkundwar & Domkundwar- Solar Energy and Non-Conventional Sources of Energy, Dhanpat Rai& Sons, New Delhi.
3. R.K.Rajput, Power Plant Engineering‖, Laxmi Publications New Delhi.
4. D.K.Chavan & G.K.Phatak, Power Plant Engineering‖, Standard Book House, New Delhi.

References :

1. E.I.Wakil, Power Plant Engineering‖, McGraw Hill Publications New Delhi
2. P.K.Nag, Power Plant Engineering‖, McGraw Hill Publications New Delhi.
3. R.Yadav , Steam and Gas Turbines‖ ,Central Publishing House, Allahabad.
4. G.D.Rai, Non-Conventional Energy Sources, Khanna Publishers,Delhi
5. S.P.Sukhatme, Solar Energy‖ Tata McGraw-Hill Publications, New Delhi
6. G R Nagpal Power Plant Engineering , Khanna Publication

Term Work shall consist of following assignments:

IMP Notes for Term Work:

- Any Eight Experiment should be conducted (*from Experiment No. 1 to 10*) and
- *Experiment No 1, 2, 7,* and *8* are compulsory
- *Experiment No: 3 - 9* can be performed using suitable simulation software

1. Visit to Thermal Power plant /Co-generation Power plant.
2. Visit to HEPP/GTPP/Non-Conventional Power Plants.
3. Study of Fluidized Bed Combustion system.
4. Study of High Pressure Boilers
5. Study of Steam Turbine Systems –governing systems, protective devices, lubricating systems, glands and sealing systems.
6. Study of Co-generation Plants
7. Trial on Steam Power Plant or with help of suitable software to determine
    a) Plant Efficiency, Rankine Efficiency Vs Load
    b) Specific Steam consumption Vs Load
    c) Rate of Energy Input Vs Load
    d) Heat Rate and Incremental heat Rate Vs Load
8. Trial on Diesel Power Plant or with help of suitable software to determine
    a) Plant Efficiency Vs Load

b) Total fuel consumption Vs Load
c) Rate of Energy Input Vs Load
d) Heat Rate and Incremental heat Rate Vs Load

9. Study of Power Plant Instruments.
10. Study of Different Tariff Methods

Savitribai Phule Pune University
Final Year of Mechanical Engineering (2015 Course)

Course Code : 402048 **Course Name : Mechanical System Design**

Teaching Scheme:		**Credits**		**Examination Scheme:**		
Theory	**: 04 Hrs Per Week**	**TH**	**: 04**	**Theory**	**In-Sem : 30**	**PR : --**
Practical	**: 02 hrs per week**	**TW**	**: 01**		**End-Sem : 70**	**OR : 25**
						TW : 50

Pre-requisites:	Engineering Mechanics, Manufacturing Process, Strength of Materials, Machine design, Engineering Mathematics, Theory of Machines, Dynamics of Machinery, and IC Engines.

Course Objectives:

- To develop competency for system visualization and design.
- To enable student to design cylinders and pressure vessels and to use IS code.
- To enable student select materials and to design internal engine components.
- To introduce student to optimum design and use optimization methods to design mechanical components.
- To enable student to design machine tool gearbox.
- To enable student to design material handling systems.
- Ability to apply the statistical considerations in design and analyze the defects and failure modes in components

Course Outcomes:

On completion of the course, students will be able to -

- Understand the difference between component level design and system level design.
- Design various mechanical systems like pressure vessels, machine tool gear boxes, material handling systems, etc. for the specifications stated/formulated.
- Learn optimum design principles and apply it to mechanical components.
- Handle system level projects from concept to product.

Course Contents

Unit 1: Design of Machine Tool Gear Box **8 Hrs**

Introduction to machine tool gearboxes, design and its applications, basic considerations in design of drives, determination of variable speed range, graphical representation of speed and structure diagram, ray diagram, selection of optimum ray diagram, gearing diagram, deviation diagram.
(Note: Full design problem to be restricted up to 2 Stages only)

Unit 2: Statistical Consideration in Design **8 Hrs**

Frequency distribution-Histogram and frequency polygon, normal distribution - units of central tendency and dispersion- standard deviation - population combinations - design for natural tolerances - design for assembly - statistical analysis of tolerances, mechanical reliability and factor of safety.

Unit 3: Design of Belt Conveyor System for Material Handling **8 Hrs**

System concept, basic principles, objectives of material handling system, unit load and containerization.

Belt conveyors, Flat belt and troughed belt conveyors, capacity of conveyor, rubber covered and fabric ply belts, belt tensions, conveyor pulleys, belt idlers, tension take-up systems, power requirement of horizontal belt conveyors for frictional resistance of idler and pulleys.

Unit 4: Design of Cylinders and Pressure Vessels **8 Hrs**

Design of Cylinders: Thin and thick cylinders, Lame's equation, Clavarino's and Bernie's equations, design of hydraulic and pneumatic cylinders, auto-frettage and compound cylinders,(No Derivation) gasketed joints in cylindrical vessels (No derivation).

Design of Pressure vessel : Modes of failures in pressure vessels, unfired pressure vessels, classification of pressure vessels as per I. 2825 - categories and types of welded joints, weld joint efficiency, stresses induced in pressure vessels, materials for pressure vessel, thickness of cylindrical shells and design of end closures as per code, nozzles and openings in pressure vessels, reinforcement of openings in shell and end closures - area compensation method, types of vessel supports (theoretical treatment only).

Unit 5: Design of I.C. Engine Components **8 Hrs**

Introduction to selection of material for I. C. engine components, Design of cylinder and cylinder head, construction of cylinder liners, design of piston and piston-pins, piston rings, design of connecting rod. Design of crank-shaft and crank-pin, (Theoretical treatment only).

Unit 6: Optimum Design **8 Hrs**

Objectives of optimum design, adequate and optimum design, Johnson's Method of optimum design, primary design equations, subsidiary design equations and limit equations, optimum design with normal specifications of simple machine elements- tension bar, transmission shaft and helical spring, Pressure vessel Introduction to redundant specifications (Theoretical treatment).

Books

Text :

1. Bhandari V.B. ―Design of Machine Elements‖, Tata McGraw Hill Pub. Co. Ltd.
2. Juvinal R.C, Fundamentals of Machine Components Design, Wiley, India

References :

1. Design Data- P.S.G. College of Technology, Coimbatore.
2. Bhandari, V. B. Machine Design data book, Tata McGraw Hill Publication Co. Ltd.
3. I.S. 2825: Code for unfired pressure vessels.
4. Shigley J. E. and Mischke C.R., ―Mechanical Engineering Design‖, McGraw Hill Pub. Co
5. M. F. Spotts, –Mechanical Design Analysis‖, Prentice Hall Inc.
6. Black P.H. and O. Eugene Adams, –Machine Design‖ McGraw Hill Book Co. Inc.
7. Johnson R.C., ―Mechanical Design Synthesis with Optimization Applications‖, Von Nostrand Reynold Pub.
8. S.K. Basu and D. K. Pal, –Design of Machine Tools, Oxford and IBH Pub Co.
9. Rudenko,‖Material Handling Equipment‖, M.I.R. publishers, Moscow
10. P. Kannaiah ,‖Design of Transmission systems‖, SCIETCH Publications Pvt Ltd.
11. Pandy, N. C. and Shah, C. S., Elements of Machine Design, Charotar Publishing House.
12. Mulani, I. G., ―Belt Conveyors‖
13. Singiresu S. Rao, Engineering Optimization: Theory and Practice, John Wiley & Sons.

14. M.V. Joshi, Process Equipment Design, Mc-Millan.

Term Work shall consist of following assignments:

1. One Design Project:

The design project shall consist of two imperial size sheets (Preferably drawn with 3D/2D CAD software) - one involving assembly drawing with a part list and overall dimensions and the other sheet involving drawings of individual components, manufacturing tolerances, surface finish symbols and geometric tolerances must be specified so as to make it working drawing. A design report giving all necessary calculations of the design of components and assembly should be submitted. Projects shall be in the form of design of mechanical systems including pressure vessel, conveyor system, multi speed gear box, I.C engine, etc.

Each Student shall complete any one of the following assignments.

1. Design of Flywheel.
2. Design for Manufacture, Assembly and safe.
3. Application of Composite Material for different mechanical components.
4. Case study of one patent/ copyright/trademark from the product design point of view.
5. Design of Human Powered system.

Savitribai Phule Pune University
Final Year of Mechanical Engineering (2015 Course)

Course Code : 402049 A | **Course Name : Elective – III Tribology**

Teaching Scheme:		**Credits**		**Examination Scheme:**			
Theory	**: 03 Hrs Per Week**	**TH**	**: 03**	**Theory**	**In-Sem : 30**	**PR**	**: --**
Practical	**: 02 hrs per week**	**TW**	**: 01**		**End-Sem : 70**	**OR**	**: --**
						TW	**: 25**

Pre-requisites	: Physics, Chemistry, Mathematics, Fluid Mechanics, Theory of Machine and Machine Design

Course Objectives:

- To provide the knowledge and importance of Tribology in Design, friction, wear and lubrication aspects of machine components.
- To select proper grade lubricant for specific application.
- To understand the principles of lubrication, lubrication regimes, theories of hydrodynamic and the advanced lubrication techniques.
- To introduce the concept of surface engineering and its importance in tribology.
- To understand the behavior of Tribological components.

Course Outcomes:

On completion of the course, students will be able to -

- The course will enable the students to know the importance of Tribology in Industry.
- The course will enable the students to know the basic concepts of Friction, Wear, Lubrications and their measurements.
- This course will help students to know the performance of different types of bearings and analytical analysis thereof.
- This course will help students to apply the principles of surface engineering for different applications of tribology.

Course Contents

Unit 1: Introduction to Tribology **6 Hrs**

Importance of Tribology in Design, Tribology in Industry, Economic Considerations, Lubrication-Definition, Lubricant properties, Viscosity, its measurements- Numerical, basic modes of lubrication, types of lubricants, Standard Grades of lubricants, selection of lubricants, commonly used lubricants and Hazards, Recycling of used oil, Disposal of used oil, bearing materials, bearing construction, oil seals and gaskets.

Unit 2: Friction and Wear **5 Hrs**

Introduction, Laws of friction, kinds of friction, causes of friction, area of contact, friction measurement, theories of friction.

Types of wear, various factors affecting wear, measurement of wear, wear between solids and flowing liquids, theories of wear

Unit 3: Hydrodynamic Lubrication **7 Hrs**

Theory of hydrodynamic lubrication, mechanism of pressure development in an oil film. Two dimensional Reynolds equation, Petroff's equation, pressure distribution in journal bearings - long & short, Load Carrying capacity, Somerfield number and its importance- Numerical. Introduction to Hydrodynamic Thrust Bearing

Unit 4: Hydrostatic Lubrication **5 Hrs**

Introduction to hydrostatic lubrication, hydrostatic step bearing, load carrying capacity and oil flow through the hydrostatic step bearing- Numerical.

Hydrostatic squeeze film : basic concept, circular and rectangular plate approaching a plane- Numerical

Unit 5: Elasto-hydrodynamic lubrication and Gas Lubrication **5 Hrs**

Elasto - hydrodynamic lubrication: Basic concept, Elasto-hydrodynamic lubrication between two contacting bodies, different regimes in EHL contacts.

Gas lubrication: Introduction, merits and demerits, applications, externally pressurized gas bearings, porous gas bearings, and Dynamic characteristics of gas lubricated bearing.

Unit 6: Surface Engineering **8 Hrs**

Concept and scope of Surface engineering, surface topography, apparent and real area of contact, tribological behavior of asperities contact- contact stress, surface roughness and hydrodynamic action- Numerical, surface coating-plating, fusion process, vapor phase processes, selection of coating for wear and corrosion resistance. Behavior of tribological components- selection of bearings, plain bearings, gears, wire ropes, seals and packings, conveyor belts, other tribological measures.

Books

Text :

1. Basu S.K., Sengupta S. N. and Ahuja B.B. "Fundamentals of Tribology" PHI Learning, Ltd. India.
2. Majumdar B. C. "Introduction to Tribology and Bearings", S. Chand and Company Ltd., New Delhi.

References :

1. Bharat Bhushan, "Principles and Applications of Tribology", John Wiley and Sons.
2. Sahu P., "Engineering Tribology", PHI Learning, Ltd. India
3. Fuller D.D. "Theory and Practice of Lubrication for Engineers". John Wiley and Sons.
4. Neale M. J. "Tribology hand Book", Butterworths. London.
5. Orlov P., "Fundamentals of Machine Design", Vol. IV, MIR Publication.
6. Cameron A. "Basic Lubrication Theory", Wiley Eastern Ltd.
7. 'Hailing J., "Principles of Tribology", McMillan Press Ltd., 1975.
8. Ghosh M.K., Mujumdar B.C. and Sarangi M., "Theory of lubrication", Tata McGraw Hill Education Pvt. Ltd., New Delhi.

Term Work shall consist of following assignments:

A] *Any one case study of the following*

1. Friction in sliding/ rolling contact bearing.
2. Wear of cutting tool.
3. Surface Coating.
4. Sliding/ rolling contact bearing Performance

B] Assignment based on the Tribological design of the system like I C Engine, Machine Tool, Rolling Mill.

OR

Industrial Visit: Students should visit the industry to study the lubrication systems or to study the techniques of surface coating.

Savitribai Phule Pune University
Final Year of Mechanical Engineering (2015 Course)

Course Code : 402049 B **Course Name : Elective – III Industrial Engineering**

Teaching Scheme:		Credits		Examination Scheme:		
Theory	: 03 Hrs Per Week	TH	: 03	Theory	In-Sem : 30	PR : --
Practical	: 02 hrs per week	TW	: 01		End-Sem : 70	OR : --
						TW : 25

Pre-requisites:	NIL

Course Objectives:
- To introduce the concepts, principles and framework of contents of Industrial Engineering.
- To acquaint the students with various productivity enhancement techniques.
- To acquaint the students with different aspects of Production Planning and Control and Facility Design.
- To introduce the concepts of various cost accounting and financial management practices as applied in industries.
- To acquaint the students with different aspects of Human Resource activities and Industrial Safety rules.
- To acquaint students with different aspect of simulation modeling for various industrial engineering\applications.

Course Outcomes:
On completion of the course, students will be able to -
- Apply the Industrial Engineering concept
- Understand, analyze and implement different concepts involved in method study.
- Design and Develop different aspects of work system and facilities.
- Understand and Apply Industrial safety standards, financial management practices.
- Undertake project work based on modeling & simulation area.

Course Contents

Unit 1: Introduction to Industrial Engineering and Productivity **6 Hrs**

Definition and Role of Industrial Engineering, Types of production systems and organization structure, Functions of management.

Measurement of productivity: Factors affecting the productivity, Productivity Models and Index (Numerical), Productivity improvement techniques.

Note: *Productivity improvement techniques viz. 5S, Kaizen, TPS, KANBAN, JIT, etc. shall be discussed at the end of this* Unit.

Unit 2: Method Study **6 Hrs**

Work Study: Definition, objective and scope of work-study, Human factors in work-study.
Method Study: Definition, objective and scope of method study, work content, activity recording and exam aids.
Charts to record movements: Operation process charts, flow process charts, travel chart, two-handed chart and multiple activity charts. Principles of motion economy, classification of movements, SIMO chart, and micro motion study.
Definition and installation of the improved method, brief concept about synthetic motion studies.
Introduction to Value Engineering and Value Analysis.

Unit 3: Work Measurements **6 Hrs**

Work Measurements: Definition, objectives and uses, Work measurement techniques.
Work Sampling: Need, confidence levels, sample size determinations, random observation, conducting study with the simple problems.
Time Study: Definition, time study equipment, selection of job, steps in time study. Breaking jobs into elements, recording information, Rating and standard rating, standard performance, scales of rating, factors affecting rate of working, allowances and standard time determination.
Introduction to PMTS and MTM: (Numerical), Introduction to MOST.

Unit 4: Production Planning and Control **6 Hrs**

Introduction: Types of production systems, Need and functions of PPC, Aggregate production planning.
Capacity Planning, ERP: Modules, Master Production Schedule, MRP and MRP-II.
Forecasting Techniques: Causal and time series models, moving average, exponential smoothing, trend and seasonality (Numerical), Demand Control strategies (MTO, MTA, MTS).
Introduction to Supply Chain Management: Basic terminologies.

Unit 5: Facility Design **6 Hrs**

Plant Location : Need and factors influencing plant location,
Plant Layout: Objectives, principles, types of plant layouts, Introduction to Assembly Line Balancing and Layout parameters to evaluate.
Material Handling: Objectives, relation with plant layout, principles. Types and purpose of different material handling equipment, Selection of material handling equipment.
Inventory control and Management: Types of inventories, Need of inventories, terminology, costs, Inventory Models: Basic production models, (with and without shortage and discount), ABC, VED Analysis.

Unit 6: Engineering Economy, Human Resource and Industrial Safety **6 Hrs**

Introduction to Costing: Elements of Cost, Break-Even Analysis (Numerical).
Introduction to Debit and Credit Note, Financial Statements (Profit and loss account and Balance Sheet), Techniques for Evaluation of capital investments.
Human Resource Development: Functions: Manpower Planning, Recruitment, Selection, Training. Concept of KRA (Key Result Areas), Performance Appraisal (Self, Superior, Peer, 3600).
Industrial Safety: Safety Organization, Safety Program

Books

Text :

1. M Mahajan, Industrial Engineering and Production Management, Dhanpat Rai and Co.
2. O. P. Khanna, Industrial engineering and management, Dhanpat Rai publication
3. Martend Telsang, Industrial Engineering, S. Chand Publication.
4. Banga and Sharma, Industrial Organization& Engineering Economics, Khanna publication.

References :

1. Introduction to Work Study by ILO, ISBN 978-81-204-1718-2, Oxford & IBHPublishing Company, New Delhi, Second Indian Adaptation, 2008.
2. H. B. Maynard, K Jell, Maynard's Industrial Engineering Hand Book, McGraw Hill Education.
3. Askin, Design and Analysis of Lean Production System, Wiley, India
4. Zandin K.B., Most Work Measurement Systems, ISBN 0824709535, CRCPress,2002
5. Martin Murry, SAP ERP: Functionality and Technical Configuration, SAP Press; 3rdNew edition (2010).
6. Barnes, Motion and time Study design and Measurement of Work, Wiley India
7. Raid Al-Aomar, Adwerd J Williams, Onur M. Uigen 'Process Simulation using WITNESS', Wiley

Term Work shall consist of following assignments:

- Minimum of *8 Experiments* are compulsory from the following list of Experiments.
- Assignment number *1*, *2*, *3*, *8* and *12* are compulsory.
- It is advisable that, students shall collect data by visiting suitable industry to complete following assignments (*Per batch of Max. 20 students*)
- For completing above assignments *any suitable simulation software* like WITNESS can be used

1. Case study based Assignment on Method Study.
2. Hands on Assignment on application of Work Measurement technique(s).
3. Assignment on simulation of Routing & Scheduling Model
4. Assignment on **s**imulation of Manufacturing System **/** Service System Operations for demand forecasting of the given product using any two methods.
5. Assignment on simulation determination of EOQ and plot the graphs.
6. Assignment on analysis of Manufacturing / Service Operation for Capacity Planning.
7. Case study based assignment on supply chain model.
8. Assignment on analysis of (selected) plant layout modeling and simulation for bottleneck / line balancing.
9. Assignment on analysis of material handling system - modeling simulation for the selected plant layout.
10. Case study based assignment on identification of Key Result Areas for performance appraisal for selected company (3600 feedback).
11. Case study based assignment on cost-revenue model analysis.
12. Assignment on industrial safety audit of selected work environment.

Savitribai Phule Pune University
Final Year of Mechanical Engineering (2015 Course)

Course Code : 402049 C **Course Name : Elective – III Robotics**

Teaching Scheme:		Credits		Examination Scheme:		
Theory	: 03 Hrs Per Week	TH	: 03	Theory	In-Sem : 30	PR : --
Practical	: 02 hrs per week	TW	: 01		End-Sem : 70	OR : --
						TW : 25

Pre-requisites:	Engineering Mechanics, TOM, Mechatronics, Basics of Electrical and Electronics Engineering, Control system.

Course Objectives:

- To get acquainted with basic components of robotic systems.
- To study various gripper mechanisms and sensors and understand role of suitable control system.
- To understand statistics & kinematics of robots
- To develop competency in obtaining desired motion of the robot.
- To study various programming methods in robotics.
- To understand need of modern techniques in robotics.

Course Outcomes:

On completion of the course, students will be able to -

- Identify different type of robot configuration with relevant terminology.
- Select suitable sensors, actuators and drives for robotic systems.
- Understand kinematics in robotic systems.
- Design robot with desired motion with suitable trajectory planning.
- Select appropriate robot programming for given application.
- Understand need of IoT, machine learning, simulation in robotics.

Course Contents

Unit 1: **6 Hrs**

Introduction: Basic Concepts, laws of Robotics, Robot anatomy, Classification, structure of robots, point to point and continuous path robotic systems. Robot performance- resolution, accuracy, repeatability, dexterity, compliance, RCC device, Applications.

Robot Grippers: Types of Grippers, Design of gripper, Force analysis for various basic gripper systems including Mechanical, Hydraulic and Pneumatic systems.

Unit 2: **6 Hrs**

Robotic Sensors: Characteristics of sensing devices, Classification, Selection and applications of sensors. Types of Sensors, Need for sensors and vision system in the working and control of a robot. GPS, IMU, Vision, PVDF Tactile (construction, working and selection)

Drives and Control Systems : Types and selection of Drives, Actuators and transmission systems, Types of Controllers, closed loop control, second order linear systems and their control, control law of partitioning, trajectory-following control, modeling and control of a single joint, force control.

Unit 3: **6 Hrs**

Kinematics : Transformation matrices and their arithmetic, link and joint description, Denavit–Hartenberg parameters, frame assignment to links, direct kinematics, kinematics redundancy, kinematics calibration, inverse kinematics of two joints, solvability, algebraic and geometrical methods.

*Velocities and Static Forces in Manipulators***:** Motion of the manipulator links, Jacobians, singularities, static forces, Jacobian in force domain.

Unit 4: **6 Hrs**

Introduction to Dynamics, Trajectory generations, Motion planning and control: Joint and Cartesian space trajectory planning and generation, potential field method for motion planning Manipulator Mechanism Design, Force control and hybrid position/force control

Unit 5: **6 Hrs**

Machine Vision System: Vision System Devices, Image acquisition, Masking, Sampling and quantization, Image Processing Techniques, Masking, Sampling and quantization, Noise reduction methods, Edge detection, Segmentation.

Robot Programming : Methods of robot programming, lead through programming, motion interpolation, branching capabilities, WAIT, SIGNAL and DELAY commands, subroutines, Programming Languages: Robot language structure, Introduction to various types such as RAIL and VAL II

Unit 6: **6 Hrs**

*Artificial Intelligence***:** Introduction, Need and Application, Problem solving through forward and backward search.

Introduction to Internet of Things (Industrial control, Smart Social Network), Industry 4.0, Machine learning

Simulation : Need of simulation, tools, types and techniques of simulation

Books

Text :

1. S. R. Deb, Robotics Technology and Flexible Automation, Tata McGraw Hill.

References :

1. Groover M.P.-Automation, production systems and computer integrated manufacturing‘ - Prentice Hall of India
2. S B Niku, Introduction to Robotics, Analysis, Control, Applications, 2nd Edition, Wiley Publication, 2015.
3. John Craig, Introduction to Robotics, Mechanics and Control, 3rd Edition, Pearson Education, 2009
4. Mathia, Robotics for Electronics Manufacturing, Cambridge Uni. Press, India
5. A Ghosal, Robotics: Fundamental Concepts and Analysis, Oxford University Press, 2013.
6. R K Mittal & I J Nagrath, Robotics and Control, McGraw Hill Publication, 2015.

7. K Astrom & T Hagglund, PID Controllers: Theory, Design and Tuning, 2nd Edition, The Instrumentation, Systems, and Automation Society, 1995.
8. Asfahl, Robots and Manufacturing Automation, Wiley, India, 2012
9. S. K. Saha, Introduction to Robotics, TMH International
10. Ganesh Hegde, Industrial Robotics, Laxmi publication
11. www.roboanalyzer.com

Term Work shall consist of following assignments:

*The term work shall consist of detailed report on **any five** of the following practical, essentially with one demonstration, one gripper design and an industrial visit.*

1. Simulation of Cartesian / Cylindrical/Spherical robot.
2. Simulation of Articulated / SCARA robot.
3. Virtual modeling for kinematic and dynamic verification any one robotic structure using suitable software.
4. Design, modeling and analysis of two different types of gripper.
5. Program for linear and non-linear path.
6. Report on industrial application of robot /Industrial visit.

Savitribai Phule Pune University
Final Year of Mechanical Engineering (2015 Course)

Course Code : 402050 A — **Course Name : Elective – IV**

Advanced Manufacturing Processes

Teaching Scheme:		**Credits**		**Examination Scheme:**			
Theory	**: 03 Hrs Per Week**	**TH**	**: 03**	**Theory**	**In-Sem : 30**	**PR**	**: --**
Practical	**: --**	**TW**	**: --**		**End-Sem : 70**	**OR**	**: --**
						TW	**: --**

Pre-requisites:	Basic Engineering Science - Physics, Chemistry, Material Science, Engineering Metallurgy, Manufacturing processes

Course Objectives:

- To analyze and identify applications of special forming processes
- To analyze and identify applications of advanced joining processes
- To understand and analyze the basic mechanisms of hybrid non-conventional machining techniques
- To understand various applications and methods of micro and nano fabrication techniques
- To understand advanced Additive Manufacturing (AM) technology for innovations in product development
- To understand various material characterization techniques.

Course Outcomes:

On completion of the course, students will be able to -

- Classify and analyze special forming processes
- Analyze and identify applicability of advanced joining processes
- Understand and analyze the basic mechanisms of hybrid non-conventional machining techniques
- Select appropriate micro and nano fabrication techniques for engineering applications
- Understand and apply various additive manufacturing technology for product development
- Understand material characterization techniques to analyze effects of chemical composition, composition variation, crystal structure, etc.

Course Contents

Unit 1: Special Forming Processes — **6 Hrs**

Principle, Machines, Process variables, characteristics, advantages, limitations and application of High Energy Rate Forming process (HERF), High Velocity Forming (HVF), Explosive forming, Magnetic pulse forming, Electro hydraulic forming, Metal spinning, Flow forming, Stretch forming, Incremental sheet metal forming, Petro-forge forming, Micro forming, Micro coining, Micro extrusion, Micro bending/laser bending, fine blanking.

Unit 2: Advanced Joining Processes — **6 Hrs**

Friction stir welding, Electron Beam welding, Laser beam welding, Ultrasonic welding, Under water welding, Cryogenic welding, Thermal spray coatings, Welding of plastics and composites, Explosive joining, Adhesive bonding

Unit 3: Hybrid Non-conventional Machining Techniques **6 Hrs**

Introduction to hybrid processes, Abrasive flow finishing, Magnetic abrasive finishing, Abrasive water-jet machining, Wire electric discharge machining, Electrochemical grinding (ECG), Electrochemical Deburring (ECD), Shaped tube electrolytic machining (STEM), Electro-jet Machining (EJM), Electrolytic In-process dressing (ELPD), Ultrasonic assisted EDM, Rotary EDM, Electrochemical discharge Machining (ECDM), Laser surface treatments.

Unit 4: Micro Machining and Nano Fabrication Techniques **6 Hrs**

Introduction, need of micro and nano machining, Machine/setup, Process parameters, Mechanism of material removal, Applications, Advances of the Diamond Turn machining, Ultrasonic micro-machining, Focused Ion Beam Machining, Lithography, photochemical machining, Challenges in micro and nano fabrication techniques.

Unit 5: Additive Manufacturing Processes **6 Hrs**

Introduction and principle of the additive manufacturing process; Generalized additive manufacturing process chain; Classification of additive manufacturing processes and its principle, process steps and materials;

Post-processing of parts manufactured by Additive Manufacturing (AM) processes, Software issues in AM, Design For Additive Manufacturing (DFAM), Applications of Additive Manufacturing in Medical and Aerospace technologies

Unit 6: Material Characterization Techniques **6 Hrs**

Introduction : Material Characterization

Microscopy : Electron Microscopes, Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM), Scanning Tunneling Microscope (STM), Atomic Force Microscope (AFM), Field Ion Microscope (FIM);

Spectroscopy : Energy-dispersive X-ray spectroscopy (EDX), X-Ray Diffraction (XRD), X-Ray Photoelectron Spectroscopy (XPS), Nuclear Magnetic Resonance Spectroscopy (NMR), Electron Backscatter Diffraction (EBSD)

Books

Text :

1. V. K. Jain, “Advanced Machining Processes”, Allied Publishers Pvt. Ltd.
2. M. P Groover., Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, 6^{th} Edition, Wiley 2015
3. A. Ghosh, A. K. Mallik, Manufacturing Science, Affiliated East-West Press Pvt. Ltd., New Delhi

References :

1. ASM: Metal Handbook, Volume 6, “Welding, Brazing and Soldering”, Metal Park, Ohio.
2. ASM: Metal Handbook, Volume 14, “Forming”, Metal Park, Ohio.
3. R. Balasubramaniam, RamaGopal V. Sarepaka, SathyanSubbiah, Diamond Turn Machining: Theory and Practice, CRC Press, ISBN 9781138748323 - CAT# K32643
4. V. K. Jain, Micro manufacturing Processes, CRC Press ISBN-13: 978-1138076426 ISBN-

10: 1138076422
5. Ian Gibson, David Rosen, B.Stucker, Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, And Direct Digital Manufacturing, New York, NY : Springer, 2015.
6. Sam Zhang, Lin Li, Ashok Kumar, Materials characterization techniques. Boca Raton: CRC Press. ISBN 1420042947
7. Douglas B. Murphy, Fundamentals of light microscopy and electronic imaging, 2001, Wiley-Liss, Inc. USA
8. Schwartz, A. J., Kumar, M., Adams, B. L., and Field, D. P., eds., 2009, Electron Backscatter Diffraction in Materials Science, Springer US.

Savitribai Phule Pune University
Final Year of Mechanical Engineering (2015 Course)

Course Code : 402050 B **Course Name : Elective – IV**
Solar and Wind Energy

Teaching Scheme:		Credits		Examination Scheme:		
Theory	: 03 Hrs Per Week	TH	: 03	Theory	In-Sem : 30	PR : --
Practical	: --	TW	: --		End-Sem : 70	OR : --
						TW : --

Pre-requisites	**:** Basic Mechanical Engineering, Basic Electrical and Electronics Engineering and Heat Transfer

Course Objectives:

- To understand fundamentals of solar and wind energies.
- To understand constructions, working principle and design procedure of solar and wind power plants.
- To apply basic engineering principle to design a simple solar and wind power system.

Course Outcomes:

On completion of the course, students will be able to -

- Design of solar food drier for domestic purpose referring existing system
- Design of parabolic dish solar cooker for domestic purpose referring existing system
- Design of solar photovoltaic system for domestic purpose referring existing system
- Design miniature wind mill for domestic purpose referring existing system

Course Contents

Unit 1: Solar Energy Principles **6 Hrs**

Present solar energy scenario, world energy futures, governing bodies (self-study), solar radiations and its measurements, solar constant, solar radiation geometry, solar radiation data, estimation of average solar radiation, solar radiation on tilted surface.

Unit 2: Solar Thermal Systems and Applications **8 Hrs**

Types of Solar thermal collector, flat plate collector analysis, Evacuated tube collectors (ETC) analysis, its design and application, solar air heaters and its types, solar distillation.

Solar Concentrating collectors: types- line and point concentrator, theory of Concentrating collectors, parabolic trough collector, parabolic dish collector, solar tower, concentrated Fresnel linear receiver (CFLR).

Unit 3: Solar Photovoltaic and Applications **6 Hrs**

Forming the PN junction solar cells & its applications, Structure of a solar cell, types of modules, PV array, solar cell equation, Fill factor and maximum power, Grid aspects of solar power, equipment used in solar photovoltaic plants, Power Conditioning Equipment-inverters, Regulators, Other Devices; System Analysis-Design Procedure, Design Constraints, Other Considerations.

Unit 4: Case Study on Solar Energy Applications **6 Hrs**

Case study 1: Design of solar food drier for domestic purpose referring existing system
Case study 2: Design of parabolic dish solar cooker for domestic purpose referring existing system
Case study 3: Design of solar photovoltaic system for domestic purpose referring existing system

Unit 5: Wind Energy **8 Hrs**

Principle of wind energy conversion; Basic components of wind energy conversion systems; various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations, wind energy potential and installation in India.

Unit 6: Case Study on Wind Mill Design **2 Hrs**

Case study on designing miniature wind mill for domestic purpose referring existing system.

Books

Text :

1. G. D. Rai, 'Non-Conventional Energy Sources', Khanna Publisher
2. S. P. Sukhatme, 'Solar Energy: Principles of thermal collections and storage', McGraw Hill
3. Tiwari G N. 'Solar Energy: Fundamentals, design, modeling and Applications', Narosa, 2002

References :

1. Mukund R. Patel, 'Wind And Solar Power Systems: Design, Analysis and Operation, Second Edition', CRC Press
2. Kreith And Kreider, Solar Energy Handbook, McGraw Hill
3. Ray Hunter, 'Wind Energy Conversion: From Theory to Practice', John Wiley and Son Ltd
4. Gary L Johnson, 'Wind Energy Systems', Prentice-Hall Inc., New Jersey
5. Martin O L Hansen, 'Aerodynamics of Wind Turbines', James & James/Earthscan.
6. Goswami D Y, Kreith F, Kreider J F, 'Principles of Solar Engineering', Taylor & Francis
7. Robert Gasch, 'Wind Power Plant Fundamentals, Design, Construction And Operations', Springer
8. C S Solanki, 'Solar Photovoltaic: Fundamentals, Technology And Applications', PHI Learning

Savitribai Phule Pune University
Final Year of Mechanical Engineering (2015 Course)

Course Code : 402050 C | **Course Name : Elective – IV**

Product Design and Development

Teaching Scheme:		**Credits**		**Examination Scheme:**		
Theory	**: 03 Hrs Per Week**	**TH**	**: 03**	**Theory**	**In-Sem : 30**	**PR : --**
Practical	**: --**	**TW**	**: --**		**End-Sem : 70**	**OR : --**
						TW : --

Pre-requisites	**:** Basic Engineering Science - Physics, Chemistry, Material Science, Engineering Metallurgy, Manufacturing processes

Course Objectives:

To explain student's significance of

- Product design and Product development process
- Customer needs, satisfaction and commercialization of product
- Forward & Reverse Engineering and its role in designing a product
- Design Aspects (DFA, DFMEA, Design for Reliability and Safety)
- Product Life Cycle Management and Product Data Management

Course Outcomes:

On completion of the course, students will be able to -

- Understand essential factors for product design
- Design product as per customer needs and satisfaction
- Understand Processes and concepts during product development
- Understand methods and processes of Forward and Reverse engineering
- Carry various design processes as DFA, DFMEA, design for safety
- Understand the product life cycle and product data management

Course Contents

Unit 1: Introduction to Product Design and Development **6 Hrs**

Definition of product design, Essential Factors for product design, Modern approaches to product design, standardization, simplification and specialization in product design product development, product development versus product design, modern product development process, product testing and validation.

Unit 2: Product Development –Technical and Business Concerns **6 Hrs**

Mission Statement and Technical Questioning, Technology Forecasting and S Curve, Customer Needs and Satisfaction, Customer Needs - Types and Models, tools for Gathering Customer Needs, Customer Population and Market Segmentation.

Unit 3: Product Development from Concept to Product Function **6 Hrs**

Product information gathering, brainstorming and lateral thinking, morphological analysis of product, generating concepts, concept selection - design evaluation, estimation of technical feasibility, concept selection process, Pugh's concept, selection charts, concept scoring, process of concept embodiment, system modeling, functional modeling and decomposition, fast method, subtract and operate procedure, Simulation driven design.

Unit 4: Reverse Engineering **6 Hrs**

Product Teardown Process, Tear Down Methods, Force Flow Diagrams, Measurement and Experimentation, Applications of Product Teardown, Benchmarking Approach and Detailed Procedure, Tools Used in Benchmarking Indented Assembly Cost Analysis, Function -Form Diagrams, Trend Analysis, Setting Product Specifications, Introduction to Product Portfolio and Architecture.

Unit 5: Design for X **6 Hrs**

Design for manufacture, Design for assembly, Design for robustness, Design for safety, Design for reliability, Design for environment, Design for piece part production, manufacturing cost analysis. Local, Regional and Global issues, basic life cycle assessment - basic method, weighed sum assessment method (Numerical), Design Failure mode effect analysis.

Unit 6: Product Life Cycle Management and Product Data Management **6 Hrs**

Introduction, Concept of Product Life Cycle management, Components/Elements of PLM, Customer Involvement, Product Data and Product Workflow, The Link Between Product Data and Product Workflow, Different Phases of Product Life Cycle and corresponding technology.

Books

Text :

1. K. Chitale; R.C. Gupta, Product Design and Manufacturing, Prentice Hall India.
2. Dieter George E., Engineering Design McGraw Hill Pub. Company, 2000.

References :

1. Kevin Otto and Kristin Wood, Product Design: Techniques in Reverse Engineering and New Product Development, Pearson Education Inc.
2. Grieves, Michael, Product Lifecycle Management McGraw Hill
3. Bralla, James G., Handbook of Product Design for Manufacturing, McGraw Hill Pub.
4. Karl Ulrich, product design and development, TMH.

Savitribai Phule Pune University
Final Year of Mechanical Engineering (2015 Course)

Course Code : 402051 **Course Name : Project – II**

Teaching Scheme:		Credits		Examination Scheme:			
Theory	: --	TH	: --	Theory	In-Sem : --	PR	: --
Practical	: 12 hrs per week	TW	: 06		End-Sem : --	OR	: 100
						TW	: 100

Course Contents

INSTRUCTIONS FOR PROJECT REPORT WRITING

It is important that the procedures listed below be carefully followed by all the students of B.E. (Mechanical Engineering).

1. Prepare ***Three Hard Bound Copies*** of your manuscript.
2. Limit your Dissertation report to *80– 120* pages (preferably)
3. The *footer must include* the following:
   Institute Name, B.E. (Mechanical) Times New Roman 10 pt. and centrally aligned.
4. Page number as second line of footer, Times New Roman 10 pt. centrally aligned.
5. Print the manuscript using
   a) Letter quality computer printing.
   b) The main part of manuscript should be Times New Roman 12 pt. with alignment - justified.
   c) Use 1.5 line spacing.
   d) Entire report shall be of 5- 7 chapters
6. Use the paper size 8.5’’ × 11’’ or A4 (210 × 197 mm). Please follow the margins given below.

Margin Location	Paper 8.5’’ × 11’’	Paper A4 (210 × 197 mm)
Top	1’’	25.4 mm
Left	1.5’’	37 mm
Bottom	1.25’’	32 mm
Right	1’’	25.4mm

7. All paragraphs will be 1.5 lines spaced with a one blank line between each paragraph. Each paragraph will begin with without any indentation.
8. Section titles should be bold with 14 pt. typed in all capital letters and should be left aligned.
9. Sub-Section headings should be aligning at the left with 12 pt. bold and Title Case (the first letter of each word is to be capitalized).
10. Illustrations (charts, drawings, photographs, figures) are to be in the text. Use only illustrations really pertinent to the text. Illustrations must be sharp, clear, black and white. Illustrations downloaded from internet are not acceptable.
    a) Illustrations should not be more than two per page. One could be ideal
    b) Figure No. and Title at bottom with 12 pt.
    c) Table No. and Title at top with 12 pt.
    d) Legends below the title in 10 pt.
    e) Leave proper margin in all sides

f) Illustrations as far as possible should not be photo copied.

11. Photographs if any should be of glossy prints
12. Please use SI system of units only.
13. Please number the pages on the front side, centrally below the footer
14. References should be either in order as they appear in the thesis or in alphabetical order by last name of first author
15. Symbols and notations if any should be included in nomenclature section only
16. Following will be the order of report
    i. Cover page and Front page (*as per the specimen on separate sheet*)
    ii. Certificate from the Institute (*as per the specimen on separate sheet*)
    iii. Acknowledgements
    iv. Contents
    v. List of Figures
    vi. List of Tables
    vii. Nomenclature
    viii. Abstract (A brief abstract of the report not more than 150 words. The heading of abstract i.e. word “Abstract” should be bold, Times New Roman, 12 pt and should be typed at the center. The contents of abstract should be typed on new line without space between heading and contents. Try to include one or two sentences each on motive, method, key-results and conclusions in Abstract

    1. Introduction (2-3 pages) (TNR – 14 Bold)
        1.1 Problem statement (TNR – 12)
        1.2 Objectives
        1.3 Scope
        1.4 Methodology
        1.5 Organization of Dissertation

    2. Literature Review (20-30 pages)
    Discuss the work done so far by researchers in the domain area and their significant conclusions. No derivations, figures, tables, graphs are expected.

    3. This chapter shall be based on your own simulation work (Analytical/ Numerical/FEM/CFD) (15- 20 pages)

    4. Experimental Validation - This chapter shall be based on your own experimental work (15-20 pages)

    5. Concluding Remarks and Scope for the Future Work (2-3 pages)
    References ANNEXURE (if any) (Put all mathematical derivations, Simulation program as Annexure)

17. All section headings and subheadings should be numbered. For sections use numbers 1, 2, 3, … and for subheadings 1.1, 1.2, …. etc and section subheadings 2.1.1, 2.1.2, …. etc.
18. References should be given in the body of the text and well spread. No verbatim copy or excessive text from only one or two references. If figures and tables are taken from any reference then indicate source / citation of it. Please follow the following procedure for references

    Reference Books :

    Collier, G. J. and Thome, J. R., Convective boiling and condensation, 3rd ed., Oxford

University Press, UK, 1996, pp. 110 – 112.

Papers from Journal or Transactions :
Jung, D. S. and Radermacher, R., Transport properties and surface tension of pure and mixed refrigerants, *ASHRAE Trans*, 1991, 97 (1), pp. 90 – 98.
Bansal, P. K., Rupasinghe, A. S. and Jain, A. S., An empirical correction for sizing capillary tubes, *Int. Journal of Refrigeration*, 1996, 19 (8), pp.497 – 505.

Papers from Conference Proceedings :
Colbourne, D. and Ritter, T. J., *Quantitative assessment of flammable refrigerants in room air conditioners*, Proc. of the Sixteenth International Compressor Engineering Conference and Ninth International Refrigeration and Air Conditioning Conference, Purdue University, West Lafayette, Indiana, USA, 2002, pp. 34 – 40.

Reports, Handbooks etc. :
United Nations Environmental Programme, Report of the Refrigeration, Air Conditioning and Heat Pumps, Technical Option Committee, 2002, Assessment - 2002.
ASHRAE Handbook: Refrigeration, 1994 (Chapter 44)

Patent :
Patent no, Country (in parenthesis), date of application, title, year.

Internet :
www.(Site) [Give full length URL] *accessed on date*

A Project Report on
(TNR, 16pt, centrally aligned)

Title of the Project Report

(TNR, 27pt, Bold, Centrally Aligned, Title Case)

By
(TNR, 16pt, Centrally Aligned)

Mr. Student's 1 Name
(TNR, 16pt, Centrally Aligned)

Mr. Student's 2 Name
(TNR, 16pt, Centrally Aligned)

Mr. Student's 3 Name
(TNR, 16pt, Centrally Aligned)

Mr. Student's 4 Name
(TNR, 16pt, Centrally Aligned)

Guide
Guide's Name
(TNR, 16pt, Centrally Aligned)

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Name of the Institute
[2018-19]

(TNR, 22pt, Title Case Centrally Aligned)

Name of the Institute

Institute Logo

C E R T I F I C A T E

This is to certify that ***Mr. (Name of the Student)***, has successfully completed the Project Stage – I entitled "(***Title of the Project)***" under my supervision, in the partial fulfillment of Bachelor of Engineering - Mechanical Engineering of University of Pune.

Date:

Place:

Guide's Name Guide	**Internal Examiner**
HoD Name Head of the Department	**Principal Name** Principal

External Examiner

Seal

UNIVERSITY OF PUNE, PUNE

Structure and Syllabus

FOR

M. E. (Mechanical) (Design Engineering)
2017- Course

UNDER FACULTY OF ENGINEERING

EFFECTIVE FROM JULY 2017

M.E. Mechanical Engineering (Design Engineering) - 2017 Course

SEMESTER I

CODE	SUBJECT	TEACHING SCHEME	EXAMINATION SCHEME					CREDITS
		Lect./ Pr	Paper		TW	Oral/ Presentation	Total	
			In Semester Assessment	End Semester Assessment				
507201	Advanced Mathematics@	4	50	50	-	-	100	4
502202	Material Science and Mechanical Behavior of Materials	4	50	50	-	-	100	4
502203	Advanced Stress Analysis	4	50	50	-	-	100	4
502104	Research Methodology	4	50	50	-	-	100	4
502205	Elective I**	5	50	50	-	-	100	5
502206	Lab Practice I	4			50	50	100	4
Total		25	250	250	50	50	600	25

SEMESTER II

CODE	SUBJECT	TEACHING SCHEME	EXAMINATION SCHEME					CREDITS
		Lect./ Pr	Paper		TW	Oral/ Presentation	Total	
			In Semester Assessment	End Semester Assessment				
502207	Analysis and Synthesis of Mechanisms	4	50	50	-	-	100	4
502208	Advanced Mechanical Vibrations	4	50	50	-	-	100	4
502209	Finite Element Method	4	50	50	-	-	100	4
502210	Elective II	5	50	50	-	-	100	5
502211	Lab Practice II	4	-	-	50	50	100	4
502212	Seminar I	4	-	-	50	50	100	4
Total		25	200	200	100	100	600	25

Note:
Elective I: Common to All M.E. Mechanical Specializations**
@ Syllabus is common with Automotive Engineering. Hence End Semester examination paper will be same.

SEMESTER III

CODE	SUBJECT	TEACHING SCHEME	EXAMINATION SCHEME					CREDITS
		Lect./ Pr	Paper		TW	Oral/ Presentation	Total	
			In Semester Assessment	End Semester Assessment				
602213	Optimization Techniques	4	50	50	-	-	100	4
602214	Mechanical Measurements and Controls	4	50	50	-	-	100	4
602215	Elective III	5	50	50	-	-	100	5
602216	Seminar II	4	-	-	50	50	100	4
602217	Project Stage I	08	-	-	50	50	100	8
Total		25	150	150	100	100	500	25

SEMESTER IV

CODE	SUBJECT	TEACHING SCHEME	EXAMINATION SCHEME				CREDITS
		Lect./ Pr	Paper	TW	Oral/ presentation	Total	
602218	Seminar III	5	-	50	50	100	5
602219	Project Work Stage II	20	-	150	50	200	20
Total		25	-	200	100	300	25

Lab Practice I & II:
The laboratory work will be based on completion of assignments confined to the courses of that semester.

SEMINAR:
The student shall deliver the seminar on a topic approved by authorities.

Seminar I : shall be on state of the art topic of student's own choice approved by authority. The student shall submit the seminar report in standard format, duly certified for satisfactory completion of the work by the concerned Guide and head of the department/institute.

Seminar II : shall be on the topic relevant to latest trends in the field of concerned branch, preferably on the topic of specialization based on the electives selected by him/her approved by authority. The student shall submit the seminar report in standard format, duly certified for satisfactory completion of the work by the concerned Guide and head of the department/institute.

Seminar III: shall be extension of **seminar II.** The student shall submit the seminar report in standard format, duly certified for satisfactory completion of the work by the concerned Guide and head of the department/institute.

PROJECT WORK:

The project work shall be based on the knowledge acquired by the student during the coursework and preferably it should meet and contribute towards the needs of the society. The project aims to provide an opportunity of designing and building complete system or subsystems based on area where the student likes to acquire specialized skills.

Project Work Stage – I

Project work Stage – I is the integral part of the project Work. In this, the student shall complete the partial work of the Project that will consist of problem statement, literature review, project overview, scheme of implementation (UML/ERD/block diagram/ PERT chart, etc.) and Layout & Design of the Set-up. The candidate shall deliver a presentation as a part of the progress report of Project work Stage-I, on the advancement in Technology pertaining to the selected dissertation topic.
The student shall submit the progress report of Project Work Stage-I in standard format duly certified for satisfactory completion of the work by the concerned guide and head of the department/Institute.

Project Work Stage - II

In Project Work Stage – II, the student shall complete the balance part of the Project that will consist of fabrication of set up required for the project, conducting experiments and taking results, analysis & validation of results and conclusions.

The student shall prepare the final report of Project work in standard format duly certified for satisfactory completion of the work by the concerned guide and head of the department/Institute.

Note: Institute must submit the list of candidates, guide and project details (title, area, problem definition, and abstract - clearly indicating objectives and scope, sponsorship details, if any) to the university within month of commencement of third semester. The guide must be approved/qualified teacher of the institute. A guide can guide at the most 8 students per year.

Semester - I
Advanced Mathematics [507201]

CODE	TEACHING SCHEME	EXAMINATION SCHEME					CREDITS
	Lect. /Week	Paper		TW	Oral/ Presentation	Total	
		In Semester Assessment	End Semester Assessment				
507201	4	50	50	-	-	100	4

1. **Inner Product Spaces, Orthogonality**
   Inner products, Cauchy-Schwartz inequality, Orthogonal projections, Gram-Schmidt orthogonalization, Matrix representation of inner product, Least square solutions

2. **Complex Analysis**
   Complex variables, Complex differentiation, Harmonic functions, conformal mapping, Complex integration, Cauchy's integral formulae and Calculus of residues

3. **Transforms**
   Concept of transforms, Fourier transforms, Applications to partial differential equations, Discrete Fourier transform, Laplace transforms and its inverse, Laplace transform of special functions: Unit step, Unit impulse, Periodic and Error. Applications to initial value problem and wave equation using transform techniques.

4. **Differential Equation**
   Series Solution of differential equations, Bessel's and Legendre's differential equations, Mass spring systems of multi degree freedom, Matrix formulation for differential equations in vibration theory, Normal mode solution, Numerical computation of Eigen value.

5. **Numerical Analysis**
   Finite difference analysis, Explicit and Implicit finite difference scheme, Stability of finite difference method, Applications of finite difference analysis in boundary value problems, one dimensional diffusion equation, Wave equation, Laplace equation.

6. **Calculus of Variation**
   Introduction, Functional, Euler's equation, Isoperimetric Problem, Functional involving higher order derivative, Approximate solution of boundary value problem, Rayleigh –Ritz method , Galerkin's method, Lagrange's principal.

References –

1. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley India
2. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers Delhi
3. Linear Algebra, Jin Ho Kwak and Sungpyo Hong, Springer international edition
4. Mechanical Vibration, Singiresu S. Rao, Pearson Education, Inc
5. Applied Numerical Analysis, Curtis F.Gerald and Patrick O. Wheatley, Pearson Education, Inc
6. Essential Mathematical Methods for Physicists, Hans J. Weber and G. B. Arfken, Academic Press.

Semester - I
Material Science and Mechanical Behavior of Materials [502202]

CODE	TEACHING SCHEME	EXAMINATION SCHEME					CREDITS
	Lect. /Week	Paper		TW	Oral/ Presentation	Total	
		In Semester Assessment	End Semester Assessment				
502202	4	50	50	-	-	100	4

1. **Modern Materials in Design Engineering**
   Dual phase alloy, HSLA, lightweight non-ferrous alloy and their full range stress strain behaviour subjected quasi-static and high strain rate loading, composites and its orthotropic properties, plastics, smart materials, nano-materials – types, applications and its properties, heat treatment and strengthening mechanisms.

2. **Response of metals and alloys to applied load**
   Stress, strain, transformations, Mohr's circle, isotropic elasticity, anisotropic elasticity, anisotropic thermal expansion, octahedral shear stress, yield criteria, yield surface, yield curve.

3. **Material Testing under Complex Loading**
   Tensile testing–uni-axial and biaxial tension test, full range stress-strain curves, true stress-strain curve, Bridgman correction, temperature rise, Bauschinger effect, combined bending and torsion test, three point bend test, elastic recovery.

4. **Plastic Behavior**
   Experimental studies of plastic deformations under simple and complex loading, strain hardening, power law approximations, isotropic, kinematic and combined hardening models, theory of plastic flow, strain-rate and temperature dependence of flow stress, deformation theory of plasticity, thermo-plasticity, behavior of metals with initial deformations.

5. **Elastic-Plastic Equilibrium**
   Equations of Elastic-Plastic Equilibrium, residual stresses and strains, plastic-rigid body, elastic-plastic bending and torsion, elastic-plastic bodies under variable loading, shake down theorems.

6. **Elasto-Visco-Plasticity**
   Visco-elasticity, rheological models, Maxwell model, Voigt model, Voigt–Maxwell model, damping, natural decay, dependence of damping and elastic modulus on frequency, thermo-elastic effect, low temperature and high temperature visco-plastic deformation models, rubber elasticity, damping, yielding, effect of strain rate, crazing.

References–

1. Fundamentals of Materials Science and Engineering, William D. Callister, Jr., John Wiley & Sons,
2. Mechanical Metallurgy, George E. Dieter, McGraw Hill Book Company, 1988
3. Theory of Plasticity, J. Chakrabarty, Elsevier, 2006
4. Foundations of Theory of Plasticity, L. M. Kachanov, Dover Publications, 2004
5. Theory of Plasticity and Metal Forming Processes, Sadhu Singh, Khanna Publishers
6. Mechanical Behavior of Materials, W.F.Hosford, Cambridge University Press, 2005
7. Plasticity for Structural Engineers, W.F. Chen, Da-Jian Han, Springer

Semester - I
Advanced Stress Analysis [502203]

CODE	TEACHING SCHEME	EXAMINATION SCHEME					CREDITS
	Lect. /Week	Paper		TW	Oral/ Presentation	Total	
		In Semester Assessment	End Semester Assessment				
502203	4	50	50	-	-	100	4

1. Theory of Elasticity

Elasticity problems in two dimensions - stress strain relationship for brittle materials, ductile materials. Compatibility equations in two and three dimensions, free body diagram of complicated structures and stress calculations, stress functions in rectangular and cylindrical coordinate systems, evaluation of stresses in flat rectangular plates with different clamp and load conditions evaluation of the stresses in the flat and circular plate with center hole / holes using stress function.

2. Theory of Torsion:-

Torsion of prismatic bars of solid section and thin walled section. Analogies for torsion, membrane analogy, fluid flow analogy and electrical analogy. Torsion of conical shaft, bar of variable diameter, thin walled members of open cross section in which some sections are prevented from warping, Torsion of non-circular shaft.

3. Stresses in Beams

Concept of shear centre in symmetrical and unsymmetrical bending, stress and deflections in beams subjected to unsymmetrical bending, shear centre for thin wall beam cross section, open section with one axis of symmetry, general open section, and closed section. Curved Beams (Winkler-Bach formula), Combined Bending and torsion, Equivalent Bending Moment, Equivalent Torque, combined bending, torque and internal pressure. Moving loads on Beams.

4. Contact stresses

Geometry of contact surfaces, method of computing contact stresses and deflection of bodies in point contact, Stress for two bodies inline contact with load normal to contact area and load normal and tangent to contact area, gear contacts, contacts between cam and follower, ball bearing contacts.

5. Experimental stress analysis

Dimensional analysis, analysis techniques, strain gauges, types of strain gauges, materials, configuration, instrumentation, characteristics of strain gauge measurement, theory of photo-elasticity, elements of polariscope, simple and circular polariscope, fringes in dark and white field, isoclinic and isochromatic fringe patterns, evaluation of stresses from these fringe patterns.

References-

1. Advanced Mechanics of Materials– Cook and Young, Prentice Hall
2. Advanced Strength and Applied Stress Analysis–Richard G. Budynas, McGrawHill
3. Advanced Mechanics of Materials–Boresi, Schmidt, Sidebottom,Willey
4. Advanced Mechanics of Solids, L S Shrinath, Tata McGrawHill

5. Theory of Elasticity–Timoshenko and Goodier, McGrawHill
6. Advanced Strength of Materials,Vol.1, 2–Timoshenko, CBS
7. Advanced Strength of Materials–Den Hartog
8. Experimental Stress Analysis–Dally & Riley
9. Mechanics of Materials E J Hern, Buttorwoth
10. Strength of Materials, Singer Andrue Pytel, Pearson

Semester – I
Research Methodology [502104]

CODE	TEACHING SCHEME	EXAMINATION SCHEME					CREDITS
	Lect. /Week	Paper		TW	Oral/ Presentation	Total	
		In Semester Assessment	End Semester Assessment				
502104	4	50	50	-	-	100	4

1. **Introduction**
   Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Criteria of Good Research

2. **Research Problem and Research Design:**

   Definition of good research problem, Feasibility study of research problem, Importance of research problem, Sources of research problem, Criteria of good research problem, Meaning of Hypothesis, Characteristics of Hypothesis, Errors in selecting a research problem, Concept & need of research design, Meaning of variable, Selection of variables

3. **Mathematical Modelling and prediction of performance:**
   Steps in Setting up a computer model to predict performance of experimental system, Validation of results, Multi-scale modelling and verifying performance of process system, Nonlinear analysis of system and asymptotic analysis, Verifying if assumptions hold true for a given apparatus setup, Plotting family of performance curves to study trends and tendencies, Sensitivity analysis.

4. **Basic instrumentation:**
   Instrumentation schemes, Static and dynamic characteristics of instruments used in experimental set up, Performance under flow or motion conditions, Data collection using a digital computer system, Linear scaling for receiver and fidelity of instrument, Role of DSP in data collection in noisy environment, Good measurement practice.

5. **Applied statistics:**

   Regression analysis, curve fitting and developing Correlation, Parameter estimation, Multivariate statistics, Principal component analysis, Moments and response curve methods, State vector machines and uncertainty analysis, Probable errors in the research, Error analysis and methods to reduce errors in research process.

6. **Research report writing and Publication**

   Research Report: Dissemination of research findings, outline and structure of research report, different steps and precautions while writing research report, methods and significance of referencing

Publishing Research work: Selection of suitable journal for publishing research work, Open access Vs Subscription Journals, Identifying indexing of selected journals, Impact factor of the journal, structure of research paper, Check for plagiarism of the article, Research paper submission and review process.

Lab Practice:

1. Write Sample research proposal of the planned research topic giving details of topic, significance, funding required etc.
2. Write a research paper on review of at least 5 research papers for a research topic (Language, formatting and authors guidelines to be strictly followed from standard Springer or Elsevier Journals and referred journal details to be mentioned in the Lab practice file) and verify the research article for plagiarism and attach the plagiarism report.

Reference Books:

1. Research methodology: an Introduction for Science & Engineering students, by Stuart Melville and Wayne Goddard
2. Research Methodology: Methods and Trends, by Dr. C. R. Kothari
3. Research Methodology: An Introduction by Wayne Goddard and Stuart Melville
4. Research Methodology: A Step by Step Guide for Beginners, by Ranjit Kumar, 2nd Edition
5. Operational Research by Dr. S.D. Sharma, Kedar Nath Ram Nath & Co.
6. Software Engineering by Pressman

Semester – I
Elective – I [502205]

CODE	TEACHING SCHEME	EXAMINATION SCHEME					CREDITS
	Lect. /Week	Paper		TW	Oral/ Presentation	Total	
		In Semester Assessment	End Semester Assessment				
502205	5	50	50	-	-	100	5

Modules of 2 Credits (Select any Two)			
Code No.	**Title**	**Code No.**	**Title**
ME2I – M1	Energy Audit and Management	**ME2I – M6**	Operation Management
ME2I – M2	Financial Management	**ME2I – M7**	Engineering Economics
ME2I – M3	Financial Costing	**ME2I – M8**	Technology Forecasting
ME2I – M4	Project Management	**ME2I – M9**	Technology Transfer
ME2I – M5	Energy Efficient Technologies in Electrical Systems	**ME2I – M10**	Human Rights
Modules of 1 Credit (Select any One)			
Code No.	**Title**	**Code No.**	**Title**
ME1I – M11	Environmental Pollution and Control	**ME1I – M12**	Intellectual property Rights

Note: For e.g., ME2I-M1 indicates
ME – Common to all M.E. Mechanical Course, 2 – 2 Credits, I – Elective I, M1 – Module 1

ME2I – M1 Energy Audit and Management
Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach- understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments
Ref. Books: Guide Books, Bureau of Energy Efficiency

ME2I – M2 Financial Management
Investment-need, Appraisal and criteria, Financial analysis techniques- Simple payback period, Return on investment, Net present value, Internal rate of return, Cash flows, Risk and sensitivity analysis, Financing options, Energy performance contracting and role of Energy Service Companies (ESCOS).
Ref. Books: Guide Books, Bureau of Energy Efficiency

ME2I – M3 Financial Costing
Significance, Traditional absorption costing, Marginal costing, Contract costing, Activity based costing, Process costing
Ref. Books: Cost Accounting, N K Prasad, Book Syndicate Pvt. Ltd.

ME2I – M4 Project Management
Definition and scope of project, Technical design, Financing, Contracting, Implementation and performance monitoring, Implementation plan for top management, Planning Budget, Procurement Procedures, Construction, Measurement and Verification
Ref. Books: Guide Books, Bureau of Energy Efficiency

ME2I – M5 Energy Efficient Technologies in Electrical Systems

Maximum demand controllers, Automatic power factor controllers, Energy efficient motors, Soft starters with energy saver, Variable speed drives, Energy efficient transformers, Electronic ballast, Occupancy sensors, Energy efficient lighting controls.
Ref. Books: Guide Books, Bureau of Energy Efficiency

ME2I – M6 Operation Management
Introduction, Importance, Operating systems models, key decisions, Planning and controlling, Strategic approach, Processes and systems, supply chain or network approach, Technology and knowledge management, Quality Management, Operations - Challenges, Opportunities, Excellence, risk management and sustainability, Case studies
Ref. Books:1) Operations Management - An Integrated Approach, Danny Samson and Prakash J. Singh, :Cambridge University Press, 2) Modern production/Operations Management, 8th Edition, E.S. Buffa and R. K. Sarin, John Wiley & Sons.

ME2I – M7 Engineering Economics
Fundamentals, Markets and Government in a Modern economy, Basic Elements of Supply and Demand, Demand and Consumer Behaviour, Analysis of Perfectly Competitive Markets, Unemployment, Inflation and Economic policy
Ref. Books: Economics, Samuelson Nordhaus, Tata McGraw Hill

ME2I – M8 Technology Forecasting
Approaches, Technology Performance Parameters, Use of Experts in Technology Forecasting, Planning, Technology Progress, Morphological Analysis of a Technology System.
Ref. Books: 1) Gerard H. Gaynor, Hand Book of Technology Management, Mc Graw Hill.

ME2I – M9 Technology Transfer
Definition, Source of Technology Transfer [TT], Model of TT with Public and Private Enterprises, Success and Failure Factors in Technology Transfer, The concepts of Invention and Innovation, Definition and classifications of Research and Development, New Product Development, Challenges in Commercializing Research Results.
Ref. Books: 1) Gerard H. Gaynor, Hand Book of Technology Management, Mc Graw Hill.

ME2I – M10 Human Rights
Human Rights – Concept, Development, Evolution, Philosophical, Sociological and Political debates, Benchmarks of Human Rights Movement. Human Rights and the Indian Constitution Human Rights & State Mechanisms, Police & Human Rights, Judiciary & Human Rights, Prisons & Human Rights, National and State Human Rights Commissions, Human Rights of the Different Sections and contemporary issues, Citizens' Role and Civil Society, Human Rights and the international scene Primary Information with reference to Engineering Industry
Ref. Books:1)Study material on UNESCO,UNICEF web site, 2)HUMAN RIGHTS IN INDIA A MAPPING,Usha Ramanathan, 3)Introduction to International Humanitarian Law by Curtis F. J. Doebbler - CD Publishing , 2005 .This book is an introductory text on international humanitarian law (the laws of war) that provides the basics of law, including excerpts from some of the leading treaty texts. Perfect for a short course in the law -- one to five weeks, 4) Freedom of Information by Toby Mendel - UNESCO , *2008*

ME1I – M8 Environmental and Pollution control
Pollution and Environmental Ethics, Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards Environmental impact and economic aspects, Emission standards and regulations for Automobiles.
Ref. Books: 1) Environmental Pollution and Control, J. Jeffrey Peirce, P Aarne Vesilind, Ruth Weiner, Butterworth-Heinemann, 2) Environmental Pollution Control Engineering, C.S. Rao, New Age International

ME1I – M12 Intellectual property Rights

Patentable and non-patentable inventions, statutory exceptions, Persons entitled to apply for patents.

Ref. Books: 1) Satyawrat Ponkshe, The Management of Intellectual Property, by, Ponkshe & Bhate Publications, Pune.

Semester - I
Lab Practice – I [502206]

CODE	TEACHING SCHEME	EXAMINATION SCHEME					CREDITS
	Lect. /Week	Paper		TW	Oral/ Presentation	Total	
		In Semester Assessment	End Semester Assessment				
502206	4	-	-	50	50	100	4

Lab practice file shall consist of following assignments/experiments

1. Computer program to find Eigen values using numerical method
2. Computer program of Fourier and Laplace transform for an engineering application
3. Measurement of strain in cantilever beam using strain gauges
4. Contact stress analysis using FEM software
5. Elasto-plastic analysis of a tensile test specimen using FEM software
6. Determination of full range stress strain curve for mild steel and aluminium specimen as per ASTM -E8M
7. Assignment on instrumentation and data collection
8. Assignment on research proposal

Lab. work or Assignments have to be carried out at respective labs as mentioned in the syllabus of respective. It is to be submitted as term work at the end of semester after continuous assessment of each by respective teacher. Assessment of term work has to be carried out as per R-1.4 and R-1.5 of PG Rules and Regulations of Credit System.

Semester - II
Analysis and Synthesis of Mechanisms [502207]

CODE	TEACHING SCHEME	EXAMINATION SCHEME					CREDITS
	Lect. /Week	Paper		TW	Oral/ Presentation	Total	
		In Semester Assessment	End Semester Assessment				
502207	4	50	50	-	-	100	4

1. Introduction to Kinematics

Review of concepts related to kinematic analysis of mechanisms, degree of freedom, Grashoff's and Grubler's criteria, Transmission and deviation angles, mechanical advantage, Review of graphical and analytical methods of velocity and acceleration analysis of simple mechanisms.

2. Complex Mechanisms

Types of complex Mechanisms, velocity-acceleration analysis of complex mechanisms by the Normal Acceleration method and Auxiliary Point Method, Introduction to Goodman's Method.

3. Curvature theory

Fixed and moving centrodes, inflection circle, Euler-Savary equation, Bobillier constructions, cubic of stationary curvature, Ball's point, applications in dwell mechanisms.

4. Synthesis of Planar Mechanisms

Types, number and dimensional synthesis, function generation, path generation and rigid body guidance

problems, accuracy(precision)points, Chebychev spacing, types of errors, graphical synthesis for function generation and rigid body guidance with two and three accuracy points using Relative pole method & Inversion method, center point and circle point curves, Bermester points, branch and order defects, synthesis for path generation.

5. Analytical synthesis of Planar Mechanisms

Freudenstein's equation, synthesis for four accuracy points, compatibility condition, Introduction to complex numbers method of synthesis, the dyad, center point and circle point circles, ground pivot specifications, three accuracy point synthesis using dyad method, Robert Chebychev theorem, Cognate linkages.

6. Kinematics of Spatial Mechanisms

Transformations describing planar finite displacements, planar finite transformations, identity transformation, rigid-body transformations, spatial transformations Denavit-Hartenberg parameters, matrix method of analysis of spatial mechanisms

References:

1. Theory of Machines and Mechanisms, A. Ghosh and A.K. Mallik, Affiliated East-West Press.
2. Kinematic Synthesis of Linkages, R.S. Hartenberg and J. Denavit, McGraw-Hill.
3. Theory of Machines and Mechanisms, J. E. Shigley and J. J. Uicker,2nd Ed. McGraw-Hill.
4. Design of Machinery: An Introduction to the Synthesis and Analysis of Mechanisms and Machines, Robert L. Norton, Tata McGraw-Hill,3rd Edition.

5. Theory of machines – S. S. Rattan McGraw-Hill Publications.
6. Mechanisms and Machine Theory- A.G. Ambekar. PHI Learning Pvt. Ltd.
7. Mechanism Design- Analysis and Synthesis (Vol.1and 2), A.G. Erdman and G.N. Sandor, Prentice Hall.

Semester – II
Advanced Mechanical Vibrations [502208]

CODE	TEACHING SCHEME	EXAMINATION SCHEME					CREDITS
	Lect. /Week	Paper		TW	Oral/ Presentation	Total	
		In Semester Assessment	End Semester Assessment				
502208	4	50	50	-	-	100	4

1. Multi Degree Freedom System

Free vibration equation of motion, influence coefficient i) stiffness coefficient (ii) flexibility coefficient generalized coordinates, coordinate couplings, Lagrange's equations matrix method Eigen values Eigen vector problems, modal analysis, forced vibrations of un-damped system and modal analysis.

Numerical methods - (i) Rayleigh's Method, (ii) Rayleigh-Ritz Method (iii) Holzer's Method (iv) Methods of Matrix iterations (v) Transfer Matrix Method

2. Continuous System

Transverse vibrations of String, Longitudinal vibration of Rods, Torsional vibrations of Shaft, Lateral vibrations of simply supported and cantilever beams, Forced vibration of beams.

3. Transient vibrations

Laplace transformation, Response to an impulsive input, Response to step input, Response to a pulse input-rectangular pulse and half sinusoidal pulse.

4. Vibration Control

Balancing of rotating machine, in-situ balancing of rotors, control of natural frequency, vibration isolation and vibration absorbers, Passive, active and semi-active control, free layer and constrained layer damping.

5. Vibration Measurement

FFT analyzer, vibration exciters, signal analysis, time domain and frequency domain analysis of signals, experimental modal analysis, machine conditioning and monitoring, fault diagnosis

6. Random Vibrations

Auto and cross correlation function, spectral density, response of linear systems, and analysis of narrow band systems

References:

1. Theory of Vibrations with Applications, W. T. Thomson, Pearson Education, Delhi
2. Mechanical Vibrations, S. S. Rao, Pearson Education, Delhi
3. Mechanical Vibrations, G K Groover, Nem Chand & Bros, Roorkee, India
4. Fundamentals of Vibration, Leonard Meirovitch, McGraw Hill International Edison
5. Principles of Vibration Control: Ashok Kumar Mallik, Affiliated East-West Press, New Delhi.
6. Mechanical Vibrations, A H Church, John Wiley & Sons Inc
7. Mechanical Vibrations & Noise Engineering, A.G.Ambekar, Prentice Hall of India, New-Delhi.

Semester - II
Finite Element Method [502209]

<table>
<tr><th rowspan="3">CODE</th><th>TEACHING SCHEME</th><th colspan="5">EXAMINATION SCHEME</th><th rowspan="3">CREDITS</th></tr>
<tr><th rowspan="2">Lect. /Week</th><th colspan="2">Paper</th><th rowspan="2">TW</th><th rowspan="2">Oral/ Presentation</th><th rowspan="2">Total</th></tr>
<tr><th>In Semester Assessment</th><th>End Semester Assessment</th></tr>
<tr><td>502209</td><td>4</td><td>50</td><td>50</td><td>-</td><td>-</td><td>100</td><td>4</td></tr>
</table>

1. Introduction

Finite element method, brief history, basic steps, advantages and disadvantages, weak formulation, variational methods of approximation – Rayleigh-Ritz methods, Galerkin method of Weighted Residuals.

2. One dimensional problems

Variational formulation of 1D bar and beam elements (Euler Bernoulli and Timoshenko beam) – governing equation, domain discretization, elemental equations, assembly and element connectivity, application of boundary condition, solution of equations, post-processing of the results.

3. Two Dimensional Isoperimetric Formulation

Introduction, types of 2D elements (CST, LST, QST, Isoparametric), shape functions – linear & quadratic, displacement function – criteria for the choice of the displacement function, polynomial displacement functions, displacement function in terms of nodal parameters, strain-nodal parameter relationship, stress-strain relationship, element stiffness matrix, convergence of isoparametric elements, rate of convergence, plane elasticity problems – plane stress, plane stain and axisymmetric problems

Numerical Integration – Trapezoidal rule, Simpson's 1/3 rule, Newton-Cotes Formula, Gauss Quadrature formula, Gauss Quadrature in two and three dimensions, reduced and selective integration

4. 3D Problems in stress analysis

Introduction, Finite element formulation, stress calculations, mesh preparation, hexhedral and tetrahedral elements, modeling problems [Only theoretical treatment]

5. Plate Bending Problems – Plate and Shell Elements

Introduction, thin and thick plates – Kirchhoff theory, Mindlin plate element, triangular and rectangular, conforming and nonconforming elements, degenerated shell elements, shear locking and hour glass phenomenon

6. Nonlinear Problems – Geometric, Material and Contact Problems

Introduction to non-linear analysis, formulation for geometrical, material and contact nonlinear problems, Nonlinear equation solving procedure - direct iteration, Newton-Raphson method, modified Newton-Raphson method, incremental techniques

7. Dynamic Problems – Eigen value and Time Dependent Problems

Formulation of dynamic problems, consistent and lumped mass matrices Solution of eigenvalue problems – transformation methods, Jacobi method, Vector Iteration methods, subspace iteration method

Forced vibration – steady state and transient vibration analysis, modeling of damping, the mode superposition scheme, direct integration methods – implicit and explicit numerical integration

8. Special Topics

Algorithmic approach for Finite element formulation of element characteristics, Assembly and incorporation of boundary conditions, Guidelines for code development, Automatic mesh generation techniques, Mesh quality checks, h & p refinements, symmetry – mirror/plane, axial, cyclic & repetitive, Node Numbering scheme

Computer implementation: Pre-processor, Processor, Post-processor

References

1. Seshu P., “Text book of Finite Element Analysis”, PHI Learning Private Ltd., New Delhi, 2010.
2. Mukhopadhyay M and Sheikh A. H., “Matrix and Finite Element Analyses of Structures”, Ane Books Pvt. Ltd., 2009.
3. Bathe K. J., “Finite Element Procedures”, Prentice-Hall of India (P) Ltd., New Delhi.
4. Cook R. D., “Finite Element Modeling for Stress Analysis”, John Wiley and Sons Inc, 1995
5. Chandrupatla T. R. and Belegunda A. D., “Introduction to Finite Elements in Engineering”, Prentice Hall India.
6. Liu G. R. and Quek S. S. “The Finite Element Method – A Practical Course”, Butterworth Heinemann, 2003.
7. Reddy, J. N., “An Introduction to The Finite Element Method”, Tata McGraw Hill, 2003.

Semester – II
Elective II [502210]

CODE	TEACHING SCHEME	EXAMINATION SCHEME					CREDITS
	Lect. /Week	Paper		TW	Oral/ Presentation	Total	
		In Semester Assessment	End Semester Assessment				
502210	5	50	50	-	-	100	5

Modules of 2 Credits (Select any Two)			
Code No.	**Title**	**Code No.**	**Title**
DE2II-M1	Vehicle Dynamics – I	**DE2II-M5**	Mechanics of Composites
DE2II-M2	Vehicle Dynamics – II	**DE2II-M6**	Design of Composite Structure
DE2II-M3	Design of Material Handling Equipment – I	**DE2II-M7**	Acoustics and Noise Control - I
DE2II-M4	Design of Material Handling Equipment – II	**DE2II-M8**	Acoustics and Noise Control – II
Modules of 1 Credit (Select any One)			
Code No.	**Title**	**Code No.**	**Title**
DE1II-M9	Design of Piping System	**DE1II-M11**	Dynamics of Structures
DE1II-M10	Process Equipment Design	**DE1II-M12**	Robotics

Note: For e.g., DE2II-M1 indicates
DE – Design Engineering, 2 – 2 Credits, II – Elective II, M1 – Module 1
For e.g., DE1II-M12 indicates
DE – Design Engineering, 1 – 1 Credit, II – Elective II, M12 – Module 12

DE2II-M1 Vehicle Dynamics - I

Tire Characteristics - Tire – types, axis system, mechanics of pneumatic tires - tire forces and moments, rolling resistance of tires, tractive (braking) effort and longitudinal slip (skid), cornering properties of tires, slip angle and cornering force, slip angle and aligning torque, camber and camber thrust, characterization of cornering behaviour of tires, performance of tires on wet surfaces, ride properties of tires

Performance characteristics of road vehicles - Equation of motion and maximum tractive effort, aerodynamic forces and moments, vehicle power plant and transmission characteristics, acceleration time and distance, gradability, engine and transmission matching, Electronic Stability Control (ESC), Braking characteristics of a two-axle vehicle, braking efficiency and stopping distance, antilock brake systems, traction control systems, Electronic Brakeforce Distribution (EBD), Electronic Brake assist System (EBS)

Suspension Kinematics - Terminology, definitions – reference frame, toe-in, toe-out, wheel camber, caster and kingpin angle, steering offset, types of dependent and independent suspensions, equivalent mechanisms (front view / side view), anti-dive and squat geometry, roll center analysis, steering geometry, error, steering force and moments

Ref. Books: 1) Road Vehicle Dynamics – Problems & Solutions, Rao & Dukkipati, SAE, 2) Theory of Ground Vehicles, J.Y. Wong, John Wiley & Sons, 3) Fundamentals of Vehicle Dynamics, T.D. Gillespie, SAE

DE2II-M2 Vehicle Dynamics - II

Handling characteristics of vehicle - Steady-state handling characteristics of a two-axle vehicle, steady-state response to steering input, testing of handling characteristics, transient response characteristics, directional stability, steering of tracked vehicles

Vehicle ride characteristics - Calculation of spectral densities, RMS values, relation to ride comfort, vehicle ride models - two-degree-of-freedom vehicle model for sprung and un-sprung mass, numerical methods for determining the response of a quarter-car model to irregular surface profile excitation, two-degree-of-freedom vehicle model for pitch and bounce, active and semi-active suspension
Road and Suspension modeling - Road – modeling aspects, deterministic profile, random profile, auto-correlation function, spectral density, relation between input and output spectral densities, effect of wheelbase, modeling of springs, anti-roll bars, torsion bar, air springs, dampers, bump stop
Ref. Books: 1) Road Vehicle Dynamics – Problems & Solutions, Rao & Dukkipati, SAE, 2) Theory of Ground Vehicles, J.Y. Wong, John Wiley & Sons, 3) Fundamentals of Vehicle Dynamics, T.D. Gillespie, SAE

DE2II-M3 Design of Material Handling Equipment - I
Material handling system - principles and features of material handling system, importance, terminology, objectives and benefits of better material handling, classification of material handling equipment
Selection of material handling equipment - choice of material handling equipment, factors affecting for selection, general analysis procedures, basic analytical techniques, the unit load concept
Design of cranes - hand-propelled and traveling mechanisms of cantilever and monorail cranes, design considerations for structures of rotary cranes with fixed radius, fixed post and overhead traveling cranes, stability of stationary rotary and traveling rotary cranes, electric overhead travelling crane - essential parts, design parameters, structural considerations, end carriages, long and cross travel mechanisms, brakes, motor selection, safety arrangements, electrical control system
Ref. Books 1) N. Rudenko, 'Material Handling Equipment', Peace Publishers 2) James M. Apple, 'Material Handling System Design', John-Wiley and Sons 3) John R. Immer, 'Material Handling' McGraw Hill 4) Colin Hardi, 'Material Handling in Machine Shops'. Machinery Publication Co. Ltd., 5) M .P. Nexandrn, 'Material Handling Equipment', MIR Publication, 6) C. R. Cock and J. Mason, 'Bulk Solid Handling', Leonard Hill Publication Co. Ltd., 7) Spivakovsy, A.O. and Dyachkov, V.K., 'Conveying Machines', Volumes I and II, MIR Publishers, 8) Kulwiac R. A., 'Material Handling Hand Book', John Wiley Publication

DE2II-M4 Design of Material Handling Equipment - II
Load lifting attachments - load chains and types of ropes used in material handling system, forged, standard and Ramshorn hooks, crane grabs and clamps; grab buckets; electromagnet; design consideration for conveyor belts; drums, sheaves, sprockets
Study of bulk material handling systems - objectives of storage; bulk material handling; gravity flow of solids through slides and chutes; storage in bins and hoppers; screw conveyor, vibratory conveyor, pneumatic & hydraulic conveyor (classification, types, principles of operation)
Automation in material handling - control of hoisting & conveying machinery, material handling in direct-line production and automated lines, safety and design; safety regulations and discipline
Ref. Books 1) N. Rudenko, 'Material Handling Equipment', Peace Publishers 2) James M. Apple, 'Material Handling System Design', John-Wiley and Sons 3) John R. Immer, 'Material Handling' McGraw Hill 4) Colin Hardi, 'Material Handling in Machine Shops'. Machinery Publication Co. Ltd., 5) M .P. Nexandrn, 'Material Handling Equipment', MIR Publication, 6) C. R. Cock and J. Mason, 'Bulk Solid Handling', Leonard Hill Publication Co. Ltd., 7) Spivakovsy, A.O. and Dyachkov, V.K., 'Conveying Machines', Volumes I and II, MIR Publishers, 8) Kulwiac R. A., 'Material Handling Hand Book', John Wiley Publication

DE2II-M5 Mechanics of Composites
Introduction to Composite Materials - Introduction, types – fibrous, laminate, particulate, combination, polymer matrix composites, metal matrix composites, mechanical behaviour of composite material, applications – military, civil, space and automotive.
Mechanical Behaviour of Lamina - Anisotropy, orthotropy, stiffness, engineering constants, uniaxial and biaxial strength of lamina, failure theories – maximum stress, maximum strain, Tsai-Hill,

Hoffman, Tsai-Wu, computational procedure, applicability, mechanics approach to stiffness and strength

Mechanical Behaviour of Laminate - Classical laminate theory, stress-strain variation in laminate, resultant laminate forces and moments, laminate configurations, laminate stiffness, strength of laminates, interlaminar stresses

Ref. Books 1) Mechanics of Composite Materials, Robert M. Jones, Taylor & Francis 2) Engineering Mechanics of Composite Materials, Isaac M. Daniel and Ori Ishai, Oxford University Press 3) Mechanics of Composite Materials, Autar K. Kaw, CRC Press 4) Mechanics and Analysis of Composite Materials, Valery V. Vasiliev and Evgeny V. Morozov, Elsevier

DE2II-M6 Design of Composite Structure

Bending, Buckling and Vibration of Laminated Plates - Governing equations, simply supported laminated plates – deflection under distributed transverse load, buckling under in-plane load, vibration

Testing of Composite Materials - Characterization of constituent materials, physical characterization of composite material, determination of tensile, compressive and shear properties, determination of inter-laminar fracture toughness, bi-axial testing, characterization of composites with stress concentration

Design of Composite Structures - Structural design procedure, configuration selection, joints, design requirements, failure criteria, design analysis, optimization

Ref. Books 1) Mechanics of Composite Materials, Robert M. Jones, Taylor & Francis 2) Engineering Mechanics of Composite Materials, Isaac M. Daniel and Ori Ishai, Oxford University Press 3) Mechanics of Composite Materials, Autar K. Kaw, CRC Press 4) Mechanics and Analysis of Composite Materials, Valery V. Vasiliev and Evgeny V. Morozov, Elsevier

DE2II-M7 Acoustics and Noise Control - I

Basics of acoustics - speed of sound, wavelength, frequency, and wave number, acoustic pressure and particle velocity, acoustic intensity and acoustic energy density, spherical wave, directivity factor and directivity index, levels and the decibel, combination of sound sources, octave bands, weighted sound levels. A**coustic measurement -** sound level meters, intensity level meters, octave band filters, acoustic analysers, dosimeter, measurement of sound power, sound power measurement in a reverberant room, sound power measurement in an anechoic, sound power survey measurements, measurement of the directivity factor, noise measurement procedures

Transmission of sound - the wave equation, complex number notation, wave equation solution, solution for spherical waves, changes in media with normal incidence, changes in media with oblique incidence, sound transmission through a wall, transmission loss for walls - stiffness-controlled region- mass-controlled region - damping-controlled region, method for estimating the transmission loss, transmission loss for composite walls, sound transmission class, absorption of sound, attenuation coefficient

Acoustic criteria - the human ear, hearing loss, industrial noise criteria, speech interference level, noise criteria for interior spaces

Ref. Books: 1) Vibration and Noise for Engineers, Kewal Pujara, Dhanpat Rai and Co. 2) Industrial Noise Control Fundamentals and applications, Lewis H. Bell, Douglas H. Bell, Marcel Dekker, Inc. 3) Fundamentals of Noise & Vibration analysis for Engineers: M. P. Norton, D. G. Karczub, Cambridge University Press 4) Engineering Noise Control, Bies D. A. and Hansen C. H, Spon 5) Fundamentals of Acoustics, Kinsler L. E. et al , Wiley Mechanical Vibrations, S. S. Rao, Addison-Wesley Publishing Co.

DE2II-M8 Acoustics and Noise Control - II

Room acoustics - surface absorption coefficients, steady-state sound level in a room, reverberation time, effect of energy absorption in the air, noise from an adjacent room, acoustic enclosures, acoustic barriers

Noise control - noise sources, vibration isolation for noise control- un-damped single-degree-of-freedom (sdof) system - damped single-degree-of-freedom (sdof) system, damping factors, forced vibration, mechanical impedance and mobility, transmissibility, rotating unbalance, displacement excitation, dynamic vibration isolator, vibration isolation materials.

Silencer design - silencer design requirements, lumped parameter analysis, Helmholtz resonator, side branch mufflers, expansion chamber mufflers, dissipative mufflers, evaluation of the attenuation coefficient, commercial silencers

Ref. Books: 1) Vibration and Noise for Engineers, Kewal Pujara, Dhanpat Rai and Co. 2) Industrial Noise Control Fundamentals and applications, Lewis H. Bell, Douglas H. Bell, Marcel Dekker, Inc. 3) Fundamentals of Noise & Vibration analysis for Engineers: M. P. Norton, D. G. Karczub, Cambridge University Press 4) Engineering Noise Control, Bies D. A. and Hansen C. H, Spon 5) Fundamentals of Acoustics, Kinsler L. E. et al , Wiley Mechanical Vibrations, S. S. Rao, Addison-Wesley Publishing Co.

DE1II-M9 Design of Piping System

Piping design and procedure for process plant, design of piping support, valves and fittings, standards, stress analysis, operation and maintenance aspects in piping design, safety consideration, use of computer software for piping design

Ref. Books: 1) Design of Piping Systems, M. W. Kellogg Company 2) Pipe Stress Engineering, Liang-Chuan Peng and Tsen-Loong Peng, ASME Press 3) Introduction to Pipe Stress Analysis, Sam Kannappan , ABI Enterprise

DE1II-M10 Process Equipment Design

Basic concepts in process design, block diagrams for flow of processes, material flow balance, design pressures and temperatures, design stresses, factory of safety, minimum shell thickness and corrosion allowance, weld joint efficiency, design loading, stress concentration and thermal stresses, failure criteria, optimization technique such as Lagrange's multiplier and golden section method, cost and profitability estimation, introduction to design codes like IS-2825, ASME-SECT, EIGHT-DIV-II TEMA.API-650, BS-1500 & 1515

Ref. Books: 1) Process Equipment Design, Lloyd E. Brownell and Edwin H. Young, Wiley-Interscience 2) Process Equipment Design, M.V. Joshi, Mc-Millan

DE1II-M11 Dynamics of Structures

Single degree of freedom system, multi degree of freedom system, numerical evaluation of dynamic response – linear and nonlinear, time stepping methods, methods based on interpolation of excitation, central difference method, Newmark's method, stability and computational error, free vibration, modal analysis, modal response contribution

Ref. Books: 1) Mechanical Vibrations and Structural Dynamics - Analytical, Numerical and Experimental Methods, Waller, Heinz, Lenzen, Amin, Springer 2) Mechanical Vibrations: Theory and Applications to Structural Dynamics, M. Géradin, Wiley

DE1II-M12 Robotics

Manipulator Kinematics

Matrix algebra, inverse of matrices, rotational groups, matrix representations of coordinate, transformation, transformation about reference frame and moving frame, forward and inverse kinematics

Robotics Dynamics

Velocity kinematics, acceleration of rigid body, mass distribution Newton's equation, Euler's equation, iterative newton – Euler's dynamic formulation, closed dynamic, Lagrangian formulation of manipulator dynamics, dynamic simulation, and computational consideration

Trajectory planning

Introduction, general considerations in path description and generation, joint space schemes, cartesian space schemes, path generation in runtime, planning path using dynamic model, point to point and continuous trajectory

Ref. Book: 1) Robotics Technology and Flexible Automation, S. R. Deb, Tata McGraw Hill 2) Industrial Robotics (Technology ,Programming and application s), M. P. Groover, M. Weiss R.N. Nagel, N.G. Odrey, McGraw, Hill 3)Robotics : Control , sensors vision and in intelligence, K. S. Fu, R. C. Gonzalez and C. S. G. Lee, McGraw-Hill.

Semester – II
Lab Practice – II [502211]

<table>
<tr><th rowspan="3">CODE</th><th>TEACHING SCHEME</th><th colspan="5">EXAMINATION SCHEME</th><th rowspan="3">CREDITS</th></tr>
<tr><th rowspan="2">Lect. /Week</th><th colspan="2">Paper</th><th rowspan="2">TW</th><th rowspan="2">Oral/ Presentation</th><th rowspan="2">Total</th></tr>
<tr><th>In Semester Assessment</th><th>End Semester Assessment</th></tr>
<tr><td>502211</td><td>4</td><td>-</td><td>-</td><td>50</td><td>50</td><td>100</td><td>4</td></tr>
</table>

Lab practice file shall consist of following assignments/experiments

1. Analysis of inertia forces in slider crank mechanism using computer software
2. Coupler curve synthesis for a mechanism using computer software
3. Determination of natural frequencies & modal analysis of a machine component using FFT Analyzer
4. Stress and deflection analysis of short and long beams with different end conditions and cross-sections subjected to different loading conditions (i.e., point load – force & moment, distributed load etc) using FEA software
5. Stress and deflection analysis of thin and thick rectangular and circular plates/shells with different end conditions subjected to different loading conditions (i.e., point load – force & moment, distributed load etc) using FEA software
6. Stress analysis of rotating disc (solid and hollow discs) using FEA software
7. Buckling mode analysis of a thin shell cylinder using FEA software
8. Direct/Modal frequency response analysis of a beam/plate under a single-point cyclic load/base excitation with and without damping using FEA software

Lab. work or Assignments have to be carried out at respective labs as mentioned in the syllabus of respective. It is to be submitted as term work at the end of semester after continuous assessment of each by respective teacher. Assessment of term work has to be carried out as per R-1.4 and R-1.5 of PG Rules and Regulations of Credit System.

Seminar – I, II and III [502212, 602216, 602218]

CODE	TEACHING SCHEME	EXAMINATION SCHEME					CREDITS
	Pr /Week	Paper		TW	Oral/ Presentation	Total	
		In Semester Assessment	End Semester Assessment				
502212	4	-	-	50	50	100	4
602216	4	-	-	50	50	100	4
602218	5	-	-	50	50	100	5

Assessment of Seminar has to be carried out as per R-1.4 and R-1.5 of PG Rules and Regulations of Credit System.

INSTRUCTIONS FOR SEMINAR REPORT WRITING

It is important that the procedures listed below be carefully followed by all the students of M.E. (Mechanical Engineering).

1. Prepare 3 **COPIES** of your manuscript.
2. Limit your project report to preferably
    a) 15-20 manuscript pages for Seminar I
    b) 20-25 manuscript pages for Seminar II
    c) 25-30 manuscript pages for Seminar III
3. The footer must include the following:
   Institute Name, M. E. (Mechanical) (Design Engineering) Times New Roman 10 pt. and centrally aligned.

4. Page number as second line of footer, Times New Roman 10 Pt, centrally aligned.
5. Print the manuscript using
    a) Letter quality computer printing.
    b) The main part of manuscript should be Times New Roman 12 pt. and justified**.**
    c) Use 1.5 line spacing.
    d) Entire report shall be one chapter. No chapters for Seminar I, II and III.
    e) Seminar I shall not have last section as Conclusions, it will be summary only.
6. Use the paper size **8.5’’ × 11’’** or **A4 (210 × 197 mm).** Please follow the margins given below.

Margin Location	Paper 8.5’’ × 11’’	Paper A4 (210 × 197 mm)
Top	1’’	25.4 mm
Left	1.5’’	37 mm
Bottom	1.25’’	32 mm
Right	1’’	25.4 mm

7. All paragraphs will be 1.5 line spaced with a one blank line between each paragraph. Each paragraph will begin without any indentation.
8. Section titles should be bold with 14 pt typed in all capital letters and should be left aligned.

9. Sub-Section headings should be aligning at the left with 12 pt, bold and Title Case (the first letter of each word is to be capitalized).
10. Illustrations (charts, drawings, photographs, figures) are to be in the text. Use only illustrations really pertinent to the text. Illustrations must be sharp, clear, **black and white. Illustrations downloaded from internet are not acceptable.**
    a) Illustrations should not be more than **two** per page. One could be ideal
    b) Figure No. and Title at bottom with **12 pt**
    c) Legends below the title in **10 pt**
    d) Leave proper margin in all sides
    e) Illustrations as far as possible should not be Xeroxed.

11. **Photographs** if any should be of glossy prints
12. Please use **SI** system of units. If students would like to add the equivalent in inch-pound (British) units, they must be stated in parenthesis after the **SI** units. In case the final result comes out in any other units (say due to empirical formula etc.) covert the unit to **SI** unit.
13. Please **number the pages** on the front side, centrally below the footer
14. **References** should be either in order as they appear in the thesis or in alphabetical order by last name of first author
15. **Symbols** and **notations** if any should be included in nomenclature section only
16. Following will be the order of report
    i. **Cover page** and **Front page** as per the specimen on separate sheet
    ii. **Certificate** from the Institute as per the specimen on separate sheet
    iii. **Acknowledgement**
    iv. **List of Figures**
    v. **List of Tables**
    vi. **Nomenclature**
    vii. **Contents**
    viii. **Abstract** (A brief abstract of the report not more than **150 words**. The heading of abstract i.e. word “Abstract” should be **bold, Times New Roman, 12 pt** and should be typed at the **centre.** The contents of abstract should be typed on new line without space between heading and contents. Try to include one or two sentences each on **motive, method, key-results** and **conclusions** in the Abstract)
    ix. Section: Introduction
    x. References
17. All section headings and subheadings should be numbered. For sections use numbers **1, 2, 3, ….** and for subheadings **1.1**, **1.2**, **….** etc and section subheadings **2.1.1**, **2.1.2, ….** etc.
18. **References** should be given in the body of the text and well spread. No verbatim copy or excessive text from only one or two references. If **figures** and **tables** are taken from any reference then indicate source of it. Please follow the following procedure for references

    Reference Books

    Collier, G. J. and Thome, J. R., Convective boiling and condensation, 3rd ed., Oxford University Press, UK, 1996, pp. 110 – 112.

    Papers from Journal or Transactions

    Jung, D. S. and Radermacher, R., Transport properties and surface tension of pure and mixed refrigerants, *ASHRAE Trans*, 1991, 97 (1), pp. 90 – 98.

Bansal, P. K., Rupasinghe, A. S. and Jain, A. S., An empirical correction for sizing capillary tubes, *Int. Journal of Refrigeration*, 1996, 19 (8), pp.497 – 505.

Papers from Conference Proceedings

Colbourne, D. and Ritter, T. J., *Quantitative assessment of flammable refrigerants in room air conditioners*, Proc. of the Sixteenth International Compressor Engineering Conference and Ninth International Refrigeration and Air Conditioning Conference, Purdue University, West Lafayette, Indiana, USA, 2002, pp. 34 – 40.

Reports, Handbooks etc.

United Nations Environmental Programme, Report of the Refrigeration, Air Conditioning and Heat Pumps, Technical Option Committee, 2002, Assessment - 2002.

ASHRAE Handbook: Refrigeration, 1994 (Chapter 44)

Patent

Patent no, Country (in parenthesis), date of application, title, year.

Internet

www.(Site) [Give full length URL]

Format for front page and Certificate

A Seminar I / II / III on (TNR, 16pt, centrally aligned)

Title (TNR, 27pt, Bold, Centrally Aligned, Title Case)

By (TNR, 16pt, Centrally Aligned)

Mr. Student's Name (TNR, 16pt, Centrally Aligned)

Guide (TNR, 16pt, Centrally Aligned)

Guide's Name (TNR, 16pt, Centrally Aligned)

Institute

Logo

Department of Mechanical Engineering

Name of the Institute

[2011-12](TNR, 22pt, Title Case Centrally Aligned)

Name of the Institute

Institute

Logo

C E R T I F I C A T E

This is to certify that *Mr*. ……………….., has successfully completed the seminar-I/II/III entitled "Performance analysis of……." under my supervision, in the partial fulfilment of Master of Engineering (Mechanical) (Design Engineering) of University of Pune.

Date :

Place :

Guide's Name
Guide

Head
Department and
Institute Name

External Examiner

Seal

Principal,
Institute Name

Semester – III
Optimization Techniques [602213]

CODE	TEACHING SCHEME	EXAMINATION SCHEME					CREDITS
	Lect. /Week	Paper		TW	Oral/ Presentation	Total	
		In Semester Assessment	End Semester Assessment				
602213	4	50	50	-	-	100	4

1. **Introduction to Mathematical Modeling**
   Introduction to Mathematical Modeling, Types of Modeling. Objective function; Constraints and Constraint surface; Mathematical modeling characteristics and limitations, Formulation of design problems

2. **Classical Optimization Techniques**
   Engineering applications of optimization, classification of optimization problem, single variable optimization, multi variable optimization with no constraint, equality constraint, in-equality constraint

3. **Linear Programming**
   Simplex algorithm, two phases of the simplex method, Primal-dual simplex method, Sensitivity or post optimality analysis, applications in engineering

4. **Non-Linear Programming**
   One-dimensional minimization - exhaustive search, golden section method, quasi-newton method, random search methods, Powell's method

5. **Modern Methods of Optimization**
   Genetic algorithms, Simulated Annealing, Particle Swarm Optimization, Ant Colony Optimization, Teaching Learning Based Optimization, Introduction to ANN

6. **Topology and Evolutionary Structural Optimization**
   Problem formulation and parameterization of design, solution methods, topology optimization as a design tool, combining topology and shape design, ESO Based on Stress Level, evolutionary methods, two-bar frame, Michell type structure, ESO for stiffness or displacement optimization,

References

1. Structural Optimization, Raphael T. Haftka and Zafer Gurdal, Kluwer Academic Publishers
2. Practical Optimization Methods with Mathematical Applications, M. Asghar Bhatti, Springer
3. Topology Optimization – Theory, Methods and Applications, M. P. Bendse, Q. Sigmund
4. Evolutionary Topology Optimization of Continuum Structures, Methods and Applications, X. Huang, Y.M. Xie, Wiley, 2010

5. Engineering Optimization: Theory and Practice, Singiresu S. Rao, John Wiley & Sons
6. Mathematical Modelling, J N Kapur, New age international publication
7. Optimization for engineering design, K. Deb, PHI
8. Optimization concepts and applications in engineering, Belegundu, Chandrupatla, Pearson Education.

Semester – III
Mechanical Measurements and Controls [602214]

CODE	TEACHING SCHEME	EXAMINATION SCHEME					CREDITS
	Lect. /Week	Paper		TW	Oral/ Presentation	Total	
		In Semester Assessment	End Semester Assessment				
602214	4	50	50	-	-	100	4

1. **Fundamentals of Measurements:**
   Characteristics of Measurement system: Static and Dynamic
   Sensors and Transducers: Force, Speed Measurement, Strain Stress Measurement, FFT (Fast Fourier Transform): Vibration and Noise Measurement, Laser Doppler Vibrometer, Temperature, pressure, flow rate, velocity, humidity.

2. **Fundamentals of interfacing of sensors with Microcontroller/computer**
   Analog and Digital Signals, ADC, DAC, Bitwidth, Sampling theorem,
   Noise Filters: Low Pass, Band Pass and High Pass.

3. **Modeling of Mechatronic Systems:**
   Mathematical Modeling of Mechatronics System. Representation of mechatronics system into transfer function blocks, block reduction fundamentals, State space representation, only second order mechanical, electro-mechanical. System Stability analysis using Poles and Zeros of System.

4. **Control using time domain:**
   Transient response of electromechanical and mechanical system, Routh Hurwitz criterion to determine Poles and Zeros of system, PID control system design and tuning PID parameters based on transient response.

5. **Control using Frequency Domain:**
   Frequency response of electromechanical and mechanical system, Bode plot to determine Phase margin and gain margin, PID control system design and tuning PID parameters based on frequency response.

Reference Books:

1. Measurement Systems-Application and Design, Doebelin E.O, McGraw Hill Publication
2. Measurement and Instrumentation – Theory and Application, Alan Morris, Reza Langari, Elsevier
3. Instrumentation for Engineering Measurements, James Dally, William riley and Kenneth McConnell, Wiley.
4. Mechanical Measurements, S.P. Venkateshan, Ane Books Pvt. Ltd.
5. Control System Engineering, Norman Nise, 6th Edition, John Wiley and Sons
6. Engineering Metrology and Measurement, N V Raghavendra and Krishnamurthy, Oxford University Press,

7. Engineering Metrology and Measurements, Bentley, Pearson Education
8. Theory and Design for Mechanical Measurements, 3rd Edition, Richard S Figliola, Donald E Beasley, Wiley India
9. Doebelin's Measurement Systems Ernest Doebelin, Dhanesh Manik McGraw-Hill
10. Instrumentation, Measurement and Analysis, B.C. Nakra, K.K. Chaudhry McGraw-Hill
11. A Text book of Engineering Metrology, I C Gupta, Dhanpat Rai Publications
12. A course in Mechanical Measurements and Instrumentation, A K Sawhney, Dhanpat Rai Publications
13. Mechanical Measurements and Instrumentations, Er. R K Rajput, Kataria Publication(KATSON)

Semester – III
Elective – III [602215]

CODE	TEACHING SCHEME	EXAMINATION SCHEME					CREDITS
	Lect. /Week	Paper		TW	Oral/ Presentation	Total	
		In Semester Assessment	End Semester Assessment				
602215	5	50	50	-	-	100	5

Modules of 2 Credits (Select any Two)			
Code No.	**Title**	**Code No.**	**Title**
DE2III-M1	Fatigue	**DE2III-M5**	Condition Monitoring – I
DE2III-M2	Fracture Mechanics	**DE2III-M6**	Condition Monitoring – II
DE2III-M3	CAE – I	**DE2III-M7**	Industrial Tribology – I
DE2III-M4	CAE – II	**DE2III-M8**	Industrial Tribology – II
Modules of 1 Credit (Select any One)			
Code No.	**Title**	**Code No.**	**Title**
DE1III-M9	Reliability Engineering	**DE1III-M11**	Fatigue Analysis using FEM
DE1III-M10	Design for X	**DE1III-M12**	Product Life Cycle Management

DE2III-M1 Fatigue

Fatigue Mechanics

Time varying uniaxial, biaxial and multiaxial loading of components, load spectra, cycle counting, fatigue damage theories of crack initiation, stress based and strain based approach

Fatigue Testing

Data acquisition and instrumentation, classical methods of fatigue testing, ASTM standards - specimen preparation, procedure

Advanced Topics in Fatigue

Fatigue analysis in frequency domain, vibration fatigue, fatigue of welded structure, corrosion fatigue, high temperature and low temperature fatigue

Ref. Books: 1) Metal Fatigue Analysis Handbook, YUNG-LI LEE, Elsevier 2) Design & Analysis of Fatigue Resistant Welded Structure, Dieter Radaj, Woodhead Publishing 3) Fatigue of Structures and Materials, Japp Schijve, Kluwer Academic 4) Fatigue Testing and Analysis – Theory and Practice, YUNG-LI LEE, Elsevier 5) Metal Fatigue in Engineering, Ali Fatemi, Wiley-Interscience

DE2III-M2 Fracture Mechanics

Linear Elastic Fracture Mechanics

Mechanisms of fracture, initiation of fracture and crack propagation, stress and energy criteria and fracture - effects of geometry, Inglis theory of stress, energy concept – Griffith theory of fracture, energy balance during crack growth, modes of loading, calculation of stress intensity – center crack, single edge crack, double edge crack, round hole with crack, superposition of stress intensity factors, leak before break criterion, experimental determination of stress intensity factor – strain gauge method, optical method of photo elasticity

Elastic – Plastic Fracture Mechanics
introduction, crack tip stress state, Irwin's approximation, Dugdale's approximation, crack opening displacement, shape of the plastic zone – von Mises and Tresca yielding criteria, plastic constraint factor
Energy Principle
Energy release rate, criteria for crack growth, linear compliance, path independent integrals, J – integral, application of J-integral to cracks and notches, J – integral fracture criterion, experimental determination of the J – integral - single specimen and multiple specimen method
Ref. Books: 1) Fracture Mechanics Anderson T.L., CRC Press 2) Fracture Mechanics, Nestor Perez, , Kluwer Academic Publishers 3) Fracture Mechanics – An Introduction, Gdoutos E. E., , Springer 4) Nonlinear Fracture Mechanics for Engineers, Ashok Saxena, , CRC Press 5) Elements of Fracture Mechanics, Prashant Kumar, Mc Graw Hill Education 6) Deformation and Fracture Mechanics of Engineering Materials, Hertzberg, R. W., John Wiley & Sons, Inc. 7) Mechanical Metallurgy, George E Dieter and David Bacon, Mc Graw Hill Book Co.

DE2III-M3 CAE - I
CAE Driven Design Process
Analysis types, geometry clean-up, meshing techniques, 1-D, 2-D and 3-D mesh, element selection, special elements, solution convergence, element quality checks, material information, boundary conditions and loads.
Static Analysis
Externally applied forces and pressures, steady-state inertial forces (such as gravity or rotational velocity), imposed (nonzero) displacements, temperatures (for thermal strain), non-linear structural analysis, model verification
Normal Modes and Buckling analysis
Real eigenvalue analysis, governing equations, methods of computations, normal modes analysis, Block Lanczos and QR damped methods of modes extraction, linear buckling analysis
Ref. Books: 1) Strukturdynamik, R. Gasch, K. Knothe, Springer 2) Dynamics of Structures, W. C. Hurty and M. F. Rubinstein, Prentice-Hall 3) Dynamics of Structures, R. W. Clough and J. Penzien, McGraw-Hill 4) S. Timoshenko, D. H. Young, and W. Weaver, Jr., Vibration Problems in Engineering, John Wiley & Sons 5) K. J. Bathe and E. L. Wilson, Numerical Methods in Finite Element Analysis, Prentice-Hall 6) Theory of Matrix Structural Analysis, J. S. Przemieniecki, McGraw-Hill 7) Structural Dynamics: An Introduction to Computer Methods, R. R. Craig, , John Wiley & Sons

DE2III-M4 CAE - II
Harmonic Response Analysis
Definition, applications, methods – full, reduced and mode superposition, pre-stressed harmonic response analysis
Transient dynamic analysis
Dynamic modeling input, normal mode analysis, reduction in dynamic analysis, rigid body modes, damping, transient response analysis, frequency response analysis, direct matrix input, dynamic equations of motion, residual vector methods, enforced motion, shock and response spectrum analysis, random response analysis, complex eigenvalue analysis
Advanced topics in FEA
Complex eigenvalue analysis, normal mode analysis using parts super-element, transfer functions, normal modes of preloaded structures, dynamic design optimization, test-analysis correlation

Ref. Books: 1) Strukturdynamik, R. Gasch, K. Knothe, Springer 2) Dynamics of Structures, W. C. Hurty and M. F. Rubinstein, Prentice-Hall 3) Dynamics of Structures, R. W. Clough and J. Penzien, McGraw-Hill 4) S. Timoshenko, D. H. Young, and W. Weaver, Jr., Vibration Problems in Engineering, John Wiley & Sons 5) K. J. Bathe and E. L. Wilson, Numerical Methods in Finite Element Analysis, Prentice-Hall 6) Theory of Matrix Structural Analysis, J. S. Przemieniecki, McGraw-Hill 7) Structural Dynamics: An Introduction to Computer Methods, R. R. Craig, , John Wiley & Sons

DE2III-M5 Condition Monitoring – I

Vibrations

System response to vibration, nature of vibration, harmonics, limits and standards of vibration

Predictive maintenance techniques

Predictive maintenance basics, maintenance philosophies, evolution of maintenance philosophies, plant machinery classification and recommendations, principles of predictive maintenance, predictive maintenance techniques, and vibration analysis – a key to predictive maintenance

Data acquisition

Introduction, collection of vibration signal – vibration transducers, characteristics and mountings, conversion of vibrations to electrical signal

Ref. Books: 1) Theory of Vibration with Applications, Thomson, W. T., CBS Publishers and Distributors, New Delhi 2) Introductory Course on Theory and Practice of Mechanical Vibrations, Gupta K., New Age International Ltd. 3) Vibratory Condition Monitoring of Machines, J. S. Rao, Narosa Publishing House, New Delhi 3) Shock and Vibration Handbook, Cyril M. Harris, Allan G. Piersol, McGraw-Hill Publishing Co., 4) Practical Machinery Vibration Analysis and Predictive Maintenance, C. Scheffer, Paresh Girdhar, Elsevier

DE2III-M6 Condition Monitoring – II

Signal processing - applications and representation

The Fast Fourier transform (FFT) analysis, time waveform analysis, phase signal analysis, spectral signal processes.

Machinery fault diagnosis using vibration analysis

Commonly witnessed machinery faults diagnosed by vibration analysis, correcting faults that cause vibration, balancing, alignment, resonance vibration control with dynamic absorbers

Oil and particle analysis

Condition-based maintenance and oil analysis, setting up an oil analysis program, oil analysis – sampling methods, oil analysis – lubricant properties, oil analysis – contaminants in lubricants, particle analysis techniques, alarm limits for various machines

Ref. Books: 1) Theory of Vibration with Applications, Thomson, W. T., CBS Publishers and Distributors, New Delhi 2) Introductory Course on Theory and Practice of Mechanical Vibrations, Gupta K., New Age International Ltd. 3) Vibratory Condition Monitoring of Machines, J. S. Rao, Narosa Publishing House, New Delhi 3) Shock and Vibration Handbook, Cyril M. Harris, Allan G. Piersol, McGraw-Hill Publishing Co., 4) Practical Machinery Vibration Analysis and Predictive Maintenance, C. Scheffer, Paresh Girdhar, Elsevier

DE2III-M7 Industrial Tribology – I

Friction and wear

Friction control and wear prevention, boundary lubrication, tribological properties of bearing materials and lubricants, theories of friction and wear, instabilities and stick-slip motion

Lubrication of bearings

Mechanics of fluid flow, Reynold's equation and its limitations, idealized bearings, infinitely long plane pivoted and fixed show sliders, infinitely long and infinitely short (narrow) journal bearings, lightly loaded infinitely long journal bearing (Petroff's solution), finite bearings - hydrostatic, hydrodynamic and thrust oil bearings, heat in bearings

Hydrostatic squeeze film

Circular and rectangular flat plates, variable and alternating loads, piston pin lubrications, application to journal bearings

Ref. Books: 1) Principles of Lubrication, Camaron, Longman's Green Co. Ltd. 2) Fundamental of Friction and Wear of Metals – ASM 3) The Design of Aerostatic Bearings – J. W. Powell 4) Gas Bearings – Grassam and Powell 5) Theory Hydrodynamic Lubrication, Pinkush and Sterrolicht 6) Tribology in Machine Design, T. A. Stolarski

DE2III-M8 Industrial Tribology – II

Elasto-hydrodynamic lubrication

Pressure-viscosity term in Reynold's equation, hertz theory, Ertel-Grubin equation, lubrication of spheres

Air lubricated bearings

Tilting pad bearings, hydrostatic, hydrodynamic and thrust bearings with air lubrication

Tribological aspects of rolling motion

Mechanics of tire-road interaction, road grip and rolling resistance, tribological aspects of wheel on rail contact, tribological aspects of metal rolling, drawing and extrusion

Ref. Books: 1) Principles of Lubrication, Camaron, Longman's Green Co. Ltd. 2) Fundamental of Friction and Wear of Metals – ASM 3) The Design of Aerostatic Bearings – J. W. Powell 4) Gas Bearings – Grassam and Powell 5) Theory Hydrodynamic Lubrication, Pinkush and Sterrolicht 6) Tribology in Machine Design, T. A. Stolarski

DE1III-M9 Reliability Engineering

Analysis of variance (ANOVA), factorial design and regression analysis, reliability theory, design for reliability, hazard analysis, fault tree analysis, gear design - involute gears, helical gears, tooth thickness, interference, undercutting, rack-shift, profile modification, spring design - vibration and surging of helical springs, helical springs for, maximum space efficiency, analysis of Belleville springs, ring spring, volute spring and rubber springs, design for spring suspension

Ref. Books: 1) Concepts of Reliability Engineering, L.S. Srinath, Affiliated East-West Press (P) Ltd. 2) Reliability Engineering, A.K. Govil, Tata McGraw-Hill Publishing Co. Ltd. 3) Reliability Engineering, E. Balagurusmy, Tata McGraw-Hill Publishing Co. Ltd.

DE1III-M10 Design for X

Design for assembly, disassembly, ease of use, maintenance, manufacture, quality, reliability, reuse, cost, environment, quality function deployment

Ref. Books: 1) Design for X: Concurrent engineering imperatives, Charles M. Eastman, Springer

DE1III-M11 Fatigue Analysis using FEM

Different approaches for fatigue analysis, stress life approach – S-N curve, mean stress correction, Haigh diagram, factors affecting fatigue, multi-axial fatigue, spot weld fatigue, arc weld fatigue analysis, vibration fatigue, fatigue life estimation based on measured strain data, fatigue testing techniques, result interpretation and correlation of results

Ref. Books: 1) Biaxial/Multiaxial Fatigue and Fracture, Andrea Carpinteri, Elsevier 2) Design & Analysis of Fatigue Resistant Welded Structure, Dieter Radaj, Woodhead Publishing 3) ***Finite Element Learning Modules for Fatigue Analysis, Joshua A. Coffman, Proquest, Umi Dissertation Publishing***

DE1III-M12 Product Life Cycle Management

background, overview, need, benefits, and concept of product life cycle, components/elements of PLM, emergence of PLM, significance of PLM, customer involvement, product data and product workflow, the link between product data and product workflow, different phases of product life cycle and corresponding technologies

Ref. Books: 1) Product Lifecycle Management, Antti Saaksvuori and Anselmi Immonen, Springer 2) ***Product Lifecycle Management: 21st Century Paradigm for Product Realisation, John Stark, Springer***

Project Stage – I and II [602217, 602219]

CODE	TEACHING SCHEME	EXAMINATION SCHEME					CREDITS
	Lect/Week	Paper		TW	Oral/ Presentation	Total	
		In Semester Assessment	End Semester Assessment				
602217	8	-	-	50	50	100	8
602219	20	-	-	150	50	200	20

Assessment of Project stage-I has to be carried out as per R-1.4 and R-1.5 of PG Rules and Regulations of Credit System.

INSTRUCTIONS FOR DISSERTATION WRITING

It is important that the procedures listed below be carefully followed by all the students of M.E. (Mechanical Engineering).

1. Prepare **Three Hard Bound Copies** of your manuscript.
2. Limit your Dissertation report to 80 – 120 pages (preferably)
3. The footer must include the following:
   Institute Name, M.E. (Mechanical) (Design Engineering) Times New Roman 10 pt. and centrally aligned.

4. Page number as second line of footer, Times New Roman 10 Pt, centrally aligned.
5. Print the manuscript using
   a. Letter quality computer printing.
   b. The main part of manuscript should be Times New Roman 12 pt. with alignment - justified**.**
   c. Use 1.5 line spacing.
   d. Entire report shall be of 5- 7 chapters.
6. Use the paper size **8.5'' × 11''** or **A4 (210 × 197 mm).** Please follow the margins given below.

Margin Location	Paper 8.5'' × 11''	Paper A4 (210 × 197 mm)
Top	1''	25.4 mm
Left	1.5''	37 mm
Bottom	1.25''	32 mm
Right	1''	25.4 mm

7. All paragraphs will be 1.5 line spaced with a one blank line between each paragraph. Each paragraph will begin with without any indentation.
8. Section titles should be bold with 14 pt typed in all capital letters and should be left aligned.
9. Sub-Section headings should be aligning at the left with 12 pt, bold and Title Case (the first letter of each word is to be capitalized).
10. Illustrations (charts, drawings, photographs, figures) are to be in the text. Use only illustrations really pertinent to the text. Illustrations must be sharp, clear, **black and white. Illustrations downloaded from internet are not acceptable.**
    a. Illustrations should not be more than **two** per page. One could be ideal
    b. Figure No. and Title at bottom with **12 pt**

c. Legends below the title in **10 pt**
d. Leave proper margin in all sides
e. Illustrations as far as possible should not be photo copied.

11. **Photographs** if any should of glossy prints
12. Please use **SI** system of units only.
13. Please **number the pages** on the front side, centrally below the footer
14. **References** should be either in order as they appear in the thesis or in alphabetical order by last name of first author
15. **Symbols** and **notations** if any should be included in nomenclature section only
16. Following will be the order of report
    i. **Cover page** and **Front page** as per the specimen on separate sheet
    ii. **Certificate** from the Institute as per the specimen on separate sheet
    iii. **Acknowledgements**
    iv. **List of Figures**
    v. **List of Tables**
    vi. **Nomenclature**
    vii. **Contents**
    viii. **Abstract** (A brief abstract of the report not more than **150 words**. The heading of abstract i.e. word "Abstract" should be **bold, Times New Roman, 12 pt** and should be typed at the **centre.** The contents of abstract should be typed on new line without space between heading and contents. Try to include one or two sentences each on **motive, method, key-results** and **conclusions** in Abstract

    1 **Introduction** (2-3 pages) (TNR – 14 Bold)
    1.1 Problem statement (TNR – 12)
    1.2 Objectives
    1.3 Scope
    1.4 Methodology
    1.5 Organization of Dissertation

    2 **Literature Review** (20-30 pages)
    Discuss the work done so far by researchers in the domain area and their significant conclusions. No derivations, figures, tables, graphs are expected.

    3 This chapter shall be based on your own simulation work (Analytical/ Numerical/FEM/CFD) (15- 20 pages)

    4 Experimental Validation - This chapter shall be based on your own experimental work (15-20 pages)

    5 **Concluding Remarks and Scope for the Future Work** (2-3 pages)

    References

    ANNEXURE (if any)

    (Put all mathematical derivations, Simulation program as Annexure)

17. All section headings and subheadings should be numbered. For sections use numbers **1, 2, 3, ….** and for subheadings **1.1**, **1.2**, **….** etc and section subheadings **2.1.1**, **2.1.2, ….** etc.
18. **References** should be given in the body of the text and well spread. No verbatim copy or excessive text from only one or two references. If **figures** and **tables** are taken from any reference then indicate source of it. Please follow the following procedure for references

    Reference Books

    Collier, G. J. and Thome, J. R., Convective boiling and condensation, 3rd ed., Oxford University Press, UK, 1996, pp. 110 – 112.

Papers from Journal or Transactions

Jung, D. S. and Radermacher, R., Transport properties and surface tension of pure and mixed refrigerants, *ASHRAE Trans*, 1991, 97 (1), pp. 90 – 98.

Bansal, P. K., Rupasinghe, A. S. and Jain, A. S., An empirical correction for sizing capillary tubes, *Int. Journal of Refrigeration*, 1996, 19 (8), pp.497 – 505.

Papers from Conference Proceedings

Colbourne, D. and Ritter, T. J., *Quantitative assessment of flammable refrigerants in room air conditioners*, Proc. of the Sixteenth International Compressor Engineering Conference and Ninth International Refrigeration and Air Conditioning Conference, Purdue University, West Lafayette, Indiana, USA, 2002, pp. 34 – 40.

Reports, Handbooks etc.

United Nations Environmental Programme, Report of the Refrigeration, Air Conditioning and Heat Pumps, Technical Option Committee, 2002, Assessment - 2002.

ASHRAE Handbook: Refrigeration, 1994 (Chapter 44)

Patent

Patent no, Country (in parenthesis), date of application, title, year.

Internet

www.(Site) [Give full length URL]

A Project Stage-I Report on (TNR, 16pt, centrally aligned)

Title (TNR, 27pt, Bold, Centrally Aligned, Title Case)

By (TNR, 16pt, Centrally Aligned)

Mr. Student's Name(TNR, 16pt, Centrally Aligned)

Guide

Guide's Name (TNR, 16pt, Centrally Aligned)

Institute

Logo

Department of Mechanical Engineering

Name of the Institute

[2011-12](TNR, 22pt, Title Case Centrally Aligned)

Name of the Institute

Institute

Logo

C E R T I F I C A T E

This is to certify that *Mr.* ………………………….., has successfully completed the Project Stage-I entitled "Performance analysis of……." under my supervision, in the partial fulfilment of Master of Engineering (Mechanical) (Design Engineering) of University of Pune.

Date :

Place :

Guide's Name
Guide

Head
Department and
Institute Name

External Examiner

Seal

Principal,
Institute Name

A Dissertation on (TNR, 16pt, centrally aligned)

Title (TNR, 27pt, Bold, Centrally Aligned, Title Case)

By (TNR, 16pt, Centrally Aligned)

Mr. Student's Name (TNR, 16pt, Centrally Aligned)

Guide

Guide's Name (TNR, 16pt, Centrally Aligned)

Institute

Logo

Department of Mechanical Engineering

Name of the Institute

[2011-12](TNR, 22pt, Title Case Centrally Aligned)

Name of the Institute

Institute

Logo

C E R T I F I C A T E

This is to certify that ………………………………., has successfully completed the Dissertation entitled “Performance analysis of…” under my supervision, in the partial fulfilment of Master of Engineering (Mechanical) (Design Engineering) of University of Pune.

Date :

Place :

Guide’s Name
Guide

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Head
Department and
Institute Name

External Examiner

Seal

____
Principal,
Institute Name

Savitribai Phule University of Pune

M. E. Civil (Structures)

COURSE STRUCTURE (2017Course)

(w.e.f. June 2017)

University of Pune, Document on Rules and Regulation for P.G. Courses be referred for the detailed information

SEMESTER I

Code	Subject	Teaching scheme	Examination scheme					Credit
		Lect / practical	Paper		TW	Oral / presentation	Total	
			In Sem	End Sem				
501001	Theory of Elasticity & Plasticity	04	50	50	--	--	100	04
501002	Structural Dynamics	04	50	50	--	--	100	04
501003	Advanced Design of Steel Structures	04	50	50	--	--	100	04
501004	Numerical Methods in Structural Engineering	04	50	50	--	--	100	04
501005	Elective I	05	50	50	--	--	100	05
501006	Lab Practice I	04	--	--	50	50	100	04
Total		**25**	**250**	**250**	**50**	**50**	**600**	**25**

SEMESTER II

Code	Subject	Teaching scheme	Examination scheme						Credit
		Lect / practical	Paper		TW	Oral / presentation	Total		
			In Sem	End Sem					
501007	Finite Element Method	04	50	50	--	--	100		04
501008	Theory of Plates & Shells	04	50	50	--	--	100		04
501009	Advanced Design of Concrete Structures	04	50	50	--	--	100		04
501010	Elective II	05	50	50	--	--	100		05
501011	Lab Practice II	04	--	--	50	50	100		04
501012	Seminar I	04	--	--	50	50	100		04
Total		**25**	**200**	**200**	**100**	**100**	**600**		**25**

SEMESTER III

Code	Subject	Teaching scheme	Examination scheme					Credit
		Lect/practical	Paper		TW	Oral/presentation	Total	
			In Sem	End Sem				
601013	Research Methodology	04	50	50	--	--	100	04
601014	Analysis and Design of Earthquake Resistant Structures	04	50	50	--	--	100	04
601015	Elective III	05	50	50	--	--	100	05
601016	Seminar II	04	--	--	50	50	100	04
601017	Project Stage I	08	--	--	50	50	100	08
Total		**25**	**150**	**150**	**100**	**100**	**500**	**25**

SEMESTER IV

Code	Subject	Teaching scheme	Examination scheme					Credit
		Lect/practical	Paper		TW	Oral/presentation	Total	
			In Sem	End Sem				
601018	Seminar III	05	--	--	50	50	100	05
601019	Project Stage II	20	--	--	150	50	200	20
Total		**25**	**--**	**--**	**200**	**100**	**300**	**25**

Note: The Contact Hours for the calculation of load of teacher: Seminar - 1 hr /week/student &

Project - 2 hr/week/ student

501 001: Theory of Elasticity and Plasticity

Teaching Scheme
Lectures: 4 hours/week
Credits: 4

Examination Scheme
In semester Exam. : 50 marks
End Semester Exam. : 50 marks
Duration of End term. Exam: 3 hrs

Unit 1: Analysis of Stress and Strain

Concept of stress at a point, stress tensor, stress on inclined plane, stress components on a rectangular parallelepiped in Cartesian coordinate system, derivation of stress equilibrium equations, transformation of stresses, stress invariants. The state of strain at a point, strain displacement relations, strain compatibility condition.

Unit 2: Stress-Strain Relations

Generalized Hook's law, plane stress, plane strain Problems in 2D Cartesian coordinate system, Airy's stress function, relationship between Cartesian and Polar coordinate system, Equilibrium equations, Strain displacement relations, Stress-strain relationship, Strain-displacement relationship for plane stress and plane strain conditions.

Unit 3: Axisymmetric Problems

Equilibrium equations, Strain displacement relations, Stress-strain relationship, Stress compatibility equations, Plane stress and Plane strain conditions. Cylinders subjected to internal and external pressure.

Unit 4: Torsionof Non-Circular Section

Assumptions and Torsion equation for general prismatic solid bars, warping of Non-circular sections and St. Venant's theory, Prandtle's stress function approach. Torsion of Circular, Elliptical and Triangular cross-section bar, torsion of thin-walled structures by membrane analogy, torsion of rolled sections and shear flow.

Unit 5: Introduction to Plasticity

Stress - strain diagram - Ideal plastic body - Illustration of plastic Analysis - Yield criteria - Rankine's theory - St.Venant's theory - Tresca Criterion - Beltramis theory - Von Mises criterion - Mohr's theory of yielding - Yield surface - Flow rule (stress - strain relation for perfectly plastic flow)- Prandtl Reuss equality - plastic work - stress - strain relation based on Tresca - plastic potential - uniqueness of a stress distribution - strain hardening.

Unit 6: Plastic analysis of Thick Cylinder

Elasto-plastic problems of beams in bending – thick hollow spheres and cylinders subjected to internal pressure - General relations - plastic torsion –Nadai's sand heap analogy.

References

1. Timoshenko and Goodier, Theory of Elasticity, McGraw-Hill Publications.
2. Irving H. Shames and James M.Pitarresi, Introduction to Solid Mechanics, Prentice Hall of India Pvt. Ltd.
3. Sadhu Singh, Theory of Elasticity, Khanna Publishers.
4. L. S. Srinath, Advanced Mechanics of Solids, Tata McGraw-Hill Publications.
5. S M A Kazimi, Solid Mechanics, Tata McGraw-Hill Publications.
6. Chakrabarty J, Theory of Plasticity, McGraw-Hill Publications.
7. Slater R. A. C, Engineering Plasticity, John Wiley and Son, New York.

501 002: Structural Dynamics

Teaching Scheme	**Examination Scheme**
Lectures: 4 hours/week	**In semester Exam. : 50 marks**
Credits: 4	**End Semester Exam. : 50 marks**
	Duration of End term. Exam: 3 hrs

Unit I: Fundamental concepts of vibrations, dynamic equilibrium of motion, stiffness and damping, degrees of freedom, mathematical modelling, solution to single degree of freedom systems subjected to free vibrations – undamped and damped.

Unit II: Solution to single degree of freedom systems subjected to forced vibrations- undamped and damped, resonance, transmissibility.

Unit III: Response to general forcing conditions, convolution integral, pulse loadings, step and ramp functions, response to ground motion, response spectrum.

Unit IV: Numerical evaluation of Duhamel's Integral, direct integration of the equations of motion, piece-wise linear acceleration method, constant acceleration method, average acceleration method, Newmark's β method, Wilson – θ method.

Unit V: Solution to multi degrees of freedom systems, fundamental frequency, Eigen values and Eigen vectors, orthogonality of modes.

Unit VI: Continuous system: Free transverse vibrations of beams for various boundary conditions. Free vibration analysis of a cantilever beam by Rayleigh Ritz and Finite Element Method.

References

1. Humar J. L., Dynamics of Structures, CRC Press

2. Chopra A. K., Dynamics of Structures Theory and Applications to Earthquake Engineering, Prentice-Hall Publications

3. Clough R.W. and Penzin J., Dynamics of Structures, McGraw Hill Publications

4. Mario Paz, Structural Dynamics Theory and Computation, CBS Publications

501 003: Advanced Design of Steel Structures

Teaching Scheme	**Examination Scheme**
Lectures: 4 hours/week	**In semester Exam. : 50 marks**
Credits: 4	**End Semester Exam. : 50 marks**
	Duration of End term. Exam: 3 hrs

Unit I

a) Hoarding Structures: Analysis and design of hoarding structures under dead, live and wind load as per the latest IS:875 by limit state method.

b) Castellated beams: Concept, fabrication of the castellated beam from rolled steel section, design of castellated beam for bending and shear as per latest code by limit state method.

Unit II

a) Microwave Towers: Introduction, structural configuration, function, analysis and design.

b) Tubular Structures: Design of tubular Trusses and scaffoldings using circular hollow, rectangular hollow sections as per code, detailing of joints.

Unit III

Transmission Towers: Introduction, structural configuration, bracing systems, analysis and design as per code. Use working stress method.

Unit IV

Cold form light gauge section: Advantage, type of cross section, stiffened, multiple stiffened and un-stiffened element, flat-width ratio, effective design width, design of light gauge compression, tension and flexural members as per code.

Unit V

Design of chimneys: Introduction, type, joints, lining, ladder, forces acting on chimney, design of thickness of steel plates for self supporting chimney.

Unit VI

Design of base plate of chimney, design of anchor bolt, design of foundation and stability of steel chimneys.

References

1. Ram Chandra, Design of steel Structures, Volume II, Standard Book House, New Delhi.
2. Punmia and Jain, Comprehensive Design of steel structure, Laxmi Publication, New Delhi.
3. M Raghupathi, Design of steel structures, Tata McGraw Hill, New Delhi.
4. S K Duggal, Limit state design of steel structures, Tata McGraw Hill Education.
5. N Subramanian, Design of steel structures, Oxford University Press.
6. IS: 800 - 2007, Code of Practice for General Construction in Steel, BIS, New Delhi.

7. IS: 800 - 1984, Code of Practice for General Construction in Steel, BIS, New Delhi.

8. IS: 801 - 1975, Code of Practice for use of cold formed light gauge steel structural members in general building construction, BIS, New Delhi.

9. IS: 802 (Part I and II)-1978, Code of practice for use of structural steel in overhead transmission line towers, BIS, New Delhi.

10. IS:806-1988, Code of practice for use of steel tubes in general building construction, BIS, New Delhi.

11. IS: 811-1987, Specification for cold formed light gauge structural steel sections, BIS, New Delhi.

12. IS: 875 (Part 1, 2 and 3) – 1987, Code of practice for design loads for buildings and structures, BIS, New Delhi.

501 004: Numerical Methods in Structural Engineering

Teaching Scheme
Lectures: 4 hours/week
Credits: 4

Examination Scheme
In semester Exam. : 50 marks
End Semester Exam. : 50 marks
Duration of End term. Exam: 3 hrs

Unit 1: Matrix operations

Flexibility and stiffness matrices, numerical examples of application of stiffness method to beams and plane trusses, concept of transformation matrix, stiffness matrix for plane frame and space frame.

Unit 2: Solution of linear equations

Gauss elimination method, Gauss – Jordan method, Choleski's factorization method, Jacobi's method and Gauss – Seidel method.

Unit 3: Solution of differential equations

Review of Taylor's series and Euler's method. Runge – Kutta fourth order method, predictor – corrector method. Solution of Eigen value problems by Power method.

Unit 4: Numerical integration

Trapezoidal and Simpson's methods, Gauss quadrature method, Newton's – Cotes method.

Unit 5: Finite difference method

Forward, backward and centered finite difference approximations to the derivatives. Applications to indeterminate beams, columns and plates.

Unit 6: Regression analysis

Least square method, polynomial functions, curve fitting. Interpolation – Polynomial approximation, Lagrange's method, spline interpolation.

References

1. E. Ward Cheney, David R. Kincaid, Numerical Methods and Applications, Brooks Cole / Cengage Learning India
2. S. C. Chapra & R. P. Canale, Numerical Methods for Engineering, TMH Publications
3. E. Balgurusamy, Numerical Methods, TMH Publications
4. Krishna Raju, Numerical Methods in Civil Engineering, CBS

501 005 a: Optimization Technique: Elective I (Module I)

Teaching Scheme
Lectures: 4 hours/week
Credits: 4

Examination Scheme
In semester Exam. : 25 marks
End Semester Exam. : 50 marks
Duration of End term. Exam: 3 hrs

Unit I: Introduction to optimization techniques, Applications to various civil engineering problems, Statement of optimization problem, Constraints of, LP, NLP problems.

Unit II: Classical optimization methods: Single and multiple problems with equality and inequality constraints, Hessian matrix and its use, Lagrangian method, Convex and concave functions.

Unit III: Linear programming: Standard LP problem, Assumptions in LP, Geometry and graphical solutions of LP problem, Canonical form of linear simultaneous equations, Simplex method to solve LP problems, Use of big M and two phase methods.

Unit IV: Additional topics in LP: Duality in LP, Transportation problem, Assignment problem, Mathematical methods of transportation and assignment problem, Methods of solution, Variation in transportation and assignment problems such as unbalanced problem, degeneracy.

Unit V: Numerical iterative methods: One dimensional non linear functions without constraints, Dichotomous, Fibnocci and golden section search methods.

Unit VI: Dynamic programming: Introduction and its applications to various civil engineering problems, Terminology, Optimum decision policy, Bellmann's principle, Recursive relations and its use to solve DP problems with certainty, Shortest route problems.

References

1. Engineering Optimization: Theory & Practice, S. S . Rao., Wiely.
2. Engineering Optimization: Methods and Applications, Ravindran, Wiely
3. Operation Research, Taha Hamdey A.
4. Principles of Operation Research, Wagner, Prentice Hall.
5. Operation Research, Hira and Gupta, S.Chand
6. Operation Research—Ravindran-- Wiely.

501 005 b: Structural Design of Concrete Bridges: Elective I (Module I)

Teaching Scheme
Lectures: 4 hours/week
Credits: 4

Examination Scheme
In semester Exam. : 25 marks
End Semester Exam. : 50 marks
Duration of End term. Exam: 3 hrs

Unit I: Classification of concrete bridges, components of bridge and related structures, economic spans. Factors affecting the selection of site, hydrological data, waterway, scour depth. IRC provisions, loading standards.

Unit II: Load distribution on deck slabs, isotropic plate, grillage analysis, distribution of loads to longitudinal girders, Little – Morrice – Rowe method, Courbon's method, Guy on Massonet method and Hendry Jaegar method. Design of slab and box culverts for highway loadings.

Unit III: Design of T-beam deck slab bridge: design of RC deck slab, design of post-tensioned longitudinal girder and cross girders.

Unit IV: Analysis and design of rigid frame bridges.

Unit V: Types of abutments, piers, loads acting on pier and abutments, design of abutments, piers

Unit VI: Functions of bearings, types, design of elastomeric bearings, design of PTFE-pot bearings.

References

1. Krishna Raju, Design of Bridges, Oxford and IBH Publishing
2. Rajagopalan N., Bridge Superstructure, Alpha Science International
3. D. Johnson Victor, Essentials of Bridge Engineering, Oxford and IBH Publishing
4. Relevant IRCs.

501 005 c: Design of Composite Construction: Elective I (Module I)

Teaching Scheme
Lectures: 4 hours/week
Credits: 4

Examination Scheme
In semester Exam. : 25 marks
End Semester Exam. : 50 marks
Duration of End term. Exam: 3 hrs

Unit I: Introduction of composite constructions, benefits of composite construction, Introduction to IS, BS and Euro codal provisions. Composite beams, elastic behavior of composite beams, No and Full Interaction cases, Shear Connectors, Ultimate load behavior, Serviceability limits, Effective breadth of flange, Interaction between shear and moment, Basic design consideration and design of composite beams.

Unit II: Composite floors, Structural elements, Profiled sheet decking, Bending resistance, Serviceability criterion, Analysis for internal forces and moments

Unit III: Composite Columns, Materials, Concrete filled circular tubular sections, Non-dimensional slenderness, local buckling of steel sections, Effective elastic flexible stiffness, resistance of members to axial compressions, Composite Column design, Fire Resistance.

Unit IV: Composite trusses, Design of truss, Configuration, Application range, Analysis and Design aspects and connection details.

Unit V: Design of Multi-storeyed commercial and residential composite building, Design basis, load calculations, Design of composite slabs with profile decks, composite beam design, design for compression members, vertical cross bracings, design of foundation.

Unit VI: Design of Composite Construction in Bridges – IRC specifications and code of practice for loads and composite construction. Composite Deck Slab Design – Design of one way deck slab for Class AA and Class A loading, Design of Cantilever Portion of deck Slab. Design of longitudinal girders.

References

1. Johnson R. P., Composite Structures of Steel and Concrete, Vol I, Beams, Columns and Frames in Buildings, Oxford Blackwell Scientific Publications.
2. INSDAG teaching resources for structural steel design Vol II, Institute for Steel Development and Growth Publishers, Calcutta
3. INSDAG Handbook on Composite Construction: Multi-Storey Buildings, Institute for Steel Development and Growth Publishers, Calcutta
4. INSDAG Design of Composite Truss for Building, Institute for Steel Development and Growth Publishers, Calcutta
5. INSDAG Handbook on Composite Construction: Bridges and Flyovers, Institute for Steel Development and Growth Publishers, Calcutta
6. INSDAG Design Guide for Composite Highway Bridges (Steel Bridges), Institute for Steel Development and Growth Publishers, Calcutta
7. D. Johnson Victor - Essentials of Bridge Engineering Fifth Edition, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
8. N. Krishna Raju, Design of Bridges, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
9. IS:11384, 1985 Code of Practice for Composite Construction in Structural Steel and Concrete, Bureau of Indian Standards, New Delhi.
10. IRC Codes – IRC: 5, IRC: 6, IRC: 18, IRC: 27, IRC: 45, IRC: 78, IRC: 83

501 005 d: Design of Foundations: Elective I (Module I)

Teaching Scheme	**Examination Scheme**
Lectures: 4 hours/week	**In semester Exam. : 25 marks**
Credits: 4	**End Semester Exam. : 50 marks**
	Duration of End term. Exam: 3 hrs

Unit I: Introduction and Soil Structure Interaction

a. Foundation objectives and their importance, Classification of foundations, Soil classification, Geotechnical design parameters, bearing capacity, Foundation settlements.

b. Loads for design, Depth of foundation, and depth of soil exploration, parameters for design of foundation on various types of soil, Introduction to Soil Structure Interaction.

c. Review of IS Code Provisions: IS 1892, IS 1904, IS 6403, IS 8009 (Part-I & II)

Unit II: Design of Raft Foundations

a. Types of rafts, Relative Stiffness considering: Superstructure-Foundation-Soil system, Soil-Structure Interaction approach, raft on Clayey and Sandy soils

b. Review of IS Code Provisions: IS 2950 (Part-I)

c. Design of Flat slab raft foundation (Rigid Method/Elastic Line Method)

Unit III: Machine Foundation

a. Introduction, machine vibrations, vibration characteristics, design consideration for machine foundations.

b. Review of IS Code Provisions: IS 2974 (Part-II, III & IV)

c. Design of foundations for rotary machines / impact machine

Unit IV: Pile Foundation

a. Function and Classification of piles, Static point and skin resistance capacity of a Pile,Negative skin friction, Vertically and Laterally loaded piles, Pile settlements

b. Pile Cap, Pile group, Efficiency of piles in a group

c. Review of IS Code Provisions: IS 2911 (all related parts)

Unit V: Design of Drilled Shaft (Caissons/Well) Foundations -

a. Drilled Shafts (Caissons/Well) Foundations: Introduction, types and applications of drilled shafts, construction procedures – dry, wet and casing methods of construction

b. Soil-Structure interaction considerations, Design considerations under Axial and Lateral forces, ASD/LRFD method of design-General principles and steps.

Unit VI: Case Studies and Failures of Foundations -

a. Review of Case Studies of – Shallow and Deep Foundations

b. Review of Failures of - Shallow and Deep Foundations

References

1. Kurain N.P, Modern Foundations: Introduction to Advance Techniques: Tat aMcGraw Hill,1982

2. Kurain N. P, Design of foundation systems Principles and Practice, Narosa Publishing house, New Delhi, 2005.

3. Nayak N. V., Foundation Design Manual, Dhanpat Rai and Sons, Delhi.

4. Shah H. J., Reinforced Concrete, Vol II, Charotar Publishing House.

5. Winterkorn H.F. and Fang H.Y. Ed., Foundation Engineering Hand Book, Van-Nostrand Reynold, 1975

6. Bowles J. E., Foundation Analysis and Design (4th Ed.), Mc. Graw –Hill, NY, 1996

7. Poulose H. G. and Davis E. H., Pile foundation Analysis and Design, John-Wiley Sons, Neyork, 1980.

8. Leonards G. Ed., Foundation Engineering, Mc. Graw-Hill, NY, 1962

9. Shamsher Prakash, Soil Dynamics, McGraw Hill

10. Sreenivasalu & Varadarajan, Handbook of Machine Foundations, Tata McGraw Hill

11. O'Neil, M.W. and Reese, L.C. "Drilled Shafts: Construction Procedures and Design Methods", FHWA Publication No. FHWA-IF-99-025, Federal Highway Administration, Washington, D.C., USA, 1999.

12. P. C. Varghese, "Design of Reinforced Concrete Foundations", PHI Learning Pvt. Ltd., New Delhi, 2009.

13. IS 1892, IS 1904, IS 6403, IS 8009 (Part-I & II); IS 2950 (Part-I); IS 2974 (Part-II, III & IV); IS 2911 (all related parts)

501 005 e: Structural Stability: Elective I (Module I)

Teaching Scheme	**Examination Scheme**
Lectures: 4 hours/week	**In semester Exam. : 25 marks**
Credits: 4	**End Semester Exam. : 50 marks**
	Duration of End term. Exam: 3 hrs

Unit 1: Fundamental concepts, elastic structural stability, structural instability, analytical methods for the stability analysis, equilibrium, imperfections and energy methods.

Unit II: Elastic buckling of columns, assumptions, critical load for various boundary conditions, columns with geometric imperfection, large deflection theory of columns, Southwell plot, Orthogonality of buckling modes, eccentrically loaded columns, numerical techniques – Finite difference and Finite element approach.

Unit III: Elastic buckling of beam-column, differential equations of beam-column, beam-column with concentrated point load, several point loads, continuous lateral load, single couple, uniformly distributed load, end couples.

Unit IV: Elastic buckling of frames, triangular, partial, multistory portal and box frames with symmetric & anti symmetric buckling, stiffness method approaches, approximate method, buckling of open sections, torsional buckling.

Unit V: Elastic buckling of thin plates, equilibrium approach, rectangular plate with axial load in one and two directions, various boundary conditions, Energy methods – Rayleigh Ritz and Gelerkin, large deformation theory of plates and effective width concept, post buckling behavior of plates.

Unit VI: Structural Design for stability of Members, Lateral torsional buckling of beams, lateral torsional buckling of cantilever and S.S. beams, stability design of beam-column member.

References

1. Timoshenko S. P. and Gere J. M., Theory of Elastic Stability, Mc Graw Hill, Singapore
2. George Gerard, Introduction to Structural Stability Theory, Mc Graw Hill, New York
3. Iyenger N. G. R., Elastic Stability of Structural elements, Mc Millan, India
4. Ashwini Kumar, Stability of Structures, Allied Publishers, New Delhi
5. Gambhir, M. L.: Stability Analysis and Design of Structures, Springer-Verlag (2004)

501 005 I: Economics and Finance for Civil Engineering: Elective I (Module II)

Teaching Scheme
Lectures: 1 hours/week
Credits: 1

Examination Scheme
In semester Exam. : 25 marks

Unit I: Introduction & Basics of Economics & Finance
Meaning & necessity of: Economics, costing & finance, history & fundamentals of economics, basics of finance & accounting, rates of interest, basics of financial statement, financial analysis, inflation, etc.

Unit II: Principles of Costing, Estimation & Valuation
Basics of costing, activity based costing & case studies, basics of estimation & valuation, present & future values of properties, profitability & financial decisions, inventory management

Reference

1. As specified by the instructor

501 005 I: Green Buildings: Elective I (Module II)

Teaching Scheme
Lectures: 1 hours/week
Credits: 1

Examination Scheme
In semester Exam. : 25 marks

Unit 1: **Principles of Sustainability, Energy Conservation and Water Conservation**
Introduction to course, sustainability, major environmental challenges, global warming, introduction to green buildings, leed, sustainable urban development. Building energy system strategies, energy conservation in buildings, hvac systems, energy and atmosphere, leed credits, equest energy simulations, conducting an energy audit, fossil fuels vs. renewable energy. Water Conservation in Buildings, Storm Water Harvesting and Management, Water cycle strategies

Unit 2: **Green Materials and Green building codes**
Green construction materials, materials and resources - leed credits, building deconstruction, c & d recycling, indoor environmental quality – basic, ieq - leed credits, building commissioning, materials selection strategies, green building codes and standards, international green construction code, carbon accounting, green building specifications

References

1. C. J. Kibert, Sustainable Construction: Green Building Design and Delivery, 3rd Ed., John Wiley, Hoboken, New Jersey.

2. G. T. Miller, Living in the Environment: Principles, Connections, and Solutions, 14th Ed., Brooks Cole, Pacific Grove, California

3. Energy Conservation Building Code (ECBC)

501 005 III: Human Rights: Elective I (Module II)

Teaching Scheme	**Examination Scheme**
Lectures: 1 hours/week	**In semester Exam. : 25 marks**
Credits: 1	

Unit 1

Human Rights – Concept, Development, Evolution

Philosophical, sociological and political debates, benchmarks of human rights movement.

Human Rights and the Indian Constitution

Constitutional framework, Fundamental Rights & Duties, Directive Principles of State Policy, Welfare State & Welfare Schemes

Human Rights & State Mechanisms

Police & Human Rights, Judiciary & Human Rights, Prisons & Human Rights, National and State Human Rights Commissions

Unit 2:

Human Rights of the Different Sections and contemporary issues

Unorganized Sector, Right to Environment, particularly Industrial sectors of Civil Engineering and Mechanical Engineering, Globalization and Human Rights, Right to Development

Citizens' Role and Civil Society

Social Movements and Non-Governmental Organizations, Public Interest Litigation, Role of Non Government organizations in implementation of Human rights. - Right to Information

Human Rights and the international scene –Primary Information with reference to Engineering Industry, UN Documents, International Mechanisms (UN & Regional), International Criminal Court, Fundamental Rights & Duties, Directive Principles of State Policy, Welfare State & Welfare Schemes

References

1. Introduction to International Humanitarian Law by Curtis F. J. Doebbler **-** CD Publishing

2. Human Rights in India: A Mapping, Usha Ramanathan: free download from http://www.ielrc.org/content/w0103.pdf

3. Study material on UNESCO, UNICEF web site

4.Information, by Toby Mendel **-** UNESCO**,** 2008

501 006: Lab Practice I

Teaching Scheme	**Examination Scheme**
Lectures: 4 hours/week	**Term work: 50 marks**
Credits: 4	**Oral/ Presentation: 50 marks**

Term work consists of the following:

1. Theory of Elasticity & Plasticity: One assignment from each unit.

2. Structural Dynamics

a) One assignment from each unit.

b) Write a program to determine the Eigen values and Eigen vectors for a multi degree of freedom system.

c) Performance of shake table experiments to determine the natural frequencies and the mode shapes for various shear building frames subjected to harmonic base excitations. The results from the experiments should be reported in a standard format.

3. Advanced Design of Steel Structures

A mini-project to be completed individually which shall be based on design of transmission tower and steel chimney.

4. Numerical Methods in Structural Engineering

One assignment from each unit, the assignments should be completed using any computer language / program / spreadsheets.

5. Elective I: One assignment on each unit.

6. Site visits: Report based on three site visits.

501 007: Finite Element Method

Teaching Scheme	**Examination Scheme**
Lectures: 4 hours/week	**In semester Exam. : 50 marks**
Credits: 4	**End Semester Exam. : 50 marks**
	Duration of End term. Exam: 3 hrs

Unit I: Background on variational calculus, Galerkin method, collocation method, least squares methods, Variational methods of approximation, Rayleigh-Ritz method, Variational theorem, principle of minimum potential energy, use of polynomial displacement function, variational approach for formulation of element stiffness matrix for truss and beam elements, Strong and Weak formulation.

Unit II: Two dimensional elements in plane stress / plane strain problems. CST, LST and rectangular elements, modelling considerations, aspect ratio, use of polynomial displacement functions, Pascal's triangle. Requirements for convergence, geometric invariance, grid refinement. Standard stiffness and load vector formulation procedures using variational principle. Condensation of internal degrees of freedom-Summary of analysis procedure.

Unit III: Shape functions in Cartesian and natural coordinate systems, shape functions for one, two and three dimensional elements. Higher order elements- Lagrange –Serendipity – Interpolation-formulation of element stiffness.

Unit IV: Concept of isoparametric elements and isoparametric mapping, Jacobian matrix, formulation of two dimensional quadrilateral isoparametric element in plane elasticity problem, 3-D isoparametric elements.

Unit V: Thin Plate bending elements, various triangular and rectangular elements, ACM (Adini, Clough, Melosh) and BFS (Bogner, Fox, Schimdt) elements. Conforming and non-conforming elements, concept of four noded and eight nodded isoparametric elements, Mindlin's hypothesis for plate bending element.

Unit VI: Axisymmetric elements in axisymmetric problems, stress strain relations, triangular and Quadrilateral elements. Flat and curved shell element, elements for cylindered shells, curved solid elements.

References

1. J. N. Reddy, An Introduction to the finite element method, Tata McGraw Hill Publishing Co. Ltd.
2. C. S. Krishnamoorthy, Finite Element Analysis: Theory & Programming, Tata McGraw Hill Publishing Co. Ltd.
3. Zienkiewicz & Taylor, The Finite Element Method 4th Edition: Vol. I & II – McGraw Hill International Edition
4. G. R. Buchanan, Finite Element Analysis Schaum's outlines, Tata McGraw Hill Publishing Co. Ltd.
5. Daryl L. Logan, A First Course in Finite Element Method, Cengage Learning
6. S. S. Bhavikatti, Finite Element Analysis – New Age International Publishers, Delhi
7. S. S. Rao, The Finite Element Method in Engineering 4th Edition – Elsevier Publication.

501 008: Theory of Plates and Shells

Teaching Scheme	**Examination Scheme**
Lectures: 4 hours/week	**In semester Exam. : 50 marks**
Credits: 4	**End Semester Exam. : 50 marks**
	Duration of End term. Exam: 3 hrs

Unit 1

Introduction: Thin and thick plates, small and large deflections, small deflection theory of thin plates: assumptions, moment curvature relations, stress resultants, governing differential equation in Cartesian co-ordinates, various boundary conditions, pure bending of plates. Analysis of rectangular plates: Navier solution for plates with all edges simply supported, distributed loads, point loads and rectangular patch load.

Unit 2

Levy's Method: Distributed load and line load, plates under distributed edge moments. Raleigh- Ritz approach for simple cases in rectangular plates. Introduction to shear deformation theories, Reissener - Mindlin theory, moment curvature relationship for First order shear deformation theory.

Unit 3

Circular Plates: Analysis of circular plates under axi-symmetric loading, moment curvature relations, governing differential equation in polar co-ordinates. Simply supported and fixed edges, distributed load, ring load, a plate with a central hole.

Unit 4

Introduction: Classification of shells on geometry, thin shell theory, equations to shell surfaces, stress resultants, stress- displacement relations, compatibility and equilibrium equations. Shells of revolution: Membrane theory, equilibrium equations, strain displacement relations, boundary conditions, cylindrical, conical and spherical shells.

Unit 5

Circular cylindrical shells: Membrane theory: Equilibrium equations, strain displacement relations, boundary conditions. Bending Theory: Equilibrium equation, strain displacement relations, governing differential equation, solution for a simply supported cylindrical shell, various boundary conditions and application to pipes and pressure vessels.

Unit 6

Beam theory of cylindrical shells: Principles of Lundgren's beam theory, beam analysis, arch analysis, and application to cylindrical roof shells.

References

1. S. Timoshenko and W. Krieger, Theory of Plates and Shells, Mc Graw Hill.
2. Ansel C. Ugural, Stresses in Plates and Shells, Mc Graw Hill
3. G. S Ramaswamy, Design and Construction of Concrete Shell Roofs, CBS Publications
4. Chandrashekhara K., Analysis of Concrete Shells, New Age International Edition
5. Chandrashekhara K., Analysis of Plates, New Age International Edition

501 009: Advanced Design of Concrete Structures

Teaching Scheme
Lectures: 4 hours/week
Credits: 4

Examination Scheme
In semester Exam. : 50 marks
End Semester Exam. : 50 marks
Duration of End term. Exam: 3 hrs

Unit 1

Yield line theory for analysis of slabs, various patterns of yield lines, assumptions in yield line theory, characteristics of yield lines, equilibrium and virtual work method of analysis.
Design of various slabs such as rectangular, triangular, circular with various edge conditions using yield line theory, Design for limit state of strength and serviceability of orthotropically reinforced slabs

Unit 2

Grid and coffered slabs, general features, rigorous and approximate method of analysis, design of grid floor by approximate method.

Unit 3

Flat slabs, types, design methods, column and middle strip, proportioning of flat slab element, total design moment, distribution of moments, effect of pattern loading, design for shear, design of intermediate and end panel by direct method only

Unit 4

Elevated service reservoir: Rectangular and circular type only flat bottom, Design of staging for wind and earthquake forces.

Unit 5:

Design of bunkers, and Silos, square and circular bunkers, silos shallow and deep beams.

Unit 6

Design of raft foundations, pile foundations, single pile, group of piles, Pile cap, design of form work for slabs, girders and, columns.

References

1. Advance R. C. C. Design, S. S. Bhavikatti, New Age International Publishers
2. B.C. Punmia, Ashok K. Jain, Arun K. Jain, Reinforced Concrete Structures Vol. II, Laxmi Publications, New Delhi
3. N. C. Sinha, S.K. Roy, Fundamentals of Reinforced Concrete, S. Chand & Co. Ltd, NewDelhi
4. P. C. Varghese, Advanced Reinforced Concrete Design, Prentice Hall of India Pvt. Ltd., New Delhi
5. Dr .H.J.Shah, Reinforced Concrete design, Charotar publishing house
6. Design of R. C. C, S. Ramaamruthum, Dhanpat Rai publications
7. IS: 456-2000, Indian Standard code of practice for plain and reinforced concrete, Bureau of Indian Standards, New Delhi.
8. IS: 1893:-2017, Indian Standard Code of practice for criteria for Earthquake resistant design of Structures, Bureau of Indian Standards, New Delhi.
9. IS: 3370, Indian Standard code of practice for concrete structures for storage of liquids, Bureau of Indian Standards, New Delhi

501 010 a: Structural Design of Steel Bridges: Elective II (Module I)

Teaching Scheme	**Examination Scheme**
Lectures: 4 hours/week	**In semester Exam. : 25 marks**
Credits: 4	**End Semester Exam. : 50 marks**
	Duration of End term. Exam: 3 hrs

Unit 1

Introduction to bridge engineering, classification and components of bridges, layout, planning, structural forms of bridge decks, beam and slab decks, cellular decks, standard specification for bridges, IRC loadings for road bridges, loading standards for railway bridges.

Unit 2

Analysis and design of beam and plate girder bridges, analysis of through type and deck type bridges

Unit 3

Design of plate girder bridges, main plate girder, shape limitation based on local buckling, lateral torsional buckling, web buckling, shear moment interaction, fatigue effect, Lateral bracing

Unit 4

Design of truss bridges, optimum depth of truss girder, design of compression chord member, design of tension chord member, design of vertical and diagonal member, Lateral bracing

Unit 5

Design of cable supported steel bridges, design of steel box girder, design of suspension cables, Suspension bridges.

Unit 6

Box section flexural members, diaphragm requirements at support, bearing, top lateral bracing in tube girder, horizontally curved boxes, single boxes, closed boxes, proportioning limits

References

1. Owens. G. W., Knowles. P. R., Dowling. P. J., Steel Designers Manual, Fifth edition, Blackwell Scientific Publications.
2. Chatterjee S.,, The Design of Modern Steel Bridges, First edition, BSP Professional books.
3. Demetrios E. T., Design, Rehabilitation and Maintenance of Modern Highway Bridges, McGraw-Hill Publishers.
4. Victor. D. J. Essentials of Bridge Engineering, Oxford and IBH Publishers.
5. IRC: 6 - 1966 – Section II, Indian Standard for loads and stresses on Highway Bridges.
6. Bridge rules - 1982, Specifications for Indian Railway loading.
7. T. R. Jagadeesh and M. A. Jayaram, Design of Bridge Structures, Prentice-Hall of India
8. N. Krishna Raju, Design of Bridges, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
9. David Lee, Bridge Bearings and Expansion Joints, E & FN Spon
10. V. K. Raina, Concrete Bridge Practice Analysis, design and Economics, Tata McGraw Hill
11. IRC Codes – IRC: 5, IRC: 6, IRC: 18, IRC: 27, IRC: 45, IRC: 78, IRC: 83

501 010 b: Plastic Analysis of Steel Structures: Elective II (Module I)

Teaching Scheme
Lectures: 4 hours/week
Credits: 4

Examination Scheme
In semester Exam. : 25 marks
End Semester Exam. : 50 marks
Duration of End term. Exam: 3 hrs

Unit 1

Plasticity in ductile materials, actual and idealized stress-strain graph for mild steel, elasto-plastic behavior of beam in flexure, shape factor for different cross sections, yield zones, concept of plastic hinge.

Unit 2:

Plastic collapse loads of determinate and indeterminate structures such as beams and rectangular portal frames, statical and kinematical methods, basic and combined mechanisms. Determination of plastic collapse loads, bending moment diagram at collapse.

Unit 3:

Plastic collapse loads of frames with inclined members such as gable portal frames, various mechanisms.

Unit 4:

Philosophy of Limit State deign, requirement of steel for design, Limit State of Strength and Serviceability, partial safety factors, design of laterally supported beams, shear resistance

Unit 5:

Secondary design considerations, design of beams with high shear, interaction of bending and shear, interaction of bending and axial force.

Unit 6:

Design of rectangular and gable portal frames, design of corner connection with and without haunches.

References

1. Handbook for Structural Engineers SP 6 (8) 1972 (Reaffirmed 1995), Bureau of Indian Standards.

2. SP: 6 (6), 1972, Handbook for Structural Engineers: Application of plastic Theory in Design of Steel Structures

3. IS: 800 - 1984, Code of Practice for General Construction in Steel, BIS, New Delhi.

4. A. S. Arya and J. L. Ajmani, Design of Steel Structures, Nemchand & Bros., Roorkee

5. Teaching Resource for Structural Steel Design , INSDAG Kolkata

6. Ramchandra, Design of Steel Structures Vol – II, Standard Book House, Delhi

7. B. G. Neal, Plastic Method of Structural Analysis, Chapman & Hall

8. L. S. Beedle, Plastic Design of Steel Frames, John Willey & Sons

9. Steel Designers Manual, ELBS

10. Mrazik, M. Skaloud, M. Tochacek, Plastic Design of Steel Structures, Ellis Horward Limited, John Willey & Sons

501 010 c: Design of Industrial Steel structures: Elective II (Module I)

Teaching Scheme
Lectures: 4 hours/week
Credits: 4

Examination Scheme
In semester Exam. : 25 marks
End Semester Exam. : 50 marks
Duration of End term. Exam: 3 hrs

Unit 1

Analysis and design of knee braced trussed bent with hinged, fixed and partially fixed bases without gantry, design of knee brace, roof column and its base.

Unit 2

Various types of column configurations in case of knee braced trussed bent with gantry loads, design of stepped columns and bases under various load combinations.

Unit 3

Analysis and design of gable portal frame with and without gantry loads, design of bracket supporting gantry loads.

Unit 4

Open web frames for industrial shed, trussed purlins.

Unit 5

Mobile gantry structure, machine foundations

Unit 6:

Analysis and design of various bracing systems in industrial shed structure and industrial flooring.

References

1. Ramchandra, Design of Steel Structures Vol – II, Standard Book House, Delhi
2. A. S. Arya and J. L. Ajmani, Design of Steel Structures, Nemchand & Bros., Roorkee
3. Teaching Resource for Structural Steel Design, INSDAG Kolkatta
4. IS: 800 – 1984, Code of Practice for General Construction in Steel
5. IS: 875 – 1964, Code of Practice for Structural Safety of Building: Loading Standards (Revised)
6. IS: 4137 – 1967, Code of practice for Heavy Duty electric Overhead Traveling Crane
7. Steel Designers Manual, ELBS
8. John E. Lotheres, Advanced Design in Structural Steel, Prentice Hall

501 010 d: Design of Precast Concrete Structures: Elective II (Module I)

Teaching Scheme	**Examination Scheme**
Lectures: 4 hours/week	**In semester Exam. : 25 marks**
Credits: 4	**End Semester Exam. : 50 marks**
	Duration of End term. Exam: 3 hrs

Unit 1: Introduction

a) History and Development of Precast concrete construction, Advantages and disadvantages of precast concrete construction; different types of units involved in general building construction, including residential, factory and industrial framed structure; their general principles of design; mechanical handling of large projects like stadium, bridges etc.

b) Materials viz. Concrete, Self Compacting Concrete, Grout, Reinforcement and structural welded wire cages. Requirements of industrialized buildings, standardization of precast elements and unification of building design. Influence of manufacture, transport and erection technologies on design solution (Modular and Tilt-Up); expansion and contraction joints.

Unit 2: Ferrocement

a) Definition, basic concept like bond increase, comparison with concretes like RCC, Prestressed, Asbestos cement, Fiber reinforced, Polymer concretes. Composition of ferrocement, special types of ferrocement. Ferrocement as substitute for conventional building materials. typical characteristics and their applications.

b) Raw materials, skills, tools and plants. Ferrocement as material of construction. Forming a ferrocement structure. Properties and specifications of raw materials. Proportioning of cement mortar. Job requirements of required skills. Tools and plants.

Unit 3: Prefabricated Components and its Behaviour

a) Design of Precast Concrete Components and Behaviour of structural components, large panel constructions, Construction of roof and floor slabs, Wall panels, Beams, Columns, Shear walls.

b) Design for Flexure: Strength Design (Depth of Stress block, Flanged Elements, Strength reduction factor, Limitations on reinforcement, Critical sections), Service load design. Design for Shear: Horizontal and vertical shear resistance.

Unit 4: Design of Ferrocrete Structures

a) Design, analysis and optimization, Special design considerations, Typical features of ferrocrete affecting design, Design criteria, Rational method of design ferrocrete structure. Strength through shape, Shape and form of a structure, various structural forms and their behaviour, Comparative study of various forms

b) Hydraulic structures, Water retaining structures, Storage tanks of various types. Structures across streams. Ferrocement in layered form used for lining, water proofing and surface coating.

Unit 5: Joints and Connections

a) Joints and connections in precast construction; classification and their requirements. Design of Concrete bracket and corbels; Cantilever beam-design method, Strut-and-tie method.

B) Introduction to Hanger Connections. Design of bearing pads, column bases and moment connections. Typical connection designs for lateral load resisting systems.

Unit 6

Space structures and precast products :

a) Ferrocement large size special purpose structures. Space structures like shells, pyramids, domes corrugated catenaries.

b) Precast ferrocement products : Why ferrocement for precasting ? Methods of precasting. Design of precast elements. Ferrocement precast walling and flooring panels. Joints in precast ferrocement elements.

References

1. Ferrocement and laminated cementitious composites, A E Naaman, Techno-press, Ann Arbor, Michigan, U S A.
2. PCI Design Handbook, Precast and Prestressed Concrete (6th Edition
3. Koncz T., Manual of precast concrete construction, Vols. I, II and III, Bauverlag, GMBH
4. Ferrocement Construction Mannual, D. B. Divekar
5. CBRI, Building materials and components, India, 1990
6. Gerostiza C. Z., Hendrikson C. and Rehat D.R., Knowledge based process planning for construction and manufacturing, Academic Press Inc., 1994
7. Structural design manual, Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 1978.
8. State-of-the-art report and guide for Design,Construction and Repairs of Ferrocement; ACI committee Report. No ACI549R- 88 and ACI 549.1R.88. Published by American Concrete Institute, Detroit, USA
9. Ferrocement--- B R Paul and R P Pama. Published by International Ferrocement Information Centre. A.I.T.Bangkok, Thailand.
10. Ferrocement- Materials and applications-- Publication SP 61, A C I Detroit. U S A
11. Concrete Technology by Kulkarni & Ghosh, New Age International Publishers
12. Ferrocement code -ACI 549.1R

501 010 e: Design of Pre-stressed Concrete Structures: Elective II (Module I)

Teaching Scheme
Lectures: 4 hours/week
Credits: 4

Examination Scheme
In semester Exam. : 25 marks
End Semester Exam. : 50 marks
Duration of End term. Exam: 3 hrs

Unit 1

Design of Pre-tensioned Flexural members: Design of pole, sleepers and lintels.

Unit 2

Design of Post tensioned Flexural members: Design Tee, 'I' and box section girders

Unit 3

Design of Post tensioned Prestressed Concrete Slabs: Introduction, Design of one way, two way and flat slabs.

Unit 4

Composite Beams: Composite sections of Prestressed concrete beam and cast in-situ RC slab - Analysis of stress, Differential shrinkage, Deflections, Flexural and Shear strength of composite sections, Design of composite sections.

Unit 5

Statically Indeterminate Structures: Analysis and Design of continuous beams and Frames including choice of cable profile, linear transformations, concordance of cable and shift calculations.

Unit 6

Prestressed Concrete Pipes and Tanks: Circular prestressing, types of Prestressed concrete pipes.

Prestressed Concrete tanks: General features, Analysis and design of circular tanks.

References

1. T. Y. Lin & Ned H. Burns, Design of Prestressed Concrete Structures, John Wiley

2. N. Krishna Raju, Prestressed Concrete, Tata Mc Graw Hill Publication Co

3. Edward Nawy, Prestressed Concrete, A Fundamental Approach, Prectice Hall International

4. B. C. Punmia, A. K. Jain and Arun K. Jain – Reinforced Concrete Structures Vol. II, Laxmi Publications, New Delhi

5. N. C. Sinha, and S.K. Roy, Fundamentals of Reinforced Concrete, S. Chand & Co. Ltd, New Delhi

6. IS: 456: Indian Standard code of practice for plain and reinforced concrete, Bureau of Indian Standards, New Delhi.

501 010 I: Building Services and Maintenance: Elective II (Module II)

Teaching Scheme
Lectures: 1 hours/week
Credits: 1

Examination Scheme
In semester Exam. : 25 marks

Unit 1: Integrated design: factors affecting selection of services/systems, Provision of space in the building to accommodate building services, Structural integrity of building services equipment. Sound and vibration attenuation features, Provisions for safe operation and maintenance, Building services engineering system for intelligent buildings: Introduction to information transmission systems, communication and protection system, call systems, public address system and Building automation/management systems.

Unit II: The concepts and importance of energy conservation and energy efficiency for environmental protection, environmental protection and maintenance of building services systems, selection of environmentally friendly products and materials used in building services systems. Co-ordination and management of design and installation of various building services systems during the design and construction stages in particular the builder's works. Computer-aided design and installations of building services, testing and commissioning of building services systems: fire safety systems, vertical transportation equipment ventilation systems, etc. Sick building syndrome, the impacts of life-cycle-cost on planning and implementation. An appreciation of capital and operating costs, Implication of low cost, inefficient equipment, poor installation, inadequate access for maintenance.

References

1. Buiding Services, S. M. Patil

2. Building Maintenance Management, 2ed, Chanter, Wiley India

501 010 II: Structural Audit: Elective II (Module II)

Teaching Scheme
Lectures: 1 hours/week
Credits: 1

Examination Scheme
In semester Exam. : 25 marks

Unit 1

Structural Health, factors affecting health of structures, effect of leakage, age, creep, corrosion, fatigue on life of structure. Structural health monitoring. Various measures, regular maintenance, structural safety in alteration. Quality control & assurance of materials of structure, durability of concrete, Factors affecting durability of concrete, Corrosion in structures, Testing and prevention of corrosion.

Structural Audit, Assessment of health of structure, study of structural drawings, nature of distress, visual observations, Collapse and investigation, limitations on investigator, tools for investigation, Various NDT Methods for assessing strength of distressed materials, investigation management, review of assimilated information, interviews and statements, evaluation and reporting, presentation of report, communication gap among client, architect, consulting engineer & contractor.

Unit 2

Retrofitting of Structures, parameters for assessment for restoration strategies, selection of construction chemicals during restoration, Specification for important items of work in restoration, Structural detailing for restoration and various techniques of retrofitting.

Safety during construction, formwork and staging, Modular formwork, Structural aspects for formwork in buildings & bridges. Fire safety. Demolition of Structure, study of structural system and structural drawings, outline of various demolition methods and their evaluation, partial and controlled demolition, role of safety measures, temporary support structures in demolition. Recycling of demolished materials.

References

1. Handbook of material management by Deananmmer, McGraw Hills

2. Fundamentals of material management by Gopalkrishnan, Tata McGraw Hills.

3. Financial Management by M Y Khan and Jain, Tata McGraw Hills

4. Properties of Concrete by A M Neville, Longman

5. R. N. Raikar, Learning from Failures, R & D Centre, (SDCPL.

6. R. N. Raikar, Diagnosis and treatment of structures in Distress, R & D Centre, (SDCPL)

7. Jayakumar J. Shah, A Handy Guide to Repairs, Rehabilitation and Waterproofing of RCC Building (Structures).

8. Formwork Construction and Practice by Richardson. J. G.

9. Formwork For Concrete Structures by Peurifoy, Tata McGraw-Hill

10. Formwork To Concrete, by Austin. C. K, Chapman and Hall

11. Design & Construction of Formwork For Concrete Structures, by Wynn.A. E.

12. Demolition and reuse of concrete, by Y Kasai, Chapman and Hall

13. Demolition of Structures, Report by Mr. Girish Kulkarni, Mumbai

14. Structural Audit, Report by Mr. Umesh Dhargalkar, Mumbai

501 010 III: Cyber Security: Elective II (Module II)

Teaching Scheme
Lectures: 1 hours/week
Credits: 1

Examination Scheme
In semester Exam. : 25 marks

Unit 1

Basic Concepts of Technology and Law*:* Basics of Information Technology, Basics of Indian Legal System, Information Technology Act 2000 (Amended), Relevant Amendments in all other laws. E-Contract**:** The essence of digital contracts, Law of Contract, Construction of E-contracts, Issues of security, Employment contracts, Consultant Agreements and Digital signature

Intelligent Property Issues in Cyber space: Doman names and related issues, Copyright in digital media, Patents in cyber world.

Rights of Neitzens and E- Governance: Privacy and freedom issues in cyber world, E-Governance, Cyber crimes and Cyber laws.

Unit 2

Information Security Fundamentals: Background, Importance, Statistics, National and International Scenario, Goals of security, Confidentiality, Privacy, Integrity, Non-repudiation, Availability.

Essentials of computer security - Sources of security threats – Intruders, Viruses, Worms and related threats - Threat identification - Threat analysis - Vulnerability identification and Assessment.

Security Investigation: Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues

Access Control, Intrusion Detection and Server Management, Firewalls:

Overview of Identification and Authorization, Overview of IDS, Intrusion, Detection Systems and Intrusion Prevention Systems, User Management, Overview of Firewalls, Types of Firewalls, DMZ and firewall features

Security Policies and Management: Security Policy Design, Designing Security Procedures, Risk Management and Assessment Techniques, Security standards, Security Models. Security Management Practices, Security Laws, Information Classification Process, Risk Management, Security Procedures and Guidelines, Business Continuity and Disaster Recovery, Ethics and Best Practices, Security Assurance,

References

1. Bakshi P M and Sri R K, Cyber and E-commerce Laws, Bharat Publishing House
2. Syed Shakil Ahmed, Rajiv Raheja, A handbook on Information technology: Cyber law and E-Commerce, Capital Law House.
3. Rodney D Ryder, Business Process Outsourcing, Date Protection and Information Security, Wadhwa & Co., 1st Edn,
4. Vakul Sharma, Information Technology Law and Practice, Delhi Law House, 3rd Edn.
5. Lipton K., Cyberspace Law Cases and Materials, 2nd edition. Aspen Publishers.
6. Michael E Whitman and Herbert J Mattord, Principles of Information Security, Vikas Publishing House, New Delhi.
7. Micki Krause, Harold F. Tipton, Handbook of Information Security Management, Vol 1-3 CRC Press LLC.
8. Michael E Whitman and Herbert J Mattord, Principles of Information Security, Vikas Publishing House, New Delhi.

501 011: Lab Practice II

Teaching Scheme	Examination Scheme	
Lectures: 4 hours/week	**Term work**	**: 50 marks**
Credits: 4	**Oral/ Presentation**	**: 50 marks**

1. Finite Element Method: Any three assignments on the following topics using coding tools.

a) Formulation of stiffness matrix for any 1-D element

b) Formulation of stiffness matrix for any 2-D element

c) Formulation of stiffness matrix for any 3-D element

d) Assembly procedure using Jacobian matrix

2. Use of software to obtain stress resultants for any three following problems.

a) Plane stress / plane strain problem

b) Axisymmetric problem

c) Three dimensional problem

d) Plate or shell structures

3. Theory of Plates and Shells: One assignment from each unit.

4. Advanced Design of Concrete Structures

A mini-project to be completed individually which shall be based on the analysis and design of a G + 4 storeys building having a plan area not less than 150 m^2. The analysis shall be done using any commercially available software and the design of all structural members shall be done manually. The detailing shall be prepared using any commercially available drafting software.

5. Elective II: One assignment on each unit.

6. Site visits: Report based on three site visits.

501 012: Seminar I

Teaching Scheme	**Examination Scheme**
Lectures: 4 hours/week	**Term work : 50 marks**
Credits: 4	**Oral/ Presentation : 50 marks**

Seminar I: Shall be on state of the art topic of student's own choice approved by an authority. The student shall submit the duly certified seminar report (printed on both sides) in standard format, for satisfactory completion of the work by the concerned Guide and head of the department/institute.

The contents of report are as follows.

1. Introduction
2. Literature Survey
3. Theoretical contents
4. Relevance to the present national and global scenario of construction industry
5. Strengths and weaknesses of the particular area of seminar
6. R & D in the particular area
7. Field Applications/case studies/Experimental work/software application
8. Vendors associated
9. Conclusions
10. References

Students should prepare a power point presentation to be delivered in 15 minutes and should be able to answer questions asked in remaining five minutes.

501 013: Research Methodology

Teaching Scheme
Lectures: 4 hours/week
Credits: 4

Examination Scheme
In semester Exam. : 50 marks
End Semester Exam. : 50 marks
Duration of End term. Exam: 3 hrs

Unit 1: Introduction to Research

Meaning of research, types of research, process of research, Sources of research problem, Criteria / Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem, formulation of research hypotheses**.** Search for causation. Developing a Research Proposal Format of research proposal, Individual research proposal, Institutional research proposal, Significance, objectives, methodology, Funding for the proposal, Different funding agencies. Framework for the planning

Unit 2: Literature survey

Definition of literature and literature survey, need of literature survey, sources of literature, elements and objectives of literature survey, styles of literature survey, and strategies of literature survey.

Unit 3: Data collection, Measuring, Sampling and Scaling

Classification of data, benefits and drawbacks of data, evaluation of data, qualitative methods of data collection, methods of qualitative research, Sampling, sample size, sampling strategy, attitude measurement and scaling, types of measurements, criteria of good measurements, classification of scales.

Unit 4: Preliminary data analysis

Testing of hypothesis- concepts and testing, analysis of variance techniques, introduction to non-parametric tests. Validity and reliability, Approaches to qualitative and quantitative data analysis.

Unit 5: Advanced data analysis techniques

Correlation and regression analysis, Introduction to factor analysis, discriminant analysis, cluster analysis, multidimensional scaling, Descriptive statistics, Inferential statistics, Multi-dimensional measurement and factor analysis

Unit 6: Report writing

Need of effective documentation, importance of report writing, types of reports, report structure, report formulation, Plagiarism. Research briefing, presentation styles, impact of presentation, elements of effective presentation, writing of research paper, presenting and publishing paper, patent procedure.

References

1. Research Methodology: concepts and cases, Deepak Chawla and Neena Sondhi, Vikas Publishing House Pvt. Ltd.

2. Research Methods for Business, Sekaran Uma and Rogure Boudie, Wiley, India.

3. Research Methodology: Methods and Trends, by Dr. C. R. Kothari, New Age International Publishers.

4. Research Methods in Education, Louis Cohen, Manion, Morrison, Routledge (Taylor &Francis Group)/ Cambridge University Press India Pvt. Ltd.

5. Research Methodology: An Introduction, Wayne Goddard and Stuart Melville.

6. Research Methodology: A Step by Step Guide for Beginners, by Ranjit Kumar

7. Research in Education, John Best and James Kahn, Prentice Hall of India Pvt. Ltd.

501 014: Analysis and Design of Earthquake Resistant Structures

Teaching Scheme
Lectures: 4 hours/week
Credits: 4

Examination Scheme
In semester Exam. : 50 marks
End Semester Exam. : 50 marks
Duration of End term. Exam: 3 hrs

Unit 1: Basic seismology and earthquake effects
Definition of earthquake, causes of earthquakes, theories of earthquakes, seismic zones, generation of seismic waves and its composition, measurement of earthquakes. Seismic effects on structures, liquefaction and its effect on structure. Peak ground acceleration, peak velocity, peak displacement, response spectra, tripartite plot, soil – structure interaction.

Unit 2: Earthquake design philosophy
Effect of irregularities and architectural planning, center of mass and center of rigidity, philosophy of earthquake resistant design, maximum considered earthquake, design based earthquake, concept of stiffness, flexibility and ductility, P – Δ effect.

Unit 3: Methods of analysis
Equivalent linear static analysis (with numerical), modal spectrum analysis (with numerical), linear time history analysis, static push over analysis, capacity based design, performance based design, IS 1893 code provisions.

Unit 4: Design of RC members
Load combinations, concept of strong column weak beam design, design and detailing of beams, columns and beam-column joint as per IS 1893 and IS 13920.

Unit 5: Lateral load resisting systems
Types of lateral load resisting systems, computation of design lateral forces on RC shear walls, design of RC shear walls.

Unit 6: Analysis of elevated water tanks
Mathematical models, IS 3370 code provisions, analysis of elevated water tanks.

As part of In-sem assessment, other than Class Test 1 & 2, a term project must be completed individually which will be based on Units 3, 4, and 5. The project shall include the complete analysis and design of all structural elements using any commercially available software.

It shall also include the detailing as per industry standards.

References

1. Bungale S. Taranath, Wind and Earthquake Resistant Buildings: Structural Analysis and Design, CRC Press
2. Pankaj Agrawal, Manish Shrikhande, Earthquake Resistant Design of Structures, PHI
3. Shashikant K. Duggal, Earthquake Resistant Design of Structures, OUP India
4. BIS, IS 1893: Criteria for Earthquake Resistant Design of Structures
5. BIS, IS 13920: Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces – Code of Practice.

501 015 a: Bio Mechanics and Bio Materials: Elective III (Module I)

Teaching Scheme
Lectures: 4 hours/week
Credits: 4

Examination Scheme
In semester Exam. : 25 marks
End Semester Exam. : 50 marks
Duration of End term. Exam: 3 hrs

Unit 1

Structure of biomaterials, classification of bio materials, mechanical properties, Hookean elasticity, elasticity of non-Hookean materials. Elasticity models for bio materials. Structure of Hard tissue.

Unit 2

Materials for replacements, Metallic Biomaterials and ceramic biomaterials steps involved in the fabrication of metallic implants, stainless steel Co-Cr-alloys Ti & its alloys, medical applications, corrosion of metallic implants.

Unit 3

Polymeric Biomaterials and composite biomaterials, Polymerization, polyolefins, Polyamides, acrylic polymers, high strength thermoplastics for medical applications, deterioration of polymers. Structure, bounds on properties, anisotropy of composites, particulate composite fibrous composites, porous materials. On-absorbable or relatively Bio inert bio-ceramics Bio-degradable or resorbable ceramics. Bio active or surface reactive ceramics, deterioration of ceramics.

Unit 4

Mechanical properties of cartilage. Diffusiac properties of articular cartilage, mechanical properties of bone. Internal fracture fixation devices, joint replacements, dental implants.

Unit 5

Joint structure ,Kinetics and kinematics of joints, elbow, Hip, Knee joint; Evaluation of joint forces and moments. Equilibrium of joint ,fundamental concepts of Gait analysis, Link mechanism of human body.

Unit 6

Design of artificial fixation devices. Orthopedic fixation devices. Fundamentals of design of joint prosthesis. Mechanical testing of joint prosthesis Principles involved in study of rehabilitation engineering.

References

1. Y. C. Fung, Bio-mechanics, Mechanical Properties of Living Tissues Edition 2, 1993.
2. Dowson D. V., Wright, Introduction to Biomechanics of joints and joint replacement, Mechanical Engineering Publication 1987.
3. Van. C. Mow, Antony Ralcliffe, Savio, Bio-mechanics of diarthrodial joints, Springer Verlag 1990.
4. Frederick H. Silver, Bio-materials Medical Devices and Tissue Engineering, Chapman & Hall
5. Park Joon Bu, Bio-Materials Science & Engineering, Plenum Press 1990.
6. Buddy D. Ratner & Allen S.Hoffman, Bio-Materials Science an Introduction to Materials in Medicine, Academic Press 1996.
7. Hand book of Biomedical Engineering, Kline Jacob Academic Press 1988.

501 015 b: Mechanics of Modern Materials: Elective III (Module I)

Teaching Scheme
Lectures: 4 hours/week
Credits: 4

Examination Scheme
In semester Exam. : 25 marks
End Semester Exam. : 50 marks
Duration of End term. Exam: 3 hrs

Unit 1

Introduction to Modern Materials: Fiber-Reinforced Polymer Composite (FRPC) Materials: definition, historical development, applications. Fibers and Matrix: types and their properties, manufacturing process and methods for composites. Types and classification of composite materials, properties, advantages over conventional materials. Piezoelectric Materials: History, crystal structure, applications. Shape Memory Alloys (SMA), Functionally Graded Materials (FGM): definition and applications.

Unit 2

Engineering Properties of Modern Materials: FRPC Composite Lamina: Micromechanics approach, methods. Longitudinal and transverse elastic properties of composite lamina, in-plane shear modulus for continuous fibers. Stress-strain relationship, compliance and stiffness matrices for generally anisotropic, specially orthotropic material, transversely isotropic material, orthotropic, isotropic materials, Plane stress condition for thin lamina, transformation of stress and elastic properties. Three dimensional transformations. Stiffness matrix for Functionally Graded Materials.

Unit 3

Strength of Composite Lamina: Introduction. Failure theories, Maximum stress theory, Maximum strain theory, Energy based interaction theory (Tsai-Hill), Interactive tensor polynomial theory (Tsai-Wu), Failure mode based theory (Hasin-Rotem). Computation of lamina strength by Tsai-Wu theory for plane stress condition. Comparison of various failure theories.

Unit 4

Elastic behavior of Composite Laminates: Basic assumptions, Laminate configurations, Strain-displacement relationship, Stress-strain relationship, Force and moment resultants, Laminate Compliances and stiffness matrices, Transformation of matrices. Load deformation relationship for symmetric laminates, symmetric cross-ply, symmetric angle-ply, balanced, anti-symmetric cross-ply and angle ply, orthotropic, quasi-isotropic laminates.

Unit 5

Hygrothermal Expansion and Design of Composite Structure: Coefficients of thermal and moisture expansion of various unidirectional lamina, load deformation relationship, residual stresses for cross ply symmetric laminates. Design methodology, design of pressure vessel for various laminate configurations.

Unit 6

Experimental Methods of Testing of Composite Materials: Characterization of constituent materials, fiber, matrix, thermal fiber, interface/interphase characterisation, Fiber volume ratio, void volume ratio. Determination of hygrothermal expansion coefficients, tensile, compressive and shear properties of unidirectional laminates. Testing of interlaminar fracture toughness, Biaxial testing, iIntroduction to stress concentration in laminates.

References

1. Isaac M. Daniel and Ori Ishai - Engineering Mechanics of Composite Materials, Oxford University Press, Second Edition, New Delhi.
2. Michael W. Hyer - Stress Analysis of Fiber-Reinforced Composite Materials, WCB/McGraw-Hill,Singapore.
3. Jones R. M. – Mechanics of Composite Materials, McGraw-Hill, New York.
4. Ronald F.Gibbson ,Mechanics of Fiber Reinforced composites. McGraw-Hill

501 015 c: Retrofitting and Strengthening of R C Structures: Elective III (Module I)

Teaching Scheme	**Examination Scheme**
Lectures: 4 hours/week	**In semester Exam. : 25 marks**
Credits: 4	**End Semester Exam. : 50 marks**
	Duration of End term. Exam: 3 hrs

Unit 1

Introduction: Needs for repair and rehabilitations of R C structure, degradation of reinforced concrete structure, major causes and sign, deterioration of concrete structures, causes of deterioration, cracking-type, causes and characteristics.

Unit 2

Evaluation of concrete structures: Conditional evaluation- definition, objectives and stages of conditional assessment, preliminary investigation-scope, methodology and output, detailed investigation-scope and methodology, In situ and laboratory testing such as nondestructive, semi destructive, corrosion test, chemical test and NDT for cracks, flaws and voids in concrete.

Unit 3

Repair system, material and techniques: Repair methodology, compatibility of repair material and concrete, material for repair-cement base, polymer modified, resin base, micro concrete and composite, repair techniques.

Unit 4

Retrofitting and strengthening of concrete structures: Design philosophy of strengthening, strengthening technique-section enlargement, composite construction, post tensioning, stress reduction, strengthening by reinforcement, strength by FRP.

Unit 5

Strengthening of R C members: Strengthening of beams: flexural and shear, slab, columns, footings and seismic retrofitting of R C structures using FRP.

Unit 6

Quality control in concrete construction, maintenance, water leakage-detection and mitigation, fire damage-detection and reparation, corrosion-detection and mitigation, demolition of concrete structures and structural health monitoring.

References

1. Concrete Repair and Maintenance, P. H. Emmons and G M Sabnis, Galgotia Publication.
2. Repairs and Rehabilitation – Compilation from Indian Concrete Journals
3. Management of Deteriorating Concrete Structures, George Somerville, Taylor and Francis, Publication.
4. Concrete Building Pathology, Susan Macdonald, Blackwell Publishing
5. Durability of Cement and Cement Composites, C. L. Page, M M Page, Wood Head, Publishing.
6. ACI 440.2R-08, Guide for the design and construction of externally bonded FRP systems for strengthening concrete structures, American Concrete Institute.
7. Xilin lu (2010), Retrofitting design of building structures, Science Press, New York.
8. Strengthening and Rehabilitation of Civil Infrastructures Using Fibre-Reinforced Polymer (FRP) Composites, L. *C. Hollaway and J.G. Teng*, Woodhead Publishing Series in Civil and Structural Engineering
9. Maintenance, Repair & Rehabilitation & Minor Works of Building, by P C Varghese, PHI

501 015 d: Structural Reliability: Elective III (Module I)

Teaching Scheme
Lectures: 4 hours/week
Credits: 4

Examination Scheme
In semester Exam. : 25 marks
End Semester Exam. : 50 marks
Duration of End term. Exam: 3 hrs

Unit I

Concepts of structural safety: Design methods, statistics and probability: Data reductions,Histograms, Sample correlation. Random variable, Discrete and continuous variables and commonprobability distribution.

Unit II

Resistance distribution and parameters: Statistical analysis of materials: steel, concrete bricks andmortar, Dimensional variations, characterization of variables and allowable stresses based onspecified reliability.Probabilistic Analysis for live load, gravity load and wind load.

Unit II

Computation of basic structural reliability, Reliability analysis of simple element such as beamand column Reliability methods, basic variables, first order second moment methods (FOSM) andconcept of reliability index. Reliability of structural systems: Redundant and non-redundantsystems,series, parallel and mixed systems.

Unit IV

Monte Carlo Methods of Analysis: Study of structural safety-generation of random numberscontinuous,discrete and jointly distributed variables-Application to reliability analysis of concrete structures.

Unit V

Reliability based design: Load and resistance factors of design, safety checking formats and codecalibrations, I.S. code provision, Introduction to stochastic process.

Unit VI

Decision Analysis: Introduction, simple risk decision problems, decision problems, decisionmodel,decision tree, decision criteria, decision based on existing information, Prior analysis

References

1. R. Ranganathan, Reliability Analysis and Design of Structures, Mc Graw Hill.
2. Edward Haugen, Probabilistic Approaches to Design, John Wiley and Sons, London.
3. R. E. Melchers, Structural Reliability-Analysis and Prediction, Ellis Horwood Ltd. Chichester, UK.

501 015 e: Non-linear Analysis of Structures: Elective III (Module I)

Teaching Scheme	**Examination Scheme**
Lectures: 4 hours/week	**In semester Exam. : 25 marks**
Credits: 4	**End Semester Exam. : 50 marks**
	Duration of End term. Exam: 3 hrs

Unit I

Types of Nonlinearities: Geometric, Material, Nonlinear equations for beams: Moment-curvature nonlinearity, Geometric nonlinearity due to stretching, Material nonlinearity. Geo metric nonlinear beam problems: Moment curvature nonlinearity of cantilever beam, centrally loaded beam with two supports, Cantilever beam subjected to tip load.

Unit II

Nonlinear analysis of Columns: Double modulus theory, Tangent modulus theory, Empirical relations for short column, Post buckling of cantilever column, Large deflection of column with both ends hinged

Unit III

Nonlinear analysis of Trusses and Frames: Beam column, Triangulated frames, Derivation of nonlinear stiffness matrix, Matrix displacement method for nonlinear analysis of structures, nonlinear analysis of plane frame.

Unit IV

Nonlinear Static Analysis of Plates: Geometric and material nonlinearities, Governing nonlinear equations of plates: Stress function approach, Displacement equations approach. Nonlinear static analysis of plates: Boundary conditions and method of solution, Large deflection of rectangular plates.

Unit IV

Nonlinear Analysis of Shells: Derivation of governing equations, Circular cylindrical shells large deflections, Post buckling of shells: Circular cylindrical shells, Spherical shells with finite deflections.

Unit VI

Nonlinear analysis of structures with composite materials: Composite beams large deflection, Composite plates governing equations, Displacement equations, Laminated plates-cylindrical bending, symmetrically laminated plates.

References

1. M Sathyamoorthy, Nonlinear Analysis of Structures- CRC New York

2. K I Majod, Nonlinear Structures- Butter Worth, London

501 015 I: Safety practices in construction: Elective III (Module II)

Teaching Scheme	**Examination Scheme**
Lectures: 1 hours/week	**In semester Exam. : 25 marks**
Credits: 1	

Introduction to Construction Safety And Safety Technology--Introduction to construction safety; historical background and current perspective; Government's policy in industrial safety; safety & health legislation in India, Construction Sites (Safety) Regulations; Codes of practice; Potential hazards/risks associated with construction sites and high risk activities such as the use of hoist, Working at height and working in confined space. Safety in typical civil structures – Dams-bridges-water Tanks-Retaini ng walls-Critical factors for failure-Regular Inspection and monitoring. Safety in Erection and closing operation - Construction materials –Specifications – suitability – Limitatio ns – Merits and demerits – Steel structures – Concrete structure. Workplace ergonomics including display screen equipment and manual handling, personal protective equipment, first aid and emergency preparedness, fire safety, electrical hazards.

Unit 2:

Construction Safety Management and Accident Prevention. Safety training; safety policy; safety committees; safety inspection; safety audit; reporting accidents and dangerous occurrences. Accident Prevention: Principles of accident prevention; job safety analysis; fault tree analysis; accident management

References

1. Accident Prevention Manual for Industrial Operations, NSC, Chicago, 1982.
2. Fulman, J. B., Construction Safety, Security, and Loss Prevention, John Wiley, and Sons,1979.

501 015 II: Engineering ethics: Elective III (Module II)

Teaching Scheme
Lectures: 1 hours/week
Credits: 1

Examination Scheme
In semester Exam. : 25 marks

Unit I

Introduction : Meaning & scope of Ethics in general & for engineers in particular, Moralobligations and rules in engineering, Categories of moral, Work Culture, Corporate, local & global issues, Rights & responsibilities of Engineers, Conflicts in the profession, Mental Stresses & Emotional Intelligence.

Unit II

Code of Ethics for Engineers: First principles of Engineering Ethics & Ethical terminology,Social Values, Character, considerations for general Individuals, Engineers & the Society, Recommendations of the Professional bodies (Code of Conduct), Introduction to Copyright, IPR (Intellectual Property Right), Plagiarism & Legal issues

Reference

1. Ethics in Engineering Practice and Research, Carolin Whitbeck, Cambridge University Press—ISBN—978-1-107-66847-8

501 015 III: Forensic Civil Engineering: Elective III (Module II)

Teaching Scheme
Lectures: 1 hours/week
Credits: 1

Examination Scheme
In semester Exam. : 25 marks

Unit I

Introduction to forensic engineering, Forensic investigations-tools and techniques, Failures-types, causes and mechanisms ,Monitoring and instrumentation, Mitigation of failure

Unit II

Professional practice and ethics, Legal issues, Repairs and remediation, Risk and risk assessment, Assessment of damage, Forensic analysis of R.C. frames, Case studies.

References

Proceedings, Conference on Forensic Civil Engineering, Association of Consulting Civil Engineers(I), Banglore, August,2013

501 016: Seminar II

Teaching Scheme	**Examination Scheme**
Lectures: 4 hours/week	**Term work : 50 marks**
Credits: 4	**Oral/ Presentation : 50 marks**

The student is required to deliver a seminar in second semester on the topic relevant to latest trends in Civil Engineering (other than the topic of dissertation) preferably on the topic of sub specialization based on the Electives selected by him/her by authority. The student shall submit the seminar report (printed on both sides) in standard format, duly certified for satisfactory completion of the work by the concerned guide and head of the Department/ Institute.

The contents of report are as follows.

1. Introduction
2. Literature Survey
3. Theoretical contents
4. Relevance to the present national and global scenario of construction industry
5. Strengths and weaknesses of the particular area of seminar
6. R & D in the particular area
7. Field Applications/case studies/Experimental work/software application
8. Vendors associated
9. Conclusions
10. References

Students should prepare a power point presentation to be delivered in 15 minutes and should be able to answer questions asked in remaining five minutes.

501 017: Project Stage I

Teaching Scheme	**Examination Scheme**
Lectures: 8 hours/week	**Term work : 50 marks**
Credits: 4	**Oral/ Presentation : 50 marks**

Project Stage-I is the integral part of the dissertation project. The project should be based on the knowledge acquired by the students during the coursework and should contribute to the needs of the society. The project aims to provide an opportunity of designing and building complete system or subsystems in an area where the students like to acquire specialized skills.

The student shall submit the report (printed on both sides) of project work completed partly in standard format approved by the University as per the following.

1. Introduction including aim and objective of the dissertation topic
2. Review of literature
3. Problem statement and methodology
4. Theoretical contents associated with the dissertation topic
5. Data collection from field or organization / experimental set-up developed if any / part analysis
6. Limitations of study / difficulties encountered if any
7. Progress achieved
8. Future plan of action
9. References

The candidate shall deliver a presentation as a part of the progress report of Project work Stage-I in front of panel of examiners.

501 018: Seminar III

Teaching Scheme	**Examination Scheme**
Lectures: 5 hours/week	**Term work : 50 marks**
Credits: 4	**Oral/ Presentation : 50 marks**

Seminar III: Shall preferably be an extension of seminar II. The student shall submit the duly certified seminar report (printed on both sides) in standard format, for satisfactory completion of the work by the concerned guide and head of the Department/Institute.

Students should prepare a power point presentation to be delivered in 15 minutes and should be able to answer questions asked in remaining five minutes.

The contents of report are as follows.

1. Introduction
2. Literature Survey
3. Theoretical contents
4. Relevance to the present national and global scenario of construction industry
5. Strengths and weaknesses of the particular area of seminar
6. R & D in the particular area
7. Field Applications/case studies/Experimental work/software application
8. Vendors associated
9. Conclusions
10. References

Students should prepare a power point presentation to be delivered in 15 minutes and should be able to answer questions asked in remaining five minutes.

501 019: Project Stage II

Teaching Scheme	**Examination Scheme**
Lectures: 20 hours/week	**Term work: 150 marks**
Credits: 4	**Oral/ Presentation: 50 marks**

In Project Work Stage II, the student shall complete the dissertation. The student shall prepare the final report of dissertation work in standard format duly certified for satisfactory completion of the work by the concerned guide and Head of the Department/Institute.

The report shall consist of the following as applicable:

1. Introduction including aim and objective of the dissertation topic
2. Review of literature
3. Problem statement
4. Theoretical contents associated with the dissertation topic
5. Methodology adopted
6. Data collection from field or organization / experimental set up preparation if any/analysis
7. Results and discussion
8. Validation of results if applicable
9. Conclusions and future scope of work
10. References

The final dissertation shall be submitted in hard bound copy as well as a soft copy on CD. The Term Work of Dissertation of semester IV shall be assessed jointly by the pair of internal and external examiners, along with oral examination of the same. The candidate shall deliver a presentation on report of Project work Stage-II (dissertation) in front of external and internal examiner.

It is recommended that at least one paper on the dissertation topic to be presented in a conference or published in a referred journal.