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)

****

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.

Cz

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, 6^{th} 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, 2nd Law of thermodynamics statements (Kelvin Plank, Claussius), Numerical on 2nd 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:

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

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
TUT: Tutorial
OR: Oral
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

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

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

(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:	**Examination Scheme:**
Theory: 04 hrs/week	**In-Sem (Online): 50 Marks**
Practical: 02 hrs/week	**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”, 9thEdition, 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:	**Examination Scheme:**
Theory: 04 hrs/week	**In-Sem(Online): 50 Marks**
Practical: 02 hrs/week	**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:	**Examination Scheme:**
Theory: 01hrs/week	**Term work : 50 Marks**
Practical: 02 hrs/week	

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:	**Examination Scheme:**
Theory: 04hrs/week	**In-Sem(Online): 50 Marks**
Practical: 02 hrs/week	**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:
Theory : 03 hr/week

Examination Scheme:
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, 3rd 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, 4th 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, 3rd 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		**Examination Scheme**
Theory / Week	**: 2 Hrs**	**Term Work: 50 Marks**
Practical /Week	**: 2Hrs.**	

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**		**TW**	**PR**	**OR**	**Total**	**TH/ TUT**	**PR+OR**
						In Sem(Online)	**End Sem**						
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**		**TW**	**PR**	**OR**	**Total**	**TH/ TUT**	**PR+OR**
						In Sem (Online)	**End Sem**						
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: **S**tudents 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:	**Examination Schemes: Audit (P/F)**
Lectures: 2 h per week	Written and MCQ
Field Visit: 4 h	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:	Examination Schemes: Audit (P/F)
Theory: 02Hrs/ Week	Written and MCQ
Practical: 2 h x 3	

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 **π** 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

---

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", 7th edition, McGraw-Hill, ISBN0-07-289905-0
2. C. L. Liu and D. P. Mohapatra, "Elements of Discrete Mathematics", 4th Edition, McGraw-Hill

Reference Books

1. N. Biggs,"Discrete Mathematics", 2nd Edition, Oxford University Press
2. Singh, "Discrete Mathematical Structures", Wiley, ISBN-9788126527908
3. Eric Gossett, "Discrete Mathematics with Proof", Wiley, 2nd Edition, ISBN-9788126527588
4. Edgar G. Goodaire, Michael M. Parmenter, Discrete Mathematics with Graph Theory, Pearson Education, 3rd Edition, ISBN-13: 978-0131679955
5. Richard Johnsonbaugh, "Discrete Mathematics" 7th 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

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", 8th 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:
Lectures: 4 Hours/Week

Credits
04

Examination Scheme:
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:
Lectures: 4 Hours/Week

Credits
04

Examination Scheme:
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

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:	Credits:	Examination Scheme:
Practical : 4 Hours/Week	02	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.

.

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:
Practical : 4 Hours/Week

Credits:
02

Examination Scheme:
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**

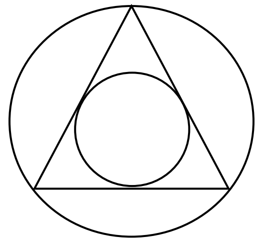
Guidelines for Practical Examination

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.

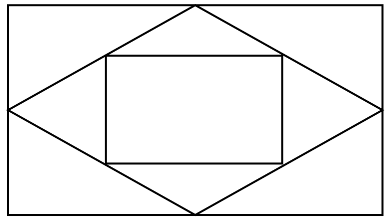
Suggested List of Laboratory Assignments

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)

Savitribai Phule Pune University
TE Civil (2015 Course) w.e.f. June 2017

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.

Savitribai Phule Pune University

TE Civil (2015 Course) w.e.f. June 2017

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

Savitribai Phule Pune University
TE Civil (2015 Course) w.e.f. June 2017

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:	**Examination Scheme:**
Lecture : 03 hr/week	**In-Sem : 30 Marks**
Tut : 01 hr/week	**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:

Practical : 04 hr/week

Examination Scheme:

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 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

- 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:	**Examination Scheme:**	
Lecture : 03 hr/week	**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, 2nd 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, 2nd 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..ir..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: **Examination Scheme:**

Lecture : 03 hr/week **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: **Examination Scheme:**

Practical : 04 hr/week **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:	**Examination Scheme:**
Practical : 04 hr/week	**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 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

- 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		TW	PR	OR		TH/ TU	PR+OR
						In Sem	End Sem						
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		TW	PR	OR		TH/ TU	PR+OR
						In Sem	End Sem						
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	TW:	Term work
Pr:	Practical hours/week	PR:	Theory
Tu:	Tutorial hours/week	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 & ʌ 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

I N D E X

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:
Lectures: 4 Hours/Week

Credits
04

Examination Scheme:
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:
Lectures: 4 Hours/Week

Credits
04

Examination Scheme:
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:	Credits	Examination Scheme:
Practical : 4 Hours/Week	02	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:	Credits	Examination Scheme:
Practical : 2 Hours/Week	01	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, 1stEdition.
2. Email Marketing: An Hour a Day, Wiley, Jeanniey Mullen, David Daniels, David Gilmour-ISBN: 978-0-470-38673-6, 1stEdition.
3. The New Rules of Marketing and PR, David Scott, Wiley India, ISBN: 978-1-119-07048-1, 1stEdition.

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:	Credits	Examination Scheme:
Lectures: 3 Hours/Week	03	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
b) ipconfig / ifconfig
c) Hostname
d) Whois
e) Netstat
f) Route
g) Tracert/Traceroute/Tracepath
h) NSlookup
i) Arp
j) Finger
k) Port Scan / nmap

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 ($1/3^{rd}$, $3/8^{th}$) [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

FACULTY OF ENGINEERING

SYLLABUS FOR THE B. E. (ELECTRICAL ENGINEERING)

(2012 course)

WITH EFFECT FROM YEAR 2015-2016

SAVITRIBAI PHULE PUNE UNIVERSITY

Savitribai Phule Pune University
B.E. (Electrical Engineering) - 2012 Course
(w.e.f. 2015-2016)

Semester I

Subject code	Subject Title	Teaching Scheme Weekly load in Hrs.			Examination Scheme (Marks)					
		Lecture	Tutorial	PR	Theory: In Semester Exam	Theory: End Semester Exam	PR	OR	TW	Max. Marks
403141	Power System Operation and Control	03	--	02	30	70	--	25	25	150
403142	PLC and SCADA Applications	04	--	02	30	70	50	--	25	175
403143	Elective I	03	--	02	30	70	--	--	25	125
403144	Elective II	03	--	--	30	70	--	--	--	100
403145	Control System II	03	--	02	30	70	--	25	25	150
403146	Project I	--	02	--	--	--	--	50	--	50
TOTAL		16	02	08	150	350	150		100	750

Semester II

Subject code	Subject Title	Teaching Scheme Weekly load in Hrs.			Examination Scheme (Marks)					
		Lecture	Tutorial	PR	Theory: In Semester Exam	Theory: End Semester Exam	PR	OR	TW	Max. Marks
403147	Switchgear and Protection	04	--	02	30	70	--	25	50	175
403148	Power Electronic controlled Drives	04	--	02	30	70	50	--	25	175
403149	Elective III	03	--	02	30	70	--	25	25	150
403150	Elective IV	03	--	--	30	70	--	--	--	100
403151	Project II	--	06	--	--	--	--	100	50	150
TOTAL		14	06	06	120	280	200		150	750

Elective I (403143)
- A) Special Purpose Machines
- B) Power Quality
- C) Renewable Energy Systems
- D) Digital Signal Processing

Elective II (403144)
- A) Restructuring and Deregulation
- B) Electromagnetic Fields
- C) EHV AC Transmission
- D) Introduction to Electrical Transportation Systems

Elective III (403149)
- A) High Voltage Engineering
- B) HVDC and FACTS
- C) Digital Control System
- D) Intelligent Systems and its Applications in Electrical Engineering

Elective IV (403150)
- A) Smart Grid
- B) Robotics and Automation
- C) Illumination Engineering
- D) Open Elective*:VLSI Design

***Proposed Open Elective: The listed open electives or any other Electives that are being taught in the current semester (Term II) under Engineering faculty or individual college and Industry can define new elective with proper syllabus using defined framework of Elective IV and GET IT APPROVED FROM BOARD OF STUDIES ELECTRICAL ENGINEERING AND OTHER NECESSARY STATUTORY SYSTEMS IN THE SAVITRIBAI PHULE PUNE UNIVERSITY WELL IN ADVANCE BEFORE THE COMMENCEMENT OF SEMESTER.**

403141: Power System Operation and Control

Teaching Scheme			**Examination Scheme**	
Lectures	**03**	**hrs/week**	**In-Sem Assessment**	**30**
Practical	**02**	**hrs/week**	**End-Sem Assessment**	**70**
			Oral:	**25**
			Term Work:	**25**

Prerequisite:
Basics of Power System
Course Objectives:

- 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 define reliability aspects at all stages of power system.

Unit 01 : Power System Stability: **(6 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: **(6 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: **(6 hrs)**

Problems of AC transmission system, evolution of FACTs technology, principle of operation, circuit diagram and applications of SVC, TCSC, STATCOM and UPFC.

Unit 04 : Automatic Generation and Control (AGC): **(6 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: (6 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, numerical.

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

Unit 06 : Energy Control and Reliability of Power Systems: (6 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) Reliability of Power Systems: 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.

Learning Outcomes:

At the end of the course, student will be able to

- Identify and analyze the dynamics of power system and suggest means to improve stability of system
- Suggest the appropriate method of reactive power generation and control
- Analyze the generation-load balance in real time operation and its effect on frequency and develop automatic control strategies with mathematical relations.
- Formulate objective functions for optimization tasks such as unit commitment and economic load dispatch and get solution using computational techniques.

List of Experiments: [Perform experiment 1 or 2 and any seven from 3 to 11 using 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 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: At least one industrial visit should be arranged to Load Dispatch Center / Power Station

Control Room.

Text Books:

1. Abhijit Chakrabarti, Sunita Halder, “Power System Analysis Operation and Control”, Prentice Hall of India.
2. I. J. Nagrath, D. P. Kothari, “Modern Power System Analysis”, 4th Edition, Tata McGraw Hill Publishing Co. Ltd.,
3. P. S. R. Murthy, “Power System Operation & Control”, Tata McGraw Hill Publishing Co. Ltd.
4. P. S. R. Murthy, “Operation & Control in Power System”, B. S. Publication.

References :

1. Allen J. Wood, Bruce F. Wollenberg “Power Generation, Operation, and Control”, Wiley India Edition.
2. “Electrical Power System Handbook”, IEEE Press.
3. Narain G. Hingorani, Laszlo Gyugyi, “Understanding FACTs” IEEE Press.
4. Olle I. Elgerd, “Electrical Energy System Theory”, 2nd Edition, Tata McGraw Hill. Publishing Co. Ltd.
5. Prabha Kundur “ Power system stability and control” Tata McGraw Hill.
6. R. Mohan Mathur, Rajiv K. Varma, “Thyristor based FACTs controller for Electrical transmission system”, John Wiley & Sons Inc.

403142: PLC and SCADA Applications

Teaching Scheme			Examination Scheme	
Lectures	**04**	**hrs/week**	**In-Sem Assessment**	**30**
Practical	**02**	**hrs/week**	**End-Sem Assessment**	**70**
			Practical	**50**
			TW	**25**

Prerequisite:

Logic gates operations, Boolean algebra

Course Objectives:

- 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 identify few real-life industrial applications.

Unit 01: Introduction to PLC **(8 hrs)**

Role of automation in Industries, benefits of automation, Necessity of PLC, History and evolution of PLC, Definition, types, selection criterion, Overall PLC system, PLC Input and output modules (along with Interfaces), CPU, programmers and monitors, power supplies, Solid state memory , advantages and disadvantages

Unit 02: Programming of PLC **(9 hrs)**

Programming equipment, Various techniques of programming, Ladder diagram fundamentals, proper construction of ladder diagram, basic components and their symbols in ladder diagram, MCR (master control relay) and control zones, Boolean logic and relay logic

Timer and counter- types along with timing diagrams, shift registers, sequencer function, latch instruction

Arithmetic and logical instruction with various examples

Unit 03: Advance PLC function **(8 hrs)**

Input ON/OFF switching devices, Input analog devices, Output ON/OFF devices, Output analog devices, programming ON/OFF Inputs to produce ON/OFF outputs.

Analog PLC operation, PID control of continuous processes, simple closed loop systems, problems with simple closed loop systems, closed loop system using Proportional, Integral & Derivative (PID), PLC interface, and Industrial process example.

Unit 04: Applications of PLC **(8 hrs)**

PLC interface to various circuits : Encoders, transducer and advanced sensors (Thermal, Optical, Magnetic, Electromechanical, Flow, Level sensors)

Measurement of temperature, flow, pressure, force, displacement, speed, level

Developing a ladder logic for Sequencing of motors, Tank level control, ON OFF temperature control, elevator, bottle filling plant, car parking

Motors Controls: AC Motor starter, AC motor overload protection, DC motor controller, Variable speed (Variable Frequency) AC motor Drive.

Unit 05: SCADA Systems: (8 hrs)

Introduction, definitions and history of Supervisory Control and Data Acquisition, typical SCADA system Architecture, Communication requirements, Desirable Properties of SCADA system, features, advantages, disadvantages and applications of SCADA. SCADA Architectures (First generation - Monolithic, Second generation - Distributed, Third generation – Networked Architecture), SCADA systems in operation and control of interconnected power system, Power System Automation (Automatic substation control and power distribution), Petroleum Refining Process, Water Purification System, Chemical Plant.

Unit 06: SCADA Protocols (7 hrs)

Open systems interconnection (OSI) Model, TCP/IP protocol, 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). Interfacing of SCADA with PLC.

Learning Outcomes:

Students will be able to

- Develop and explain the working of PLC with the help of a block diagram.
- Develop architecture of SCADA and explain the importance of SCADA in critical infrastructure.
- Execute, debug and test the programs developed for digital and analog operations.
- Reproduce block diagram representation on industrial applications using PLC and SCADA.

List of Experiments:[Instructions if any for conduction 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 10.
c) Experiments No. 11 to 14 are compulsory.
d) Any 1 experiment should be conducted from experiment number 15 to 18.

1. Interfacing of lamp & button with PLC for ON & OFF operation. Verify all logic gates.

2. Performed delayed operation of lamp by using push button.
3. UP/DOWN counter with RESET instruction.
4. Combination of counter & timer for lamp ON/OFF operation.
5. Set / Reset operation: one push button for ON & other push button for OFF operation.
6. DOL starter & star delta starter operation by using PLC.
7. PLC based temperature sensing using RTD.
8. PLC based thermal ON/OFF control.
9. Interfacing of Encoder with PLC (Incremental/Decremental)
10. PLC based speed, position measurement system.
11. PLC interfaced with SCADA & status read/command transfer operation.
12. Parameter reading of PLC in SCADA.
13. Alarm annunciation using SCADA.
14. Reporting & trending in SCADA system.
15. Tank level control by using SCADA.
16. Temperature monitoring by using SCADA.
17. Speed control of Machine by using SCADA.
18. Pressure control by using SCADA.

Industrial Visit:

Compulsory visit to SCADA and PLC based automation industry.

Text Books:

1. Gary Dunning, "Introduction to Programmable Logic Controllers", Thomson, 2nd Edition
2. John R. Hackworth, Frederick D., Hackworth Jr., "Programmable Logic Controllers Programming Methods and Applications", PHI Publishers
3. John W. Webb, Ronald A. Reis, "Programmable Logic Controllers: Principles and Application", PHI Learning, New Delhi, 5th Edition
4. Ronald L. Krutz, "Securing SCADA System", Wiley Publishing
5. Stuart A Boyer, "SCADA supervisory control and data acquisition", ISA, 4th Revised edition
6. Sunil S. Rao, "Switchgear and Protections", Khanna Publication
7. L.A. Bryan, E. A. Bryan, "Programmable Controllers Theory and Implementation" Industrial Text Company Publication, Second Edition

Reference books:

1. Batten G. L., "Programmable Controllers", McGraw Hill Inc., Second Edition
2. Bennett Stuart, "Real Time Computer Control", Prentice Hall, 1988
3. Doebelin E. O., "Measurement Systems", McGraw-Hill International Editions, Fourth Edition, 1990
4. Gordan Clark, Deem Reynders, "Practical Modern SCADA Protocols", ELSEVIER
5. Krishna Kant, "Computer Based Industrial Control", PHI
6. M. Chidambaram, "Computer Control of Process", Narosha Publishing
7. P. K. Srivstava, "Programmable Logic Controllers with Applications", BPB Publications
8. Poppovik, Bhatkar, "Distributed Computer Control for Industrial Automation", Dekkar Publications
9. S. K. Singh, "Computer Aided Process Control", PHI
10. Webb J. W, "Programmable Controllers", Merrill Publishing Company, 1988

Elective – I : 403143 : Special Purpose Machines

Teaching Scheme			**Examination Scheme**	
Lectures	**03**	**hrs/week**	**In-Sem Assessment**	**30**
Practical	**02**	**hrs/week**	**End-Sem Assessment**	**70**
			TW	**25**

Course Objectives:

- To gain knowledge of operation and performance of synchronous reluctance motors.
- To learn operation and performance of stepping motors.
- To understand operation and performance of switched reluctance motors.
- To familiarize with operation and performance of permanent magnet brushless D.C. motors.
- To illustrate operation and performance of permanent magnet synchronous motors.

Unit01: Generalised Machine Theory: (6 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: (6 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: (6 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 : (6 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: (6 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 **(6 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

Learning Outcomes:

Students will be able to

- Reproduce principal of operation of PMSM, Stepper motor, SRM, Switch reluctance and linear motors.
- Develop torque speed and performance characteristics of above motors
- Enlist application of these motors
- Demonstrate various control strategies.

Experiments:

Minimum 06 experiments should be conducted out of the list given below:

1. Experimental analysis of PMSM motor drive.
2. Experimental analysis of BLDC (Trapezoidal Motor) Drive.
3. Experimental analysis of Switched Reluctance Motor Drive.
4. Experimental analysis of Synchronous Reluctance Motor Drive.
5. Experimental analysis of Stepper Motor Drive.
6. Laboratory demonstration of Linear Induction Motor.
7. Simulation of PMSM/BLDC drive.
8. Simulation of Switched Reluctance Drive.
9. Software programing for abc-αβ and αβ-dq transformations.

Text Books :

1. K. Venkatratnam, 'Special Electrical Machines', University Press
2. A.E. Fitzgerald Charles Kingsley, Stephen Umans, 'Electric Machinery', Tata McGraw Hill Publication
3. T.J.E. Miller, 'Brushless Permanent magnet and Reluctance Motor Drives' Clarendon Press, Oxford 1989.
4. V. V. Athani, 'Stepper Motors: Fundamentals, Applications and Design', New age International, 1997.

Reference Books :

1. R Krishnan, 'Permanent Magnet Synchronous and Brushless D.C. Motor Drives' CRC Press.
2. Ion Boldea, 'Linear Electric Machines, Drives and maglevs' CRC press
3. Ion Boldea S. Nasar, 'Linear Electrical Actuators and Generators', Cambridge University Press.

Elective – I : 403143:Power Quality

Teaching Scheme			Examination Scheme	
Lectures	03	hrs/week	In-Sem Assessment	30
Practical	02	hrs/week	End-Sem Assessment	70
			TW	25

Course Objectives:

- To develop ability to identify various power quality issues
- To Understand relevant IEEE standards
- To illustrate various PQ monitoring techniques and instruments
- To learn and characterize various PQ problems
- To identify different mitigation techniques

Unit 01: Basics of power quality and standards (6 hrs)

Introduction and importance of Power Quality, symptoms of poor power quality. Various power quality issues such as transients, short duration voltage variations, long duration voltage variations, voltage imbalance, voltage fluctuations, voltage flicker and waveform distortion. Relevant power quality standards such as IEEE 1159- 2009 and IEEE 519- 2014. Grounding and power quality issues.

Unit 02: Voltage sag (6 hrs)

Origin of voltage sags and interruptions, voltage sag characteristics- magnitude, duration, phase angle jump, point on wave initiation and recovery, missing voltage. Area of vulnerability, equipment behaviour under voltage sag, ITIC curve, voltage sag monitoring and mitigation techniques.

Unit 03: Transient Over Voltages and Flickers (6 hrs)

Classification of transients, sources of transient over voltages, computer tools for transient analysis, techniques for over voltage protection.
Voltage flickers – sources of flickers, quantifying flickers and mitigation techniques.

Unit 04: Fundamentals of Harmonics (6 hrs)

Harmonic distortion – voltage and current distortion, power system quantities under non sinusoidal condition – active, reactive and apparent power, power factor – displacement and true power factor, harmonic phase sequences and triplen harmonics, harmonic indices, sources of harmonics, effect of harmonic distortion

Unit 05 : Measuring and control of harmonics (6 hrs)

Concept of point of common coupling and harmonic evaluation, principles of controlling harmonics, Harmonic study procedures and computer tools for harmonic analysis, Devices for controlling harmonic distortion design of filters for harmonic reduction.

Unit 06 : Measuring and solving power quality problems **(6 hrs)**

Introduction, power quality measurement devices – harmonic analyzer, transient disturbance analyzer, oscilloscopes, data loggers and chart recorders, true rms meters, power quality measurements, number of test location, test duration, instrument setup and guidelines.

Learning Outcomes:

Students will be able to

1. Characterize power quality events.
2. Reproduce causes of voltage sag and estimate magnitude of voltage sag.
3. Carry out harmonic analysis and calculate total harmonic distortion.
4. Calculate parameters for passive harmonic filter.

List of Experiments:

Minimum 8 experiments are to be performed from the following list:

1. Study of power quality monitor / analyzer
2. Measurement of harmonic distortion of Desktop / computer and allied equipment
3. Measurement of harmonic distortion of CFL or FTL with electronic ballast and magnetic ballast.
4. Harmonic analysis of no load current of a single phase transformer
5. Analysis of performance of three phase induction motor operated with sinusoidal supply and under distorted supply conditions supplied by 3 phase inverter
6. Analysis of performance of single phase transformer operated with sinusoidal supply and under distorted supply conditions supplied by 1 phase inverter.
7. Measurement of sag magnitude and duration by using digital storage oscilloscope
8. Design of passive harmonic filter – computer simulation for power electronic application
9. Design of active harmonic filter – computer simulation for power electronic application
10. Simulation studies of harmonic generation sources such as VFD, SVC, STATCOM and FACTS devices and harmonic measurement (THD) by using MATLAB
11. Power quality audit of institute or department

Text Books:

1. J. Arrillaga, M. R. Watson, S. Chan, "Power System Quality Assessment", John Wiley and Sons
2. M. H. J. Bollen, "Understanding Power Quality Problems, Voltage Sag and Interruptions", New York: IEEE Press, 2000, Series on Power Engineering.
3. R. C. Dugan, Mark F. McGranghan, Surya Santoso, H. Wayne Beaty, "Electrical Power System Quality", 2nd Edition, McGraw Hill Publication.

Reference Books:

1. Enriques Acha, Manuel Madrigal, "Power System Harmonics: Computer Modeling & Analysis", John Wiley and Sons Ltd.
2. Ewald F. Fuchs, Mohammad A. S. Masoum, "Power Quality in Power Systems and Electrical Machines" Elsevier Publication.
3. G. J. Heydt, "Electric Power Quality", Stars in Circle Publications
4. IEEE Std. 519-1992, IEEE recommended practices and requirements for harmonics control in electrical power system.

Elective- I : 403143: Renewable Energy Systems

Teaching Scheme		Examination Scheme	
Lectures :	**03 hrs/week**	**In-Sem Assessment :**	**30**
Practical :	**02 hrs/week**	**End Sem Assessment :**	**70**
		TW	**: 25**

Prerequisite:

Knowledge of basic renewable sources like solar, wind, biogas, fuel cell, Knowledge of conventional grid,

Course Objectives:

- 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 teach different Storage systems, Integration and Economics of Renewable Energy System.

Unit 01 : Solar Thermal **(6 hrs)**

Solar radiation at the earth's surface, Solar constant, Spectral distribution, Extraterrestrial Radiation, Solar Terrestrial Radiation, Solar radiation geometry, Computation of cosθ for any location having any orientation, Empirical equations for predicting the availability of solar radiation: 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, Devices for thermal collection and storage, Thermal applications, designing and Performance analysis of liquid flat plate collector for given heat removal factor and loss coefficient. Introduction to concentrating solar power (CSP) plants using technologies like a) Parabolic troughs b) Linear Fresnel reflector, c) Paraboloid Dish, etc.

Unit 02 : Solar Photovoltaic **(6 hrs)**

Introduction to family of solar film technology, Single c-Si, Poly c-Si PV Cell, Module and Array, Array Design (factors influencing the electrical design of the solar array) : 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, MPPT of solar system, PV system designing, PV powered water pumping.

Unit 03 : Wind Energy System **(6 hrs)**

Power Contained in Wind, Thermodynamics of Wind Energy, Efficiency Limit for Wind Energy Conversion, Maximum Energy obtained for a Thrust-operated converter (Efficiency limit), Design of Wind Turbine Rotor, Power-Speed Characteristics, Torque-Speed Characteristics, Wind Turbine Control Systems: a) Pitch Angle Control, b) Stall Control, c) Power Electronics Control, d) Yaw Control, Control Strategy, Wind Speed Statistics, Statistical Wind Speed

Distributions, Site and Turbine Selection, Extraction of wind energy and wind turbine power. Introduction to Offshore Wind Energy System and its comparison with Wind Energy System,

Unit 04 : Biomass Energy System **(6 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, designing of biogas plant
Power Generation from Municipal Solid Waste (MSW), Land Fill Gas, Liquid Waste.

Unit 05 : Fuel cell and Storage Systems **(6 hrs)**

a) Fuel Cells: Operating principles of Fuel Cell, Fuel and Oxidant Consumption, Fuel Cell System Characteristics, Introduction to Fuel Cell Technology and its type, application and limits.

b) 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.
Introduction to other storage technologies: pump storage, SMES, compressed air storage

Unit 06 : Integration and Economics of Renewable Energy System **(6 hrs)**

a) Integration of RES with grid, standards. Grid codes
b) Economics of RES: Simple, Initial rate of return, time value, Net present value, Internal rate of return, Life cycle costing, Effect of fuel Escalation, Annualized and levelized cost of energy.

Learning Outcomes:
Students will be able to

- Write theory of sources like solar, wind and also experiments of same.
- Analyze operating conditions like stand alone and grid connected of renewable sources,
- Reproduce different Storage Systems, concept of Integration and Economics of Renewable Energy System

List of Experiments

Minimum 08 experiments should be conducted out of the list given below:
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. Field visit to Renewable Energy Sources locations or Manufacturing Industry.
14. To evaluate efficiency of DFIG System (Hardware setup only).

Text Books:

1. S.P. Sukhatme, “Solar Energy”, Tata McGraw Hill
2. Mukund R. Patel, “Wind and Power Solar System”, CRC Press
3. Tony Burton, Nick Jenkins, David Sharpe, “Wind Energy Hand Book-Second Edition”, John Wiley & Sons, Ltd., Publication
4. Godfrey Boyle, “Renewable Energy”, Third edition, Oxford University Press
5. Gilbert M. Masters, “Renewable and Efficient Electrical Power Systems”, Wiley - IEEE Press, August 2004
6. Chetan Singh Solanki, “Solar Photovoltaics-Fundamentals, Technologies and Applications”, PHI Second Edition
7. H. P. Garg, J. Prakash, “Solar Energy-Fundamentals and Applications”, Tata McGraw hill Publishing Co. ltd., First Revised Edition.

Reference books:

1. D.P.Kothari, K.C.Singal, Rakesh Rajan,“Renewable Energy Sources and Emerging Technologies”, PHI Second Edition
2. Paul Gipe, “Wind Energy Comes of Age”, John Wiley & Sons Inc.
3. Donald L.Klass, “Biomass for Renewable Energy, Fuels, and Chemicals, Elsevier, Academic Press
4. S. Rao, Dr. B. B. Parulekar, “Energy Technology – Non Conventional, Renewable and Conventional”, Khanna Publication.
5. Tapan Bhattacharya, “Terrestrial Solar Photovoltaics”, Narosa Publishing House.
6. Thomas Ackermann, “Wind Power in Power Systems”, Wiley Publications.
7. B T.Nijaguna, “Biogas Technology”, New Age International Publishers.

Elective- I : 403143: Digital Signal Processing

Teaching Scheme	Examination Scheme
Lectures : 03 Hrs/week	**In-Sem Assessment : 30 Marks**
Practical : 02 Hrs/week	**End Sem Assessment : 70 Marks**
	TW : 25 marks

Prerequisite: Knowledge of basic signals and systems

Course Objectives:

- To elaborate Sampling theorem, classification of 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

Unit 01: **Classification of Signals:** **(6 hrs)**
Analog, Discrete-time and Digital, 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, ROC and its properties:** **(6 hrs)**
Z transform properties: Linearity, time shifting, multiplication by exponential sequence, differentiation, conjugation, time reversal, convolution, initial value theorem, Unilateral Z-transform: , Inverse z transform by inspection, partial fraction, power series expansion and complex inversion, solution of difference equation

Unit 03: 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 **(6 hrs)**

Unit 04: **Sampling the F.T., Fourier representation of finite-duration sequences:** **(6 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:** **(6 hrs)**
Ideal frequency selective filters, Concept of filtering, specifications of filter, IIR filter design from continuous time filters: Characteristics of Butterworth, and

Cheybyshev, impulse invariant and bilinear transformation techniques, Design examples, Basic structures for IIR Systems: direct form, cascade form

Unit 06: FIR filter design using windows: properties of commonly used windows, Design Examples using rectangular, hamming and hanning windows. Basic Structures for FIR Systems: direct form. Comparison of IIR and FIR Filters **(6 hrs)**

Applications: Measurement of magnitude and phase of voltage, current, power and frequency, power factor correction, harmonic Analysis & measurement, applications to machine control, DSP based protective relaying.

Learning Outcomes:

Student will be able to

- Sample and reconstruct any analog signal
- Find frequency response of LTI system
- Find Fourier Transform of discrete signals
- Design of IIR & FIR filter and implementation of them

List of Experiments:[Total eight experiments are to be performed]
Note: Perform the practical using C language or any other professional software for group A & 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 & Phase)
4. Verification of Z-transform properties (any two)

GROUP-B (Any Four)
1. Find DFT & 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:

1. Proakis J., Manolakis D., “Digital signal processing”, 3rd Edition, Prentice Hall, ISBN 81- 203-0720-8
2. P. Ramesh Babu, “Digital Signal Processing”, 4th Edition Scitech Publication
3. Dr.S. D. Apte,”Digital Signal Processing”,2nd Edition Wiley India Pvt. Ltd ISBN: 978-81-265-2142-5
4. 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:

1. Mitra S., “Digital Signal Processing: A Computer Based Approach”, Tata McGraw-Hill, 1998, ISBN 0-07-044705-5
2. A.V. Oppenheim, R. W. Schafer, J. R. Buck, ”Discrete Time Signal Processing”, 2nd Edition Prentice Hall, ISBN 978-81-317-0492-9

Elective-II: 403144: Restructuring and Deregulation

Teaching Scheme		**Examination Scheme**	
Lectures	**03 hrs/week**	**In-Sem Assessment**	**30**
		End-Sem Assessment	**70**

Course Objectives:

- To educate students about the process of restructuring of power system
- To familiarize students about the operation of restructured power system
- To teach students pricing of electricity
- To gain knowledge of fundamental concept of congestion management
- To analyze the concept of locational marginal pricing and transmission rights.
- To provide in-depth understanding of operation of deregulated electricity market systems.

Unit 01: Power Sector in India (6 hrs)

Institutional structure before reforms. Roles of various key entities in India. Necessity of Deregulation or Restructuring. RC Act 1998 and Electricity Act 2003 and its implications for Restructuring & Deregulation. Institutional structure during reform. National Energy policy. Introduction to Energy Exchange and trading of Renewable Energy Credits and Carbon Credits.

Unit 02: Power Sector Economics (6 hrs)

Introduction to various concepts such as capital cost, debt and equity, depreciation, fixed and variable costs, working capital, profitability indices etc. 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. Principles of Tariff setting, Phases of Tariff determination, consumer tariff & non-price issues.

Unit 03: Power Sector Regulation (6 hrs)

Regulatory process in India, types and methods of Regulation, cost plus, performance-based regulation, price cap, revenue cap regulation, rate of return regulation, benchmarking or yardstick regulation. Role of regulatory commission. Considerations of socio economic aspects in regulation.

Unit 04: Introduction to Power Sector Restructuring (6 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, ownership models, ISO models. Competition for the market vs competition in the market, International experience with electricity reform – Latin America, Nordic Pool, UK, USA, China and India. California Energy Crisis.

Unit 05: Electricity Markets (6 hrs)

Trading **–** electricity market places, rules that govern electricity markets, peculiarity of electricity as a commodity, various models of trading arrangements – integrated trading model, wheeling trading model, decentralized trading model. Various electricity markets such as spot, day ahead, forward, future options, reserve, ancillary services market. Market operation, settlement process, Market Clearing Price (MCP), Market power, market efficiency. Spot, dynamic and locational pricing.

Unit 06: Transmission Pricing & Transmission Congestion Issues (6 hrs)

Cost components of transmission system, Transmission pricing methods. Cost of transmission services, physical transmission rights. Pricing and related issues. Congestion in power network, reasons for congestion, classification of congestion management, useful definitions. Methods of congestion management, Locational marginal Pricing (LMR), Firm Transmission Right (FTR). Availability based Tariff (ABT) in India.

Learning Outcomes: Student will be able to

- Describe the process of restructuring of power system
- Identify various operation of restructured power system
- Analyze Fundamental concept of congestion management.
- Analyze pricing and transmission rights of Electricity**.**
- Analyze various cost components in Generation, transmission, distribution sector and tariff

Text Books:

1. Lei Lee Lai, " Power System Restructuring and Deregulation" John Wiley and Sons UK, 2001
2. "Know Your Power:, A citizen Primer on the electricity Sector, Prayas Energy Group, Pune

Reference books:

1. Sally Hunt, "Making Competition Work in Electricity", 2002, John Wiley Inc
2. Steven Stoft, " Power System Economics: Designing Markets for Electricity", John Wiley & Sons, 2002
3. Mohammad Shahidehpour, Muwaffaq Alomoush, "Restructured Electrical Power Systems: Operation Trading and Volatility" CRC Press, 06-Jun-2001.
4. Kankar Bhattacharya, Math Bollen, Jaap E. Daalder, "Operation of Restructured Power Systems" Springer US, 2012.
5. H. Lee Willis, Lorrin Philipson, "Understanding Electric Utilities and De-regulation" CRC Press, 31-Oct-2014.
6. Daniel S. Kirschen, Goran Strbac, "Power System Economics" John Wiely & Sons Publication Ltd. August 2006.
7. Geoffrey Rothwell, Tomas Gomez, "Electricity Economics Regulation and Deregulation" A John Wiley & Sons Publication 2003.
8. Mohammad Shahidehpour, Hatim Yamin, Zuyi Li, "Market operations in Electric Power System" A John Wiley & Sons Publication.

Elective-II: 403144: Electromagnetic Fields

Teaching Scheme		**Examination Scheme**	
Lectures	**03 hrs/week**	**In-Sem Assessment**	**30**
		End-Sem Assessment	**70**

Prerequisite: Vector Algebra, Coordinate system, Magnetic field Intensity, Fundamental relations for Electrostatic and Magnetostatic fields

Course Objectives:

- To impart knowledge on the basics of Static Electric and Static Magnetic Field and the associated laws.
- To understand the boundary conditions
- To analyze time varying electric and magnetic fields.
- To understand Maxwell's equation in different form and media.
- To give insight to propagation of EM waves

Unit01: Static Electric Field **(6 hrs)**

Gradient, Divergence basics, Curl, the vector operator del, Divergence theorem, Coulombs law, Electric field intensity, Point, Line, Surface and Volume charge distributions, Electric flux density, Gauss law and its applications, Gauss divergence theorem, Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density.

Unit 02: Conductors, Dielectrics and Capacitance **(6 hrs)**

Current and current density, Continuity of current, Boundary conditions of perfect dielectric materials, Boundary conditions for perfect dielectric materials, Capacitance, Capacitance of a two wire line, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation, Application of Laplace's and Poisson's equations.

Unit 03: Static Magnetic Fields **(6 hrs)**

Biot -Savart Law, Ampere's Circuital Law, Curl, Stokes theorem, Magnetic flux and magnetic flux density, The Scalar and Vector Magnetic potentials, Derivation of Steady magnetic field Laws.

Unit 04: Magnetic Forces, Materials and Inductance **(6 hrs)**

Force on a moving charge, Force on a differential current element, Force between differential current elements, Force and torque on a closed circuit, The nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, The magnetic circuit, Potential energy and forces on magnetic materials, Inductance and mutual inductances.

Unit 05: Time Varying Fields and Maxwell's Equations **(6 hrs)**

Faraday's law for Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces.

Unit 06: Electromagnetic Waves **(6 hrs)**

Derivation of Wave Equation – Uniform Plane Waves – Maxwell's equation in Phasor form – Wave equation in Phasor form – Plane waves in free space and in a homogenous material.

Wave equation for a conducting medium – Plane waves in lossy dielectrics –Propagation in good conductors – Skin effect. Poynting's theorem.

Outcomes:

Students will be able to:

- Interpret Electric and Magnetic Field with the help of associated laws
- Solve electromagnetic problems with the help of mathematical tools
- Solve simple electrostatic and magnetic boundary conditions
- Analyze and solve electromagnetic problems using Maxwell's equations

Text Books:

1. W H.Hayt & J A Buck: "Engineering Electromagnetics" TATA McGraw-Hill, 7th Edition 2007.
2. S. P. Ghosh, Lipika Datta, "Electromagnetic Field Theory" McGraw-Hill Education India Private Limited.
3. Matthew N.O. Sadiku, "Principles of Electromagnetics", Oxford University Press Inc, New Delhi, 2009.
4. Edward C. Jordan and Keith G. Balmain, "Electromagnetic waves and Radiating Systems", PHI, 2nd Edition.

Reference books:

1. Ashutosh Pramanik, " Electromagnetism", PHI Learning Private Limited, 2014
2. Kraus Fleisch, "Electromagnetics with applications", McGraw Hill, 5th Edition.
3. Bhag Singh Guru, Huseyin R. Hiziroglu, "Electromagnetic Field Theory Fundamentals", Cambridge University Press, 2nd Edition.

Elective-II: 403144: EHV AC Transmission

Teaching Scheme

Lectures 03 hrs/week

Examination Scheme

In-Sem Assessment 30

End-Sem Assessment 70

Course Objectives:-

- To understand the need of EHV and UHV systems.
- To describe the impact of such voltage levels on the environment
- To know problems encountered with EHV and UHV transmissions
- To know methods of governance on the line conductor design, line height and phase etc.

Unit 01 EHV ac transmission lines (6 hrs)

Need for EHV transmission lines, Power handling capacity and line loss, Examples on giant power pools and number of lines, 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 (6 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. Sequence inductances and capacitances, Diagonalization.

Unit 03 Voltage gradient of conductors (6 hrs)

Electrostatic Field of a point charge and its properties, Field of sphere gap, Field of line charges and their properties, Corona inception gradients, 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 (6 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 **(6 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, increase in effective radius of conductor and coupling factors, attenuation of travelling waves due to corona loss. Audible noise operation and characteristics limits for audible noise, AN measurement and meters, microphone, weighting networks. Formulae for audible noise and use in design, relation between single phase and three phase AN levels.

Design of cylindrical cages for corona experiments-single conductor concentric with cylinder, single conductor with eccentricity.

Unit 06: **(6 hrs)**

A) Design of EHV lines

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, Typical insulation thickness for ehv cables, Properties of cable insulation materials.

Learning outcomes:-

Student will be able to

- Highlight need for EHV ac transmission.
- Calculate line and ground parameters.
- Enlist problems encountered in EHV transmission.
- Express issues related to UHV transmission discussed.

Text books:-

1) Rakoshdas Begamudre "Extra high voltage transmission", New Age International publishers.

Reference books:-

1) S. Rao , "EHV AC and DC Transmission" Khanna publication.

.

Elective-II: 403144: Introduction to Electrical Transportation Systems

Teaching Scheme		**Examination Scheme**	
Lectures	**03 hrs/week**	**In-Sem Assessment**	**30**
		End-Sem Assessment	**70**

Prerequisite:-

Conversion of electric energy, DC and AC circuit analysis, power electronic conversion, electrical motors, Battery.

Course Objectives:-

- To make students understand the importance and various modes of electric transportation systems such as electric traction, hybrid vehicle and elevators etc.
- To differentiate various source of energy used in transportation and their performance characteristics.
- To impart knowledge about different power and energy converters.
- To classify the different controls used in electric vehicles.
- To demonstrate the knowledge about electric cars and elevators.

Unit 01: General Review of Transportation **(6 hrs)**

Need and importance of mobility, various modes of transportation, evolution of transportation system, Horse carriages to steam engines to internal combustion engines to electric vehicles, advantages and disadvantages of electric mobility, various application of electric mobility such as electrical traction, hybrid electric and electric vehicles, elevators, personal mobility and special applications such as wheel chairs, future concepts.

Unit 02: EV- Basic Building Blocks **(6 hrs)**

Various sources of energy used in transportation and their characteristics, Conventional vehicle power transmission systems. Energy conversions module integrations and their operation. Different types of Batteries & their operation. Types of batteries, their characteristics, charging and discharging of batteries, round trip efficiency, ability to deliver instantaneous power, load cycle and its effect on battery performance, environmental impact of batteries, power quality issues related to charging of batteries. Different load characteristics (Specifically road characteristics)

Unit 03: Power module & Energy converters **(6 hrs)**

Need for power converters, basic power electronic blocks, AC/DC, DC/DC, DC/AC modules.
Types of mechanical drives, conversion of electrical energy into mechanical energy, characteristics of various types of drives, BLDC machines, AC machines, DC machines, mechanical drive / power train

Unit 04: Control system and instrumentation **(6 hrs)**

Function of instrumentation and control system, speed control, acceleration characteristics, mechanical steering versus electric steering, motion control, driverless vehicles, road safety and traffic control and monitoring, emerging trends

Unit 05: **(6 hrs)**

Electric cars

Emerging trend, typical power train architecture, hybrid cars, acceleration and speed characteristics,

Traction

Introduction to Modern AC traction for high speed rail application, their control and performance under different operating conditions. Comparison of AC/DC traction.

Unit 06 : Elevators **(6 hrs)**

Load characteristics of elevator systems, Introduction to control schemes in elevators with new power-electronics controlled drives, considerations for energy efficient systems.

Special vehicles, basic concepts and emerging trend

Course Outcomes:- Students will be able to

- Select between alternative modes for electric transportation system.
- Explain various types of energy storage devices and their impact on electrified transportation.
- Explain various power and energy converters in transportation system.
- Analyze different control systems used in electric vehicles.
- Describe different characteristics of electric car and elevators.

Text Books:

1. James Larminie and John Lowry, "Electrical Vehicle" John Wiley & Sons, 2012.
2. Mark Warner, "The Electric Vehicle Conversion handbook" –HP Books, 2011.
3. Iqbal Husain, "Electric & Hybrid Vehicles-Design Fundamentals", Second edition, CRC press
4. D. A. J. Rand, R. Woods R. M. Dell, "Batteries for Electric Vehicles", New York, John Wiley and Sons.

Reference Books:

1. Mehrdad Ehsani, Yimin Gao and Ali Emadi, "Modern Electrical Hybrid Electric and Fuel Cell Vehicles: Fundamental, Theory and Design", CRC Press, 2009.
2. Burch Edward P., "Electric Traction for Railway Trains" McGraw Hill, 1911.
3. H.Partab, "Modern Electric Traction"–Dhanpat Rai & Sons, 1973.
4. Barney, George C., "Elevators Technology" international Association of Elevator Engineers by Ellis Harwood, 1986.

403145: Control System - II

Teaching Scheme			Examination Scheme	
Lectures:	**03**	**hrs/week**	**In-Sem Assessment**	**30**
Practical:	**02**	**hrs/week**	**End-Sem Assessment**	**70**
			Oral :	**25**
			TW:	**25**

Course Objectives:

- To learn the concept of compensation and to realize compensator for a system using active and passive elements.
- To understand the concept of state and to be able to represent a system in the state space format and to solve the state equation and familiarize with STM and its properties.
- To design a control system using state space techniques including state feedback control and full order observer.
- To familiarize with various nonlinearities and their behaviour observed in physical system and to understand the Describing function method and phase plane method.
- To understand the basic digital control scheme, the concept of sampling and reconstruction. To be able to analyze and design a digital control system including realization of digital controllers.

Unit 01: Compensation Technique **(6hrs)**

Approaches and preliminary consideration. Design of Linear Control System, Common compensating network, Transfer function of Lag, Lead and Simple lag-lead network. Design using Bode diagram. Physical realization of compensators using active and passive elements.Tachometer feedback compensation

Unit 02 : Introduction to state space analysis **(6 hrs)**

Important definitions – state, state variable, state vector, state space, state equation, output equation. State space representation for electrical network, n^{th} order differential equation, and transfer function. Conversion of transfer function to state model and vice versa. Concept of diagonalization, eigen values, eigenvectors, diagonalization of system matrices with distinct and repeated eigen values, Vander Monde 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.

Unit 03: Design of Control System Using State Space Technique: **(6 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.

Unit 04 : Non linear Control System Analysis **(6 hrs)**

Introduction, classification, common type of non-linearities observed in physical systems, peculiar behavior of nonlinear system- Spurious (subharmonics) response, jump resonance, limit cycle, amplitude as function of frequency oscillation, non linear spring mass system, sub harmonic oscillation, asynchronous quenching, frequency entrainment etc.

Analysis of NLCs using phase plane and describing methods for Ideal Relay

Unit 05: Digital Control System **(6 hrs)**

Introduction, Configuration of the basic digital control scheme. Advantages and limitations of digital control; data conversion and quantization, Sampling & Reconstruction processes, Shannon's Sampling theorem, practical aspects of choice of sampling rate. Zero order hold (ZOH) and it's transfer function, Review of z-transform, difference equations and solution using z transform method.

Unit 06 : Analysis and Design of Digital Control System **(6 hrs)**

Pulse transfer function and z transfer function, General procedure for obtaining Pulse-transfer-function, pulse transfer function of ZOH, 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, Digital PID controller.

Learning outcomes:

Students will able to

- Design and realize a compensator for a physical system,
- Represent a physical system in state space format and analyze the same and to realize a controller using state space technique.
- Analyze understand the various nonlinearities in a physical system.
- Realize digital control schemes.

Experiments:

Set-A: (Compulsory)

1. Op-amp based realization of highly underdamped second order plant. Find out frequency response of the system experimentally
2. Design a lead/lag compensator for given specifications for the plant in Experiment1 using MATLAB.
3. Realize the compensator designed in experiment 2 using op-amp circuits and find out frequency response of the plant and the compensator in closed loop and verify step and frequency response.

Set B: (Any five)

1) Check for observability and Controllability in MATLAB.
2) Verify State feedback control using pole placement.
3) Convert a continuous time system into digital control system and check response using software.
4) Design State observer and validate it by software.
5) Software programming for determination of state space representation for given transfer function and vice-versa
6) Software programming for determination of STM.
7) Study of non linearities using OPAMPs and verification of those by software.
8) Implementation of digital PID controller for physical system.
9) Effect of sampling and verification of sampling theorem.

Text Books:

1. J. Nagrath, M. Gopal "Control System Engineering", 5th Edition. New Age International Publishers
2. Benjamin C. Kuo, "Automatic Control Engineering", Prentice Hall of India Pvt. Ltd.
3. Benjamin C. Kuo "Digital Control System", Prentice Hall of India Pvt. Ltd.

Reference Books:

1. K. Ogata, "Modern Control Engineering", Prentice Hall of India Pvt. Ltd.
2. M. Gopal, "Digital Control and State Variable Methods", Tata McGraw-Hill.
3. M. N. Bandyopadhyay, "Control Engineering – Theory and Practice", Prentice Hall of India Ltd. Delhi.

403146: Project I

Teaching Scheme		Examination Scheme
Tutorial	**2 hrs/Week**	**Oral : 50**

The student shall take up a project in the field closely related to Electrical Engineering. An individual can undertake project . Preferably, a group of 3 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 project work. 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, experimental, design and validation.
4. To define problem, objectives, scope and it's outcomes.
5. To design scheme of implementation of project.
6. Data collection, simulation, design, hardware if any need to be completed.
7. Presentation based on partially completed work.
8. Submission of report based on the work carried out.

403147: Switchgear and Protection

Teaching Scheme		Examination Scheme	
Lectures:	**04 hrs/week**	**In-Sem Assessment**	**30**
Practical:	**02 hrs/week**	**End-Sem Assessment**	**70**
		Oral :	**25**
		TW:	**50**

Prerequisite:

1. Different types of faults in power system
2. Various switchgears and their use in substation
3. Principle and working of rotating machines and transformer with vector groups

Course Objectives:

- To elaborate construction and working principle of different types of HVCBs
- To describe the need of protective Relaying and operating principles of different types of relays.
- Study different type of faults in transformer, alternator and various protective schemes related to them.
- Learn transmission line protection schemes, and characteristics of different types of distance relays

Unit 01 : Fundamentals of protective relaying (8 hrs)

Need for protective system, nature & 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 & 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: (8 hrs)

Ionization of gases, deionization, Electric arc formation , Current interruption in AC circuit breaker, high & 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 (7 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:

A) Protection against overvoltage due to lightning: **(8 hrs)**

Overvoltage, causes of overvoltage, Lightning phenomenon, wave shape of lightning stroke, direct & indirect strokes, protection of overhead transmission lines from direct lightning strokes, Lightning arresters, rod gap type, horn gap type, Thyrite type, Metal oxide (ZnO) type lightning arrester.

B) Static & Digital Relaying

Overview of Static relay, block diagram, operating principal, merits & demerits of static relay. Numerical Relays :-Introduction, Block diagram of numerical relay, Sampling theorem, Anti – Aliasing Filter, Block diagram of PMU

Unit 05: **(9 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.

C) 3 Phase Induction Motor Protection- Abnormal conditions & causes of failures in 3 phase Induction motor, single phasing protection, Overload protection, Short circuit protection.

UNIT-06: **(8 hrs)**

A) **Bus bar Protection:** Differential protection of bus bars. Selection of C.T. ratios for bus bar protection. High impedance differential relay.

B) Transmission line: over current protection for feeder using directional &non-directional overcurrent relays, Introduction to distance protection, impedance relay, reactance relay, mho relay & 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. Realisation of distance relays (impedance, reactance and mho relay) using numerical relaying algorithm (flowchart, block diagram), Introduction to Wide Area Measurement (WAM) system.

Learning Outcomes:

Student will be able to

- Describe arc interruption methods in circuit breaker.

- Derive expression for restriking voltage and RRRV in circuit breaker
- Explain Construction, and working of different high voltage circuit breakers such as ABCB, SF_6 CB, and VCB.
- 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
- Describe various protection schemes used for transformer, alternator and busbar
- Describe transmission line protection schemes.

List of Experiments:

Minimum **8 Experiments** to be performed from the following list:

3. Study of switchgear testing kit.
4. Study of Fuse, MCB & their testing.
5. Study & testing of contactors.
6. Study & testing of MCCB.
7. Study & testing of ACB.
8. Study & testing of thermal overload relay for Induction Motor protection.
9. Study & plotting Characteristics of IDMT type Induction over current relay
10. Study & plotting Characteristics of digital over current relay
11. Percentage differential protection of transformer.
12. Protection of alternator.
13. Protection of Transmission line using Impedance relay
14. Study of various LT switchgears like RCCB, timers.

Industrial Visit:

Report on industrial visit to switchgear training centre /or switchgear/relay manufacturing unit/ or 220 kV substation visit.

Text Books:

1. S. Rao, “Switchgear Protection & Power Systems”, Khanna Publications
2. Y. G. Paithankar, S. R. Bhide, “Fundamentals of Power System Protection”, Prentice Hall of India
3. Bhavesh Bhalja, R.P. Maheshwari, N.G. Chothani,” Protection and Switchgear”, Oxford University Press, 2011 Edition.

Reference Books:

1. Badri Ram, D. N. Vishwakarma, “Power System Protection & Switchgear”, Tata McGraw Hill Publishing Co. Ltd.
2. J. Lewis Blackburn , Thomas J. Domin, “Protective Relaying: Principles and Applications”, Fourth Edition, CRC Press.
3. 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
4. A.G. Phadke and J.S. Thorp , Computer relaying for Power System, Research Studies Press LTD, England.(John Willy & Sons Inc New York)
5. Crussel Mason, “The Art and Science of Protective Relaying”, Wiley Eastern Limited.

403148: Power Electronic Controlled Drives

Teaching Scheme		Examination Scheme	
Lectures	**04 hrs/week**	**In-Sem Assessment**	**30**
Practical	**02 hrs/week**	**End-Sem Assessment**	**70**
		Practical	**50**
		TW	**25**

Prerequisites:

1. Construction, working and characteristic of different electrical motors
2. Power Electronic Applications such as converter, inverter, chopper etc.
3. Basic concept of control system

Course Objectives:

- To understand the stable steady-state operation and transient dynamics of a motor-load system.
- To study and analyze the operation of the converter, chopper fed dc drive.
- To study and understand the operation of both classical and modern induction motor drives.
- To study and analyze the operation of PMSM and BLDC drives.
- To analyze and design the current and speed controllers for different drives

Unit 01: Electrical Drives **(8 hrs)**

Definition, Advantages of electrical drives, Components of Electric drive system, Selection Factors, Types of Electrical Drives (DC & AC). Motor-Load Dynamics, Speed Torque conventions and multi quadrant operation, Equivalent values of drive parameters. Load Torque Components, Nature and classification of Load Torques, Constant Torque and Constant Power operation of a Drive. Steady state stability, Load equalization by using flywheel.

Unit 02: DC Motor Drives **(8 hrs)**

Starting and braking methods, characteristics of DC Motors: Rheostatic, Plugging, and Regenerative.

Single phase and three phases fully controlled converter drives and performance of converter fed separately excited DC Motor for starting and speed control operations. Chopper controlled drives for separately excited and series DC Motor operations. Closed loop speed control of DC motor below and above base speed.

Unit 03: Induction Motor Drives-I **(8 hrs)**

DC Dynamic Braking, Plugging, Regenerative Braking, AC Rheostatic braking, motor braking methods using static devices. Closed loop control of drives: current limit control, torque control and speed control.

Thyristorised stator voltage control (using ac regulators, for fixed frequency variable voltage control), V/f control, voltage source inverter (VSI) control, Steady State Analysis

Unit 04: **Induction Motor Drives-II** **(8 hrs)**

Current source inverter (CSI) control-open and closed loop, Regenerative braking and multi quadrant operation of Induction motor drives, relative merits and demerits of VSI and CSI for induction motor drives. Principle of vector control, Vector control of induction motor, Commutator less DC Motor (How Induction Motor is converted to Characteristics of DC Motor),AC Servo Drives.

Unit 05: **Special Machine Drives** **(8 hrs)**

1. **Permanent Magnet Synchronous Motor Drive**: vector control of PM Synchronous Motor (PMSM), Control Strategies: constant torque angle control, unity power factor control, Speed controller design
2. **Permanent Magnet Brushless DC Motor Drive:** Half Wave drives, Sensorless control, Design of current and speed controller

Unit 06: **(8 hrs)**

A)Drive Selection: Selection criteria of motors, motor duties, inverter duty motors. Load diagram, Heating and cooling, Thermal Resistance, determination of HP rating of motor based on duty cycle

B)Industrial Applications: Process/operation—Requirements of load—Suitable Drive—Advantages in following applications: 1)Rolling mills 2)Machine tools 3)Textile mills 4)Sugar Mills 5) Centrifuged Pump, 6) Traction drives 7) Aeronautic applications 8) Electric and Hybrid Vehicle 9) Solar Pumps

Learning Outcomes:

On successful completion of this course students will be able to:

- Analyze the operation of the converter, chopper fed dc drive.
- Analyze the operation of both classical and modern induction motor drives.
- Design the current and speed controllers for a closed loop solid-state d.c motor drive
- Select the drives for any particular application

List of Experiments: Minimum eight experiments are to be performed out of the list mentioned as below:
GROUP A: Any THREE Experiments (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 three phase fully converter fed separately excited D.C. motor
4. Study of Chopper fed D.C. series/separately motor speed control characteristics.
5. Study of control characteristic of BLDC drive

GROUP B: Any THREE Experiments (Hardware)

1. Study of electrical braking of 3 phases Induction Motor (DC Dynamic Braking, Plugging).
2. Study of VSI fed 3 phase Induction motor (using V/f control PWM inverter) speed control characteristics.

3. Study of Solid state stator voltage control of 3 phase Induction motor (Using AC voltage Regulator).
4. Study of VSI fed PMSM control characteristics.
5. Study of constant torque and constant power characteristic of induction motor.

GROUP C: Any TWO Experiments (Software)

1. Simulation of starting characteristics of D.C. / 3 phase Induction motor.
2. Study of Closed loop speed control of separately excited D.C. motor/ Induction Motor.
3. Simulation of an electric drive system for steady state and transient analysis.
4. Simulation/programming of controller design of PMSM/BLDC

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:

1. G. K. Dubey, "Fundamentals of Electric Drives", 2nd Edition, Narosa Publishing House
2. N. K. De, P. K. Sen, "Electric Drives", Prentice Hall of India Eastern Economy Edition
3. S. K. Pillai, "Analysis of Thyristor Power Conditioned Motors", University Press
4. R. Krishnan, "Electric Motor Drives – Modeling Analysis and Control", PHI India

Reference books:

1. B. K. Bose, "Modern Power Electronics and AC Drives", Pearson Education
2. Malcolm Barnes, "Practical Variable Speed Drives and Power Electronics", Elsevier Newnes Publications
3. V. Subrahmanyam, "Electric Drives: Concepts & Application", Tata Mc-Graw Hill (An imprint of Elsevier)
4. M.D. Singh and Khanchandani "Power Electronics", Tata Mc-Graw Hill
5. Austin Huges, "Electrical motor and drives: Fundamental, types and applications", Heinemann Newnes, London
6. G.K. Dubey, "Power Semiconductor controlled drives", PHI publication

Elective –III : 403149: High Voltage Engineering

Teaching Scheme			**Examination Scheme**	
Lectures	**03**	**hrs/week**	**In-Sem Assessment**	**30**
Practical	**02**	**hrs/week**	**End-Sem Assessment**	**70**
			Oral :	**25**
			TW:	**25**

Course Objectives:

- To make students able to explain the various breakdown processes in solid, liquid and gaseous materials and describe Lightning phenomenon, natural cause of overvoltage in detail with formation of charge in clouds.
- To provide sound knowledge of Testing, Generation & measurement methods of DC, AC and impulse voltages and current.
- To develop ability to carry out various testing procedures as per IS in laboratory with knowledge of earthing, safety and shielding of HV laboratory.

Unit 01: **Breakdown in Gases:** **(6 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 for and factors on which time lag depends. (Numerical on Townsend's theory and Paschen's law).

Unit 02: **(6 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, electromechanical 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: **Lightning and Switching Over Voltages:** **(6 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 04: **Generation of High Voltages and Current:** **(6 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 05: **Measurement of High Voltage and High Currents:** **(6 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 06: **High Voltage Testing of Electrical Apparatus and H V Laboratories:** **(6 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.

Learning Outcomes:

Students will able to

- Reproduce concepts in breadth with various concepts of breakdown phenomenon of solid, liquid and gaseous materials along with various causes of overvoltage and protection from them.
- List and reproduce various methods of generation and measurement of DC, AC and impulse high voltage.
- Demonstrate an ability to carry various DC. AC and impulse testing on high voltage equipments and materials.
- Apply safety measures, earthing, shielding for layout of HV apparatus required in High voltage laboratory.

List of Experiments:[Minimum eight experiments to be conducted from the given list]

1. To perform breakdown test on transformer oil and obtain constants of breakdown voltage equation and breakdown strength

2. Measurement of unknown high a.c. voltage using sphere gap
3. To obtain breakdown strength of composite insulation system.
4. Study of uniform and non uniform field in breakdown strength of air insulation system.
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. Study of output voltage waveform of multistage voltage doublers circuit on CRO.
10. To evaluate power loss under corona at various voltage levels.
11. To perform experiment on rod gap arrestor.
12. To Study effect of barrier on breakdown voltage of air/ transformer oil.
13. Simulation of lightening and switching impulse voltage generator.
14. To perform various HV insulation tests on cables as per IS.

Industrial visit to high voltage equipment manufacturing industry/EHV substation.

Text Books:

1. C. L. Wadhwa, "High Voltage Engineering", New Age International Publishers Ltd.
2. M. S. Naidu, V. Kamaraju, "High Voltage Engineering", Tata McGraw Hill Publication Co. Ltd. New Delhi

Reference books:

1. E. Kuffel, W. S. Zaengl, J. Kuffel, "High Voltage Engineering Fundamentals", Newnes Publication
2. Prof. D. V. Razevig Translated from Russian by Dr. M. P. Chourasia, "High Voltage Engineering", Khanna Publishers, New Delhi
3. Ravindra Arora, Wolf Gang Mosch, "High Voltage Insulation Engineering", New Age International Publishers Ltd. Wiley Estern Ltd.
4. High Voltage Engineering Theory and Practice by M. Khalifa Marcel Dekker Inc. New York and Basel.
5. Subir Ray, "An Introduction to High voltage Engineering" PHI Pvt. Ltd. New Delhi

Elective –III : 403149: HVDC and FACTS

Teaching Scheme			Examination Scheme	
Lectures	**03**	**hrs/week**	**In-Sem Assessment**	**30**
Practical	**02**	**hrs/week**	**End-Sem Assessment**	**70**
			Oral :	**25**
			TW:	**25**

Prerequisites:
Fundamental knowledge of Power Electronics and Power systems is required

Course Objectives:
- To provide students knowledge about modern trends in Power Transmission Technology
- To make students understand 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

Unit 01: General back ground **(6 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, twelve pulse converter operation Harmonics in HVDC systems.

Unit02: Multi terminal HVDC system **(6 hrs)**

HVDC system layout and placement of components, HVDC protection, grounding, multi terminal HVDC systems, configurations and types.

Unit 03:HVDC Light **(6 hrs)**

Introduction to VSC transmission, power transfer characteristics, structure of VSC link, VSC DC system control, HVDC light technology.

Unit 04: Power Electronic Controllers **(6 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.

Unit05: Shunt and series compensation **(6 hrs)**

Operation and control of SVC, STATCOM configuration and control, applications of SVC and STATCOM. TCSC operation, layout and operation, static Synchronous series compensator (SSSC).

Unit 06: Unified Power Flow Controller (6 hrs)

UPFC configuration, steady state operation control and characteristics, operational constraints of UPFC, Power flow studies in UPFC embedded systems.

Learning Outcomes:

Student will be able to

- Analyze modeling of FACTs Controllers
- Simulate various controllers and HVDC systems using softwares such as PSCAD and MATLAB.
- Develop computer programs for power flow studies

Experiments:

Minimum eight experiments are to be performed out of the list mentioned as below:

1. Study of various FACTS Controllers models.
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. Study and simulation of Three phase TCR with and without shunt capacitor
5. Study and simulation of resonance in electrical Power systems
6. Application study of SVC in Power System.
7. Application study of TCSC in Power System.
8. Application study of DSTATCOM in Power System
9. Application study of DVR in Power System
10. 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
11. Study of Power factor corrector in Power System
12. Study and simulation of 6 pulse HVDC system
13. Study of 12 pulse or 24 pulse or 48 pulse inverter
14. Study of Series compensation of a three phase transmission line
15. Complete characteristics of a three phase voltage source converter[Hardware]Constant alpha and extinction angle control

Text Books:

1. E. Acha, V.A. Agelidis, O.Anaya-lara and TJE Miller, “Power Electronic control in Electrical Systems” Newnes, Oxford.
2. N.G. Hingorani and L.Gyugi, “Understanding FACTS” IEEE Press[Indian Edition], New York.
3. J. Arrilaga, Y.H.Liu and N.R.Watson, “Flexible Power Transmission The HVDC Options”, John Wiley and sons Ltd., New York.

4. J. Arrillaga, “High Voltage Direct Current Transmission” Peter Peregrinus Ltd., London, UK.
5. Erich Uhlmann, “Power Transmission by Direct Current” Springer International.

Reference books:

1. Yong Hua Song & Allan T Johns, “Flexible ac transmission systems(FACTS), Published by The Institution of Electrical Engineers, London.
2. K.R.Padiyar, “FACTS controllers in transmission and Distribution” New Age Publications, New Delhi.
3. M.H.Rashid , “Power Electronics Handbook”, Academic Press.
4. K.R.Padiyar , “HVDC Power Transmission Systems”, New Age Publications, New Delhi, (2nd Edition)

Elective –III : 403149: Digital Control System

Teaching Scheme		**Examination Scheme**	
Lectures	**03 hrs/week**	**In-Sem Assessment**	**30**
Practical	**02 hrs/week**	**End-Sem Assessment**	**70**
		Oral	**25**
		TW	**25**

Prerequisite: Z-Transform, Basics of discrete systems.

Course Objectives:

- To make students understand basic concepts of discrete signals and systems.
- To educate students to analyze the stability of discrete systems.
- To teach formulation of state space discrete model and design the digital controllers.
- To elaborate digitize analog controllers using various numerical methods.
- To explore application of the theory of digital control to practical problems.

Unit 01: Discrete systems and Signals (6 hrs)

Standard discrete test signals, Basic operations on signals. Classification of discrete systems. Detail analysis of frequency aliasing & 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: Stability Analysis (6 hrs)

Brief review of pulse transfer function, mapping between S-plane and Z-plane, constant frequency loci and constant damping ratio loci. Stability analysis of closed loop system in the Z-Plane. Jury's stability test, Stability analysis by use of Bilinear transformation & Routh Stability Criterion. Digital compensator design using frequency response (Bode plot).

Unit 03: State - Space analysis (6 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 04: Design using state space (5 hrs)

Controllability and observability of linear time invariant discrete-data system, Tests for Controllability and obervability; Principal of Duality; Effect of pole- zero cancellation; Relationship between controllability, observability and stability. Pole placement design using linear state-feedback. State estimation and full order observer design. Ackermann's formula.

Unit 05: State space model and digitising analog controllers (7 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 & backward method, Trapezoidal method, Bilinear transformation with frequency warping. Numerical differentiation, Matching step & other response. Pole-zero matching.

Unit 06: Digital control system applications (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.

Learning Outcomes:

Students will be able to

- Differentiate between various control systems.
- Analyze digital control system and its stability.
- Elaborate applications such as digital temperature control and position control.
- Simulate digital control system by using computer software.

List of Experiments: Perform any eight experiments

Design & analysis of digital temperature control system

1. Design & analysis of digital position control system.
2. Software programming for determination of STM of DT system.
3. Software programming to design DT system by pole placement through state feedback.
4. Software programming for determination of controllability and observability of DT System.
5. Software programming to observe effect of sampling on response of the system
6. Software programming to observe effect of sampling on stability of DT system.
7. Solution of state equation of L.T.I. systems by the use of digital computer.
8. Digital computer aided difference equation solution.
9. Conversion of continuous time state space model to discrete time state space

Model.

Text Books:

1. K. Ogata, "Discrete Time Control System", 2nd Edition, PHI Learning Pvt. Ltd. 2009
2. B. C. Kuo, "Digital Control Systems**",** 2nd Edition, Oxford University Press
3. M. Gopal, "Digital Control Engineering", New Age International Publishers
4. M. Gopal, "Digital Control and State Variable Methods", 3rd Edition The McGraw Hill Co.

Reference books:

1. Load D. Landau, Gianluca Zito, 'Digital Control Systems: design, Identification and Implementation' Springer.
2. Mohammed Santina, Allen Stubberud, Gene Hostetter 'Digital control System Design', Sanders College publishing.
3. K.J. Astrom, B Wittenmark 'Computer Controlled Systems: Theory and Design' Prentice-Hall Inc New Jersey , 2011 Dover .

Elective – III : 403149: Intelligent Systems and its Applications in Electrical Engineering

Teaching Scheme		**Examination Scheme**	
Lectures	**03 hrs/week**	**In-Sem Assessment**	**30**
Practical	**02 hrs/week**	**End-Sem Assessment**	**70**
		Oral	**25**
		TW	**25**

Prerequisite:

Knowledge of MATLAB, C- Programming

Course Objectives:

- 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.

Unit 01: **Introduction to Artificial Neural Network:** **(6 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**: **(6 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:** **(6 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:** **(6 hrs)**

Fuzzy versus crisp, fuzzy sets: membership function, Basic fuzzy set operations, properties of fuzzy sets, fuzzy relations.

Unit 05: **Fuzzy Control:** **(6 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:** **(6 hrs)**

Introduction to Genetic Algorithm: biological background, GA operators, selection, encoding, crossover, mutation, chromosome.

Expert System: software architecture, rule base system

Learning Outcomes:

Students will be able to

- Compare various AI tools
- Develop algorithms for AI tools
- Apply AI tools for Applications in electrical engineering.

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:

1. Simon Haykin, “Neural Networks: A Comprehensive Foundation”, 2nd Edition, Pearson Education
2. S. Rajsekaram, G. A. Vijayalaxmi Pai, “Neural Networks, Fuzzy Logic & Genetic Algorithms Synthesis & Applications”, Practice Hall India
3. James A. Anderson, “An Introduction to Neural Networks”, Practice Hall India Publication
4. Mohamed H. Hassoun, “Fundamentals of Artificial Neural Network”, Practice Hall India

Reference books:

1. Kelvin Waruicke, Arthur Ekwlle, Raj Agarwal, “AI Techniques in Power System”, IEE London U.K.
2. S. N. Sivanandam, S. Sumathi, S. N. Deepa, “Introduction to Neural Network Using MATLAB 6.0”, Tata McGraw Hill
3. Jacek Zurada, “Introduction to Artificial Neural Network”, Jaico Publishing House India

Elective –IV : 403150 : Smart Grid

Teaching Scheme		Examination Scheme	
Lectures:	**03 hrs/week**	**In-Sem Assessment:**	**30**
		End-Sem Assessment:	**70**

Prerequisite: Knowledge of existing grid.

Course Objectives:

- To understand the concept of Smart Grid, compare with conventional grid, and identify its opportunities and barriers.
- To understand the concept of Smart Meter, Smart Appliances, Automatic Meter Reading, Outage Management System, Plug in Hybrid Electric Vehicles, Vehicle to Grid, Smart Sensors, Home & Building Automation, Phase Shifting Transformers.
- To understand 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 understand the concept of microgrid
- To understand the concept of Power Quality and its issues of Grid connected Renewable Energy Sources, Web based Power Quality monitoring, Power Quality Audit.

Unit 01: Introduction to Smart Grid: (6 hrs)

Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Functions of Smart Grid, Opportunities & Barriers of Smart Grid, Drivers of SG in India, Challenges for SG, Difference between conventional & smart grid, Smart Grid Vision & Roadmap for India, Concept of Resilient and Self Healing Grid, Present development & International policies in Smart Grid, Smart Cities, Pilot projects in India.

Unit 02: Smart Grid Technologies: (6 hrs)

Remote Terminal Unit (RTU), 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 – Battery(flow and advanced), SMES, Super Capacitors, Pumped Hydro, Compressed Air Energy Storage(CAES) and its comparison, Optimal Location of PMUs for Complete Observability.

Unit 03 Smart Meters and Advance Metering Infrastructure: (6 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 & Building Automation, Geographic Information System (GIS).

Unit 04 : Microgrids: (6 hrs)

Concept of Microgrid, need & applications of Microgrid, Microgrid Architecture, DC Microgrid, Formation of Microgrid, Issues of interconnection, protection & control of

Microgrid, 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: (6 hrs)

Power Quality & 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: (6 hrs)

Communication Architecture of SG, Wide Area Measurement System (WAMS), Home Area Network (HAN), Neighbourhood Area Network (NAN), Wide Area Network (WAN). Bluetooth, ZigBee, GPS, Wi-Fi, Wi-Max based communication, Wireless Mesh Network, Basics of CLOUD Computing & Cyber Security for Smart Grid, Broadband over Power line (BPL), IP based protocols.

Learning Outcomes:

Student will be able to

- Differentiate Conventional and Smart Grid.
- Identify the need of Smart Grid, Micro Grid, Smart metering, Smart storage, Hybrid Vehicles, Home Automation, Smart Communication.
- Get introduced to new upcoming concepts in electrical from Utility to Consumers.
- Comparing and getting acquainted with emerging technologies and current professional issues in electric Grid.
- Express the necessity of global smart communication system

Text Books:

1. Ali Keyhani, Mohammad N. Marwali, Min Dai "Integration of Green and Renewable Energy in Electric Power Systems", Wiley
2. Clark W. Gellings, "The Smart Grid: Enabling Energy Efficiency and Demand Response",CRC Press
3. Janaka Ekanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley
4. Stuart Borlase, "Smart Grids-Infrastructure, Technology and Solutions", CRC Press, Taylor and Francis group
5. Janaka Ekanayake, Kithsiri Liyanage, Jianzhong Wu and Akihiko Yokoyama, "Smart Grid-Technology and applications", Wiley
6. James Momoh, "Smart Grid-Fundamentals of design and analysis", Wiley

Reference Books:

1. Nikos Ziargyriour, "Micro grid, Architecture and Control", IEEE Press, Wiley
2. Yang Xiao, "Communication and Networking in Smart Grids", CRC Press, Taylor and Francis group
3. Lars T. Berger and Krzysztof Iniewski, "Smart Grid-Applications, Communications and Security", Wiley
4. Mladen Kezunovic, Mark G. Adamiak, Alexander P. Apostolov, Jeffrey George Gilbert "Substation Automation (Power Electronics and Power Systems)", Springer

5. Stephen F.Bush, “Smart Grid-Communication Enabled Intelligence for the Electric Power Grid”, IEEE Press, Wiley
6. R. C. Dugan, Mark F. McGranghan, Surya Santoso, H. Wayne Beaty, “Electrical Power System Quality”, 2nd Edition, McGraw Hill Publication
7. Jean Claude Sabonnadière, Nouredine Hadjsaïd, “Smart Grids”, Wiley Blackwell

Elective – IV : 403150: Robotics and Automation

Teaching Scheme		**Examination Scheme**	
Lectures	**3 hrs/week**	**In-Sem Assessment**	**30**
		End-Sem Assessment	**70**

Course Objectives:

- 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

Unit 01 : Introduction **(6 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 & non-servo controlled, their comparative study, Form of motion: P-T-P (point to point), C-P (continuous path), pick and place etc. and their comparative study

Unit 02: Mathematical preliminaries **(6 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: **(6 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.

Unit 04: **(6 hrs)**

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 **(6 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) & resolved motion rate control (RMRC).

Unit 06: Actuators and sensors: **(6 hrs)**

Drive Technology: Hydraulic, Pneumatic, Electric (stepper motor, D.C. servo motor, BLDC Motors) in detail with selection criteria. Sensors in servocontrol 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).

Learning Outcomes:

At the end of the course, a student will be able to –

- Differentiate between types of robots based on configuration, method of control, types of drives, sensors used etc.
- Choose a specific robot for specific application with given specifications.
- Analyze the robot arm dynamics for calculation of torques and forces required for different joints of robots for control of robot arm.
- Determine the D-H parameters for a robot configuration using concepts from robot arm kinematics which further leads to forward/inverse kinematics.
- Calculate the Jacobian matrix for robot arm velocity and decide the singular positions.

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:

1. 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.

2. Richard D. Klafter, Thomas A. Chemielewski, Michael Neign, "Robotic Engineering – An Integral Approach", Prentice Hall of India Pvt. Ltd., New Delhi. Eastern Economy Edition
3. Robert J. Schilling, "Fundamentals of Robotics: Analysis and Control", Prentice Hall of India, New Delhi

Reference Books:

1. K. S. Fu, R. C. Gonzalez, C. S. G. Lee, "Robotics: Control Sensing, Vision and Intelligence", International Edition, McGraw Hill Book Co.
2. John J. Craig, "Introduction to Robotics: Mechanics and Control", Pearson Education
3. R. K. Mittal, I. J. Nagrath, "Robotics and Control", Tata McGraw Hill Publishing Company Ltd., New Delhi
4. Saeed b. Niku, "Introduction to Robotics: Analysis, Control, Applications", Wiley Publication, 2011.

Elective IV :403150: Illumination Engineering

Teaching Scheme		Examination Scheme	
Lectures	03 hrs/week	In-Sem Assessment	30
		End-Sem Assessment	70

Prerequisites-

1) The working of the conventional lamps must be known.
2) The generation of light and physics of light must be known.
3) The techniques for natural and artificial lighting must be known.

Course Objectives-

- To get the detailed information about modern lamps and their accessories.
- To get detailed insight of indoor and outdoor illumination system components, its controls and design aspects.
- To know the requirements of energy efficient lighting.
- To introduce the modern trends in the lighting

Unit 01: Importance of Lighting in Human Life: (6 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 & 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 & Measurement of Light.

Unit 02: Light Sources: (6 hrs)

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 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.

Unit 03 : Electrical Control of Light Sources: (6 hrs)

Ballast, ignitors and dimmers for different types of lamps,
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 04: **(6 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

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 5: **(6 hrs)**

Factors to be considered for design of outdoor illumination scheme

Outdoor Lighting Design: Road classifications according to BIS, pole arrangement, terminology, lamp and luminaire 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 **(6 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

Course Outcomes:

Student 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.

Text Books:

1. H. S. Mamak, “Book on Lighting”, Publisher International lighting Academy
2. Joseph B. Murdoch, “Illumination Engineering from Edison’s Lamp to Lasers” Publisher -York, PA : Visions Communications
3. M. A. Cayless, A. M. Marsden, “Lamps and Lighting”, Publisher-Butterworth-Heinemann(ISBN 978-0-415-50308-2)
4. Designing with light: Lighting Handbook., Anil Valia; Lighting System 2002

Reference Books:

1. “BIS, IEC Standards for Lamps, Lighting Fixtures and Lighting”, Manak Bhavan, New Delhi
2. D. C. Pritchard, “Lighting”, 4th Edition, Longman Scientific and Technical, ISBN 0-582-23422-0.
3. “IES Lighting Handbook”, (Reference Volume 1984), Illuminating Engineering Society of North America.
4. “IES Lighting Handbook”, (Application Volume 1987), Illuminating Engineering Society of North America
5. IESNA lighting Handbook., Illuminating Engineering Society of North America 9th edition 2000
6. Applied Illumination Engineering, Jack L. Lindsey FIES (Author), Scott C. Dunning PHD PE CEM (Author) ,ISBN-13: 978-0824748098 ISBN-10: 0824748093, 3rd Edition.
7. IS 3646: Part I: 1992, *Code of practice for interior illumination.*
8. Organic Light Emitting Diodes (OLEDs): Materials, Devices and Applications, Alastair Buckley, University of Sheffieid, UK, ISBN: 978-0-85709-425-4.

Elective IV :403150 : VLSI Design

Teaching Scheme		**Examination Scheme**	
Lectures	**03 hrs/week**	**In-Sem Assessment**	**30**
		End-Sem Assessment	**70**

Course Objectives:

- To understand Modeling of Digital Systems Domains for different combinational and sequential circuits
- To understand Levels of Modeling using Modeling Language VHDL.
- To Understand Modeling and programming Concepts by Learning a New Language
- To develop of logic design and programming skills in HDL language.
- To study HDL based design approach.
- To learn digital CMOS logic design

Unit 01 : Overview of Digital Logic Circuits and Introduction to VLSI: (6 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 (6 hrs)

Data objects, Data types, Entity, Architecture & types of modeling: Behavioral, data flow, & 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 (6 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) (6 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 (6 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 : **(6 hrs)**

VLSI Design Applications: 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.

Learning Outcomes:

Student will be able to

- Design and develop combinational and sequential digital logic circuits using different techniques.
- Analyze and design basic central processing units and memory systems for general-purpose computers.
- Use appropriate techniques and modern digital-systems development tools for Digital circuits.
- Model digital circuit with HDL and simulate

Text Books:

1. Douglas Perry, “VHDL”, Tata McGraw Hill.
2. John F. Wakerly, “Digital Design, Principles and Practices”, Prentice Hall Publication
3. Wolf, “Modern VLSI Design”, Pearson Education.
4. R.P.Jain, “Modern Digital electronics”, 3rd edition, Tata McGraw-Hill.
5. Donald P. Leach, Albert Paul Malvino, “Digital Principles and Applications”, Glencoe Publisher.
6. Neil H. Weste and Kamran, “Principles of CMOS VLSI Design”, Pearson Publication.

Reference Books:

1. Charles H. Roth, “Digital System Design Using VHDL”, PWS Publishing Company (Thomson Learning)
2. Sung-Mo(Steve) Kang, Yusuf Leblebici, “CMOS Digital Integrated Circuits”, Tata McGraw Hill Publication.
3. J. Bhaskar, “VHDL Primer”, 3rd Edition, Addison Wesley Longman Singapore Pte Ltd.
4. Volner A. Dedroni, “Circuit Design with VHDL”, PHI Publications
5. Xilinx Data Manual “The Programmable Logic Data Book”.
6. Lizy Kurian John, “Principles of Digital Systems Design and VHDL” Paperback – 2008 .
7. Peter J. Ashenden (Author), Jim Lewis, “ VHDL-2008: Just the New Stuff”, (Systems on Silicon) Paperback – Import, 7 Dec 2007.
8. Data Sheets of PLDs.

403151: Project II

Teaching Scheme		Examination Scheme	
Tutorial	**6 Hrs/Week**	**OR**	**100**
		TW	**50**

Course Objectives:

1. To develop skills for carrying literature survey and organize the material in proper manner.
2. To provide opportunity of designing and building complete system/subsystem based on their knowledge acquired during graduation.
3. To understand the needs of society and based on it to contribute towards its betterment and to learn to work in a team.
4. To explore and to acquire specified skill in areas related to Electrical Engineering
5. To ensure the completion of given project such as fabrication, conducting experimentation, analysis, validation with optimized cost.
6. Collect the data in report form and represent and communicate findings of the completed work in written and verbal form.

Guidelines for VIIIth Semester for Project Work

The student shall complete the remaining part of the project which is an extension of the work carried out in 7th Semester. Remaining part of the project 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.

Course outcomes:

Students will be able to
1. Work in team and ensure satisfactory completion of project in all respect.
2. Handle different tools to complete the given task and to acquire specified knowledge in area of interest.
3. Provide solution to the current issues faced by the society.
4. Practice moral and ethical value while completing the given task.
5. Communicate effectively findings in verbal and written forms.

Savitribai Phule Pune University

Structure and Syllabus

FOR

B.E. Mechanical Engineering
2012 Course

UNDER FACULTY OF ENGINEERING

EFFECTIVE FROM June 2015

B. E. (Mechanical) Semester – I

(w. e. f. Academic year 2015 - 16)

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme(Marks)					
		Lect.	Tut	Practical	In-Sem	End-Sem	TW	PR+	OR+	Total
402041	Refrigeration and Air Conditioning	3	--	2	30	70	25	--	50	175
402042	CAD/ CAM Automation	3	--	2	30	70	--	50	--	150
402043	Dynamics of Machinery	4	--	2	30	70	25	--	50	175
402044	Elective – I	3	--	--	30	70	--	--	--	100
402045	Elective –II	3	--	--	30	70	--	--	--	100
402046	Project –I	--	2	--	--	--	50*	--	--	50
Total of Semester – I		16	2	6	150	350	100	50	100	750

B. E. (Mechanical) Semester – II

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme(Marks)					
		Lect.	Tut	Practical	In-Sem	End-Sem	TW	PR+	OR+	Total
402047	Power Plant Engineering	4	--	2	30	70	25	--	50	175
402048	Mechanical System Design	4	--	2	30	70	--	--	50	150
402049	Elective-III	4	--	--	30	70	--	--	--	100
402050	Elective- IV	4	--	2	30	70	25	--	--	125
402051	Project – II	--	6	--	--	--	150	--	50	200
Total of Semester – II		16	6	6	120	280	200	--	150	750

\+ For all Oral/Practical heads: Examination will be based on term work and Theory Subject

* Assessment should be carried out by panel of examiners from same Institute

	Elective-I		Elective-II
Code	**Subject**	**Code**	**Subject**
402044 A	Energy Audit Management	**402045 A**	Gas Turbine Propulsion
402044 B	Tribology	**402045 B**	Product Design and Development
402044 C	Reliability Engineering	**402045 C**	Operation Research
402044 D	Machine Tool Design	**402045 D**	Advanced Manufacturing Processes
	Elective-III		**Elective-IV**
Code	**Subject**	**Code**	**Subject**
402049 A	Refrigeration and Air Conditioning Equipment Design	**402050 A**	Computational Fluid Dynamics
402049 B	Robotics	**402050 B**	Finite Element Analysis
402049 C	Industrial Engineering	**402050 C**	Design of Pumps, Blowers and Compressors
402049 D	Open Elective **		

**: Open Elective – Board of studies (BoS) - Mechanical 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 – III under engineering faculty or individual college and Industry can define new elective with proper syllabus using defined framework of Elective III and GET IT APPROVED FROM BOARD OF STUDIES AND OTHER NECESSARY STATUTORY SYSTEMS IN THE SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE, BEFORE 30th NOVEMBER. Without approval from University statutory system, no one can introduce the open elective in curriculum.

(402041) Refrigeration and Air Conditioning

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut.	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
402041	**Refrigeration and Air Conditioning**	**3**	**---**	**2**	**30 (1 hr)**	**70 (2 ½ hrs)**	**25**	**---**	**50**	**175**

Prerequisite: Basic Thermodynamics- Laws of thermodynamics, Ideal gas processes, Thermodynamic cycles, Properties of pure substance, Mollier Charts, 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 vapor compression refrigeration systems
- Present the properties, applications and environmental issues of different refrigerants
- Calculate cooling load for air conditioning systems used for various applications
- Operate and analyze the refrigeration and air conditioning systems.
-

Unit 1: Fundamentals and Applications of Refrigeration and Air Conditioning 8 hrs

Fundamentals

Reverse Carnot cycle, block diagram of refrigerator & heat pump (numerical), modified reverse Carnot cycle (Bell Coleman cycle)

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.

Unit 2: Refrigerants and Vapour Compression Cycle 8 hrs

Refrigerants

Classification 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.

Vapour Compression Cycle

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,.

Unit 3: Refrigeration Systems 8 hrs

Vapour compression systems

Single stage, two stage and cascade VCC systems using single and multi evaporators

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 4: Psychometric and Air conditioning 8 hrs

Introduction to air conditioning, psychometric, psychometric properties and terms, psychometric relations, Psychometric processes and its representation on psychometric chart, BPF of coil, ADP, adiabatic mixing of two air streams, SHF, RSHF, GSHF, ESHF.

Thermodynamics of human body, comfort and comfort chart, factors affecting human comfort, concept of infiltration and ventilation, indoor air quality requirements, factors contributing to cooling load.

Unit 5 Air Conditioning Systems 8 hrs

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 6: Air Distribution Systems 8 hrs

Air handling unit, 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)

Fan coil unit, types of fans used air conditioning applications, fan laws, filters, supply and return grills, sensors (humidity, temperature, smoke).

Term work:

The term work shall consist of minimum eight experiments out of the following:

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. Visit to Vapour absorption refrigeration plant
6. Estimation of cooling load of simple air conditioning system (case study)
7. Case study on cold storage
8. Visit to any air conditioning plant
9. Thermal analysis of refrigeration cycle using suitable software
10. Installation and servicing of split air conditioner

Text Books:

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

Reference books:

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 Delhi
4. 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

(402042) CAD/CAM and Automation

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut.	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
402042	CAD /CAM and Automation	3	---	2	30 (1 hr)	70 (2 ½ hrs)	---	50	---	150

Pre-requisite: Engineering Graphics, Machine drawing, Manufacturing processes, SOM.

Course Objectives: To teach students
- Basics of modeling.
- Discuss various geometries.
- Discretization of the solid model.
- Apply Boundary Conditions similar to real world.
- Generate solution to ensure design can sustain the applied load conditions.
- Discuss latest manufacturing methods.

Course Outcomes: After completion of the course students would be able to,
- Analyze and design real world components
- Suggest whether the given solid is safe for the load applied.
- Select suitable manufacturing method for complex components.

Unit 1: Computer Graphics — 8 hrs

Computer Graphics Module, Transformations-Introduction, Formulation, Translation, Rotation, Scaling and Reflection. Homogenous Representation, Concatenated Transformation, Mapping of Geometric Models, Inverse Transformations. Projections: Orthographic and Isometric.

Unit 2: Modeling — 8 hrs

Curves-Introduction, Analytic Curves - Line, Circle, Ellipse, Parabola, Hyperbola. Synthetic Curves - Hermite Cubic Spline, Bezier Curve, B-Spline Curve. Numerical on Line, Circle, Ellipse and Hermite Cubic Spline

Surfaces-Introduction, Surface Representation, Analytic Surfaces, Synthetic Surfaces, Hermite bicubic Surface, Bezier surfaces, B-spline Surfaces, Coons Surface [No analytical treatment].

Solids: Introduction, Geometry and Topology, Solid Representation, Boundary Representation, Euler's equation, Constructive Solid Geometry, Boolean operation for CSG, Hybrid Modeling, Feature Based Modeling, Parametric Modeling, Constraint Based Modeling, Mass, area, volume calculation.

Unit 3: Finite Element Analysis — 10 hrs

Introduction, Stress and Equilibrium, Boundary Condition, Strain – Displacement Relations, Stress-Strain Relation, Potential Energy and Equilibrium: - Rayleigh-Ritz Method, Galerkin’s Method.

One Dimensional Problem: Finite Element Modelling, Coordinate and Shape function, Potential Energy Approach, Galerkin Approach, Assembly of Global Stiffness Matrix and Load Vector, Properties of Stiffness Matrix, Finite Element Equations, Quadratic Shape Function, Temperature Effects .

Trusses: Introduction, 2D Trusses, Assembly of Global Stiffness Matrix.

Unit 4: Computer Aided Manufacturing — 8 hrs

Introduction to Computer Aided Manufacturing.CNC Programming-CNC part programming adaptable to FANUC controller. Steps in developing CNC part program.CNC part programming for Lathe Machine – Threading & Grooving cycle(Canned cycle). CNC part programming for Milling Machine - Linear & circular interpolation, milling cutter, tool length compensation & cutter radius compensation. Pocketing, contouring & drilling, subroutine and Do loop using canned cycle.

Unit 5: Advanced Manufacturing Method – Rapid Prototyping 8 hrs

Introduction to Rapid Prototyping, classification of RP Processes, Working principle, models & specification process, application, advantages & disadvantages & case study of

- Stereo Lithography Apparatus (SLA)
- Laminated Object Manufacturing (LOM)
- Selective Laser Sintering (SLS)
- 3D Printing.
- Fused Deposition Modeling [FDM]

Rapid Tolling and STL format.

Unit 6: Robotics & Automation 8 hrs

Structure of Robotic System - Point to point & continuous path robotic systems, Joints, End Effectors, Grippers - Mechanical, Magnetic and Pneumatic. Drives, Controllers, Industrial Applications.

Types of Automation - Automation strategies, Group Technology & Coding Methods, Flexible Manufacturing System – Types, Advantages, Limitations. Computer Integrated Manufacturing and Computer Aided Process Planning.

Term Work:

The term work shall consist of record of ten assignments based on the following topics, with two on CAD based, three on CAE based, three on CAM based and two on robot and R. P.

1. Developing CAD model of mechanical sub assembly consisting 8- 10 components.
2. Developing component/ assembly using CAD features of Hybrid Modeling, Feature Based Modeling, Parametric Modeling and Constraint Based Modeling.
3. Program on concatenated Transformation involving Three steps.
4. Stress and Deflection Analysis of 2D truss.
5. Stress and Deflection Analysis of Beam.
6. Stress and deflection analysis of plate 2D/3D.[Mechanical Component]
7. Tool path generation for Turning – Grooving and Threading.
8. Tool path generation for Milling – Facing, Pocketing, Contouring and Drilling.
9. Tool path generation of Turn Mill.
10. Tool path generation for Multi Axis Machining.
11. Robot simulation/Robot Gripper Design.
12. Case study on R.P.

Reference Books:

1. Ibrahim Zeid and R. Sivasubramanian - CAD/CAM - Theory and Practice Tata McGraw Hill Publishing Co. 2009
2. Ibraim Zeid, “Mastering CAD/CAM” – Tata McGraw Hill Publishing Co. 2000
3. Chandrupatla T.R. and Belegunda A.D. -Introduction to Finite Elements in Engineering” - Prentice Hall India.
4. Segerling L.J. - Applied Finite Elements Analysis” John Wiley and Sons.
5. Rao P.N., Introduction to CAD/CAM Tata McGraw Hill Publishing Co.
6. Groover M.P.-Automation, production systems and computer integrated manufacturing’ - Prentice Hall of India
7. YoramKoren - Robotics McGraw Hill Publishing Co.
8. James G. Keramas, Robot Technology Fundamentals, Delmar Publishers.
9. S.R.Deb, Robotics Technology and Flexible Automation, Tata McGraw Hill.
10. Lakshiminarayana H. V. Finite Element Analysis (Procedures in Engineering), University Press, 2004.
11. Chandrupatla T. R., Finite Element Analysis for Engineering and Technology, University Press, 2009.
12. Seshu P. Text book of Finite Element Analysis, PHI Learning Private Ltd. New Delhi, 2010.
13. Ian Gibson, David W. Rosen, and Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer.

(402043) Dynamics of Machinery

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut.	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
402043	Dynamics of Machinery	4	---	2	30 (1 hr)	70 (2 ½ hrs)	25	--	50	175

Prerequisites: Engg. Mechanics, TOM- I and TOM-II

Course Objectives:

- To conversant with balancing problems of machines.
- To make the student conversant with fundamentals of vibration and noise.
- To develop competency in understanding of vibration and noise in Industry.
- To develop analytical competency in solving vibration problems.
- To make the student conversant with natural frequencies, Eigen values & Eigen vectors.
- To understand the various techniques of measurement and control of vibration and noise.

Course Outcomes:

- Solutions to balancing problems of machines.
- Ability to understand the fundamentals of vibration and Noise.
- Ability to develop analytical competency in solving vibration problems.
- Ability to understand measurement and control of vibration and noise.
- Ability to calculate natural frequencies, Eigen values & Eigen vectors.
- Ability to measure vibrations, vibration characteristics and understand various methods for vibration control for real life problem.

Unit 1: 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 2: 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, types of vibration, natural frequency, equivalent springs, modeling of a system, formulation of equation of motion by equilibrium and energy methods.

Undamped free vibrations: Natural frequency for longitudinal, transverse and torsional vibratory systems.

Damped free vibrations: Different types of damping, free vibrations with viscous damping - over damped, critically damped and under damped systems, initial conditions, logarithmic decrement, introduction to equivalent viscous damping, dry friction or coulomb damping - frequency and rate of decay of oscillations.

Unit 3: Single Degree of Freedom Systems - Forced Vibrations 8 hrs

Forced vibrations of longitudinal and torsional systems, Frequency Response to harmonic excitation, excitation due to reciprocating and rotating unbalance, base excitation, magnification factor, resonance phenomenon and phase difference, Quality Factor. Critical speed of shaft having single rotor of undamped systems.

Unit 4: Two Degree of Freedom Systems - Undamped Vibrations 8 hrs

Free vibration of spring coupled systems – longitudinal and torsional, natural frequency and mode shapes, Eigen value and Eigen vector by Matrix method, Geared systems. Introduction to Physical and Mathematical modeling: Bicycle, Motor bike and Quarter Car.

Unit 5: Measurement and Control of Vibration **8 hrs**

Force and Motion transmissibility, Vibration Measuring devices, Accelerometers, Impact hammer, Vibration shaker-Construction, principles of operation and uses, Vibration Analyzer, Analysis of Vibration Spectrum, Standards related to measurement of vibration and accepted levels of vibration
Introduction to control of vibration, vibration control methods, passive and active vibration control, reduction of excitation at the source, control of natural frequency, Vibration isolators, Tunned Dynamic Vibration Absorbers, Introduction to Torsional Damper

Unit 6: Introduction to Noise **8 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, pass-by-noise, Reverberation chamber, Anechoic Chamber, Human Exposure to Noise and Noise standards.

List of Experiments:

The Term Work shall consist of *Eight Experiments and Two Assignments* of following list.

A] Compulsory Experiments (Sr. No. 1 to 5)

1. Balancing of wheel / rotor on computerized balancing machine OR Demonstration of wheel balancing during a visit to industry / workshop.
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 determine natural frequency of transverse vibration of beam using vibration analyzer.
5. Noise measurement and analysis using vibration Analyzer.

B] Any Three Experiments from the following-

1. To determine critical speed of shaft with single rotor.
2. To verify natural frequency of torsional vibration of two rotor system and position of node .
3. Experimental verification of principle of dynamic vibration absorber.
4. Experiment on shock absorbers and to plot its characteristic curve.
5. Analysis of machine vibration signature, using any analysis software package.

C] Compulsory Assignments

1. Determination of free response of SDOF damped system to demonstrate different damping conditions using suitable software.
2. Determination of total response of SDOF damped system to harmonic excitation using suitable software

Text Books:

1. Rao S. S. "Mechanical Vibrations", Pearson Education Inc. New Delhi.
2. Grover G. K. "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

Reference Books:

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. Dr Debabrata Nag, " Mechanical Vibrations", Wiley India Pvt. Ltd, New Delhi.
5. Kelly S. G. "Mechanical Vibrations", Schaum's outlines, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
6. Meirovitch, "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, NewDelhi.

(402044A) Energy Audit and Management (Elective I)

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut.	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
402044 A	Energy Audit and Management	3	---	--	30 (1 hr)	70 (2 ½ hrs)	--	--	--	100

Pre-Requisites: Economics, Basic Thermodynamics.

Course Objectives: Following concepts to be taught to the students,
- Importance of Energy Management.
- How to carry out Energy Audit.
- Methods to reduce consumption of energy and save cost.
- How to improve energy efficiency of overall system.
- Significance of Waste heat recovery and Cogeneration.

Course Outcomes: After successful completion of the course student would be able to,
- Carry out Energy Audit of the residence / society / college where they are studying.
- Carry out electrical tariff calculation and accurately predict the electricity bill required for the installation.
- Suggest various methods to reduce energy consumption of the equipment / office / premises.
-

Unit 1: General Aspects of Energy Management **8 hrs**

Current energy scenario - India and World, Current energy consumption pattern in global and Indian industry, Principles of Energy management, Energy policy, Energy action planning, Energy security and reliability, Energy and environment, Need of Renewable and energy efficiency.

Unit 2: Energy Auditing **10hrs**

Need of Energy Audit, Types of energy audit, Components of energy audit, Energy audit methodology, Instruments, equipment used in energy audit, Analysis and recommendations of energy audit - examples for different applications, Energy audit reporting, Energy audit software. Energy conservation opportunities in Boiler and steam system, Furnace, DG sets, HVAC system, pumping system, Cooling tower and Compressed air system.

Unit 3: Energy Economics **8 hrs**

Costing of Utilities- Determination of cost of steam, natural gas, compressed air and electricity. Financial Analysis Techniques - 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 **10 hrs**

Energy performance assessment and efficiency improvement of Boilers, Furnaces, Heat exchangers, Fans and blowers, pumps, Compressors and HVAC systems. Steam distribution, Assessment of steam distribution losses, Steam leakages, Steam trapping, Condensate and flash steam recovery system.

Unit 5: Electrical Energy Management and Lighting **8 hrs**

Electricity billing, Electrical load management and maximum demand control, Power factor improvement and its benefit, Selection and location of capacitors, Distribution and transformer losses. Electrical motors- types, efficiency and selection. Speed control, Energy efficient motors. Electricity Act

2003. Lighting - Lamp types and their features, recommended illumination levels, lighting system energy efficiency.

Unit 6: Cogeneration and Waste Heat Recovery 8 hrs

Cogeneration- Need, applications, advantages, classification, the cogeneration design process. Waste heat recovery- Classification and application, Potential for waste-heat recovery in Industry, Commercial WHR devices, saving potential. CDM projects and carbon credit calculations.

Reference Books:

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
7. http://www.bee-india.nic.in

(402044B) Tribology (Elective I)

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut.	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
402044 B	Tribology	3	---	--	30 (1 hr)	70 (2 ½ hrs)	--	--	--	100

Pre-Requisites: TOM-I, TOM-II and Machine design.

Course Objectives: After successful completion of this course, students will be able-

- To know about properties of lubricants, modes of lubrication, additives etc.
- To Select suitable/proper grade lubricant for specific application.
- To select suitable material combination for tribological contact.
- To Apply the basic theories of friction, wear and lubrications about frictional behavior commonly encountered sliding surfaces.
- To suggest an explanation to the cause of tribological failures.
- To design bearing, friction, wear test rig for laboratory purposes.

Course Outcomes:

- For these simplified course contents, student develops confidence in him/her to fulfill course objectives.
- Term work includes simple case study/assignment/seminar/visit and in-semester theory examination as a part of learning process encourages students.
- He/she proves himself/herself to be excellent practical engineer in any tribological industry.
-

Unit 1: Introduction **8 hrs**

1. Tribology definition.
2. Tribology in design- bearing material its properties and construction Tribological design of oil seals and gasket.
3. Tribology in industry (Maintenance).
4. Lubrication-Definition, basic modes of lubrication, properties of lubricants, additives, EP lubricants, Recycling of used oil, oil conservation, oil emulsion.
5. Bearing Terminology-Types of Sliding contact, rolling contact bearings.
6. Comparison between sliding and rolling contact bearing. (Theoretical treatment only)

Unit 2: Friction and wear **8 hrs**

1. Friction- Introduction, laws of friction, Friction classification, causes of friction.
2. Theories of dry friction.
3. Friction measurement.
4. Stick-slip motion and friction instabilities.
5. Wear-classification, wear between solids, wear between solid and liquids, factors affecting wear.
6. Theories of wear.
7. Wear measurement.
8. Approaches to friction control and wear prevention. (Numericals)

Unit 3: Hydrodynamic lubrication **10 hrs**

1. Theory of hydrodynamic lubrication, mechanism of pressure development in oil film.
2. Two dimensional Reynold's equation and its limitations, Petroff`s equation.
3. Infinitely long journal bearing, infinitely short journal bearing and finite bearing, Designing journal bearing using Raimondi and Boyd approach.
4. Hydrodynamic thrust bearing-Introduction, types.
5. Flat plate thrust bearing-Pressure equation, load, centre of pressure, frictional force equation.

6. Tiltling pad thrust bearing- bearing-Pressure equation, load, centre of pressure, frictional force equation. (Numericals on Raimondi and Boyd approach and thrust bearing only)

Unit 4: Hydrostatic lubrication **8 hrs**

1. Hydrostatic lubrication-Basic concept, advantages, limitations, viscous flow through rectangular slot, load carrying capacity, flow requirement of hydrostatic step bearing, energy losses, optimum design of stepped bearing, compensators and their actions.
2. Squeeze film lubrication- Basic concept, circular and rectangular plate approaching a plane (Numericals on hydrostatic bearing, Squeeze film lubrication).

Unit 5: Elasto-hydrodynamic lubrication and Gas (Air) lubrication **8 hrs**

1. Elasto-hydrodynamic lubrication-Principle and applications, pressure viscosity term in Reynold's equation, Hertz theory, Ertel-Grubin equation, lubrication of spheres.
2. Gas(air) lubricated bearings-Introduction, advantages, disadvantages, applications of tilting pad bearing, hydrostatic and hydrodynamic bearing with air lubrication, Active and passive magnetic bearings(working principle, types and advantages over conventional bearing). (Theoretical treatment only)

Unit 6: Tribological Aspects **10 hrs**

1. Lubrication in rolling, forging, drawing and extrusion.
2. Mechanics of tyre road interaction, road grip, wheel on rail road.
3. Surface engineering for wear and corrosion resistance-diffusion, plating and coating methods, selection of coatings, properties and parameters of coatings.
4. Other bearings-porous bearing, foil bearing, Lobe, hybrid bearing. (Theoretical treatment only)

Reference Books:

1. Cameron A., "Basic Lubrication Theory", Wiley Eastern Ltd.
2. Bharat Bhushan, "Principles and Applications of Tribology" 2nd Edition, Wiley India
3. Mujumdar B. C., "Introduction to Tribology and Bearings", S. Chand and Company Ltd. New Delhi.
4. Fuller D. D., "Theory and Practice of Lubrication for Engineers", John Wiley and Sons.
5. Halling J., "Principles of Tribology", McMillan Press Ltd.
6. Bhushan B. and Gupta B. K., " Handbook of Tribology: Material, Coatings and Surface Treatments", McGraw Hill Ltd.
7. Davis J., "Surface Engineering for Corrosion and Wear Resistance", Woodhead Publishing, 2001.
8. Tadausz Burakowski, "Surface Engineering of Metals: Principles, Equipments and Technologies", Taylor and Francis.

(402044C) Reliability Engineering (Elective I)

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut.	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
402044 C	Reliability Engineering	3	---	--	30 (1 hr)	70 (2 ½ hrs)	--	--	--	100

Pre-Requisites: Engineering Mathematics, Probability, Statistics.

Course Objectives: To teach students,
- Understanding of basic principles of Reliability for ensuring sustainable product design.
- Application to system requirements, design, manufacturing and testing, with real-world examples.
- Understand in detail Asset Management, Maintenance, Quality and Productiveness,

Course Outcomes: After completion of the course students would be able to,
- Understand and analyze different methods of failure.
- Calculate MTTF, MTBF, failure rate and hazard rate.
- Different probability methods applied to Reliability.
- Optimize Cost & reliability.
- Perform FEMA, FMECA, DOE, Taguchi method.
- Different methods to test reliability.
-

Unit 1: Fundamental concepts of Reliability 8 hrs

Reliability terminologies, Role of the reliability function in the organization, Interrelationship of safety, quality and reliability, life characteristic phases, Product liability-Significance, importance of reliability, Introduction to maintainability, availability.

Concepts of Failure, failure density, failure Rate, hazard rate, pdf, cdf. Modes of failure, Mean Time To Failure (MTTF), Mean Time Between Failure (MTBF), Numericals based on calculation of failure rate, hazard rate.

Warranty Management and Life cycle cost.

Unit 2: Probability Concepts and System Reliability 10 hrs

Basic probability concepts, Laws of probability, Introduction to independence, mutually exclusive, conditional probability, Discrete and continuous probability distributions, Comparison of probability distributions -binomial, normal, lognormal, Poisson, Weibull, exponential,

Standard deviation, variance, mean, mode and Central Limit Theorem.

Analysis of series, parallel, mixed configurationsystems ,Concept of k- out of n structure, Conditional probability method, delta-star method for conditional probability analysis, Tie-set and Cut Set method (Concepts and Numericals).

Unit 3: System reliability Analysis 8 hrs

Reliability Improvement- Redundancy, element redundancy, unit redundancy, standby redundancy- types of stand by redundancy, parallel components single redundancy, multiple redundancies (Numericals).

Introduction to Reliability allocation or apportionment, reliability apportionment techniques - equal apportionment, AGREE, ARINC, Minimum effort method (Numericals).

Unit 4: Reliability Management 8 hrs

Objectives of maintenance, types of maintenance, Maintainability, factors affecting maintainability, system down time, availability - inherent, achieved and operational availability (Numerical treatment).

Introduction to Reliability Centered Maintenance.

Design for maintainability and its considerations, Reliability and costs, Costs of Unreliability, Standards for Reliability-MIL Handbook 217F & Carderock Model. Technology aspects in Reliability Management, BIT (Built in testing).

Unit 5: Reliability in Design & Development 8 hrs

Reliability techniques- Failure mode, effects analysis (FMEA),Failure mode, effects and criticality analysis (FMECA)-Case Studies, Basic symbols, Fault Tree construction and analysis, Monte Carlo Simulation.

Introduction to Design of Experiments (DOE) and Taguchi Method.

Human factors in design and design principles.

Unit 6: Reliability Testing 8 hrs

Introduction to reliability testing, Stress strength interaction, Introduction to Markov model

Testing for Reliability and Durability- Accelerated Life Testing and Highly Accelerated Life Testing (HALT), highly accelerated stress Screening (HASS).

Reliability in manufacturing- Production FRACAS.

Reliability Data- Acquisition &graphical analysis.

Reference Books

1. Kapur, “ Reliability in engineering Design”, Wiley india
2. Chandrupatla, “ Quality and Reliability in Engineering” Cambridge Uni. Press, India
3. S S. Rao, Reliability Based Design, McGraw Hill Inc. 1992
4. L.S.Srinath, Reliability Engineering, EWP , 4th Edition 2011
5. Bryan Dodson, Dennis Nolan, Reliability Engineering Handbook, Marcel Dekker Inc, 2002
6. Basu S.K, Bhaduri , Terotechnology and Reliability Engineering, Asian Books Publication
7. Alessandro Birolini, Reliability Engineering Theory and Practice, Springer
8. R.M. Parkhi, Market Leadership by Quality and Reliability, Vidyanand Publications 2012
9. V.N.A. Naikan, Reliability Engineering and Life Testing, PHI Learning 2010
10. Charles E. Ebeling, Reliability and Maintainability Engineering, TMH 2009
11. Dr. Robert B. Abernathy, The New Weibull Handbook.

(402044D) Machine Tool Design (Elective I)

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut.	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
402044 D	Machine Tool Design	3	---	--	30 (1 hr)	70 (2 ½ hrs)	--	--	--	100

Pre-requisite: Manufacturing Processes, TOM, Machine Design.

Course Objectives: It expected to teach following concepts to the students,

- Selection of suitable drive to run the system.
- Design of machine tools structures, guide-ways.
- Design of Spindle, power screws.
- Dynamics of machine tools.
- Special features of machine tool design.

Course Outcome: After completion of the course student will be able to,

- Design gear box.
- Design different machine tools considering static and dynamic loads.
- Understand effect of vibrations on life of machine tools.
- Understand design considerations for Special features in Machine tools.
-

Unit 1: Drives **10 hrs**

Design considerations for drives based on continuous and intermittent requirement of power, Types and selection of motor for the drive, Regulation and range of speed based on preferred number series, geometric progression. Design of speed gear box for spindle drive and feed gear box.

Unit 2: Design of Machine Tool Structure **8 hrs**

Analysis of forces on machine tool structure, static and dynamic stiffness. Design of beds, columns, housings, bases and tables.

Unit 3: Design of Guide-ways **8 hrs**

Functions and types of guide-ways, design criteria and calculation for slide-ways, design of hydrodynamic, hydrostatic and aerostatic slide-ways, Stick-Slip motion in slide-ways.

Unit 4: Design of Spindles, Spindle Supports and Power Screws **10 hrs**

Design of spindle and spindle support using deflection and rigidity analysis, analysis of antifriction bearings, preloading of antifriction bearing. Design of power screws: Distribution of load and rigidity analysis.

Unit 5: Dynamics of Machine Tools **8 hrs**

Dynamic characteristic of the cutting process, Stability analysis, vibrations of machine tools. Control Systems, Mechanical and Electrical, Adaptive Control System, relays, push button control, electrical brakes, drum control.

Unit 6: Special features in Machine Tool Design **8 hrs**

Design considerations for SPM, NC/CNC, and micro machining, Retrofitting, Recent trends in machine tools, Design Layout of machine tool using matrices. Step-less drives Design considerations of Step-less drives, electromechanical system of regulation, friction, and ball variators, PIV drive, Epicyclic drive, principle of self locking,

Text Books

1. N.K. Mehta, “Machine Tool Design“, Tata McGraw Hill, ISBN 0-07-451775-9.
2. Bhattacharya and S. G. Sen., “Principles of Machine Tool“, New central book agency Calcutta, ISBN 81-7381-1555.
3. D. K Pal, S. K. Basu, “Design of Machine Tool“, 4th Edition. Oxford IBH 2005, ISBN 81- 204-0968

Reference Books

1. N. S. Acherkan, “Machine Tool“, Vol. I, II, III and IV, MIR publications.
2. F. Koenigsberger, “Design Principles of Metal Cutting Machine Tools“, The Macmillan Company New York 1964

(402045A) Gas Turbine and Propulsion (Elective II)

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut.	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
402045 A	Gas Turbine and Propulsion	3	---	--	30 (1 hr)	70 (2 ½ hrs)	--	--	--	100

Pre-requisites: Basic Thermodynamics, Fluid Mechanics, Turbo Machinery

Course Objectives:
- Understand the thermodynamics of each component of a turbine engine which include inlets, fans, compressors, burners, turbines, afterburners and nozzles
- Know what the design variables are for each component
- Understand the linked system performance of all components in the engine and performance trends for each component
- Understand the basis for off-design performance

Course Outcome: At the end of this course the students should be able to
- Demonstrate the gas turbine power plant
- Illustrate the jet propulsion system
- Analyze the performance of gas turbine engine
- Present the technical details of compressors used in gas power systems

Unit 1: Introduction to Gas Turbine 8 hrs

Basic Mechanics, Simple Gas Turbine, Open cycle, closed cycles, single-shaft and twin-shaft arrangements, Combined and cogeneration cycle, Introduction to Aircraft propulsion and Rocket Propulsion(Principle, propellant and its properties), gas turbine design procedure, Environmental Issues, Industrial applications

Unit 2: Analysis of Shaft Power Cycles 10hrs

Idea Cycle: Assumption in ideal cycle, Simple Gas Turbine Cycle (Efficiency & Specific work), Heat Exchange Cycle, Reheat cycle, reheat Cycle with heat exchanger, intercooled compression Cycle with heat exchanger,
Practical Cycles: Methods of accounting for component losses—Stagnation properties, Compressor and Turbine Efficiencies, Polytrophic efficiency, Pressure Losses, Heat exchanger Effectiveness, Combustion efficiency Mechanical Losses, Variation of Specific Heat—Numerical on ideal cycle and considering all losses

Unit 3: Analysis of Propulsion Cycles 8hrs

Introduction to aircraft propulsion, Aircraft Intake, Nozzle and diffuser(Losses), criteria for performance, Thermodynamic analysis of turbojet engine, Thermodynamic analysis of turbofan engine, Thermodynamic analysis of turbo-prop engine, Parameter affecting the flight performance, thrust augmentation.

Unit 4: Axial Flow Turbine 8hrs

Concept of turbine - Cascade of Blade – Blade material, analysis of turbine stage - velocity triangles and characterization of blades and stages, utilization factor, Design of axial flow turbine - Performance analysis of turbines.

Unit 5: Axial Flow Compressor 8hrs

Basic operation (diffusion process), Cascade of Blade (Blade loading, Flow coefficient, blade and stage efficiency), compressor stage, Velocity triangle, Degree of reaction, work done factor, Factor affecting pressure ratio (losses),

Unit 6: Combustion System and Performance of Gas Turbine Engine 8hrs

Combustion system

Types of Combustion system, requirement of Combustion chamber, Combustion process in gas turbine, Factor effecting combustion chamber performance (pressure loss, combustion efficiency, outlet temperature distribution, stability limits and combustion intensity), Mixing and dilution.

Performance of gas turbine engine

Component characteristics of compressor and turbine, off design characteristics, Equilibrium point and procedure to find it, Equilibrium running of gas turbine generator, matching of gas generator with free turbine, part load performance

Text Books:

1. H.I.H. Saravanamuttoo, G.F.C. Rogers, H. Cohen, "Gas Turbine Theory", 6th ed.
2. Jack D. Mattingly, "Elements of Gas Turbine Propulsion"
3. V Ganesan, "Gas Turbines", 3rd ed., Tata McGraw-Hill Education
4. Sutton, " Rocket Propulsion elements", 7th edition Wiley, India
5. Flack R., " Fundamentals of Jet Propulsion with Applications", Cambridge Uni. Press, India
6. J.D. Anderson, "Introduction to Flight", 5th ed., Tata McGraw Hill

(402045B) Product Design and Development (Elective II)

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut.	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
402045 B	Product Design and Development	3	---	--	30 (1 hr)	70 (2 ½ hrs)	--	--	--	100

Pre-Requisites: Nil

Course Objectives: To explain students significance of,
- Product design and development.
- Hurdles in commercialization of product.
- Importance of reverse engineering.
- Focus of designing a product.
- Design validation plan.
- PLM and PDM

Course Outcome: After successful completion of the course students would be able to
- Design a sustainable product.
- Develop commercial Product
- Master in new techniques PLM and PDM

Unit 1: Introduction to Product Design and development 7 hrs

Definition of product design, Essential Factors for product design, Product design phases, Modern approaches to product design, standardization, simplification and specialization in product design product development, product development versus product design, product development team and product development planning, modern product development process with reference to ISO standard, product testing, product validation, Product verification and production validation

Unit 2: Product Development –Technical and Business Concerns 8 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 , Analysis of Gathered Information, Customer Population and Market Segmentation, Economic Analysis of Product (Numerical).

Unit 3: Product Development from Concept to Product Function 8 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, (numerical)concept scoring, process of concept embodiment, system modeling, functional modeling and decomposition, fast method, subtract and operate procedure

Unit 4: Reverse Engineering 8 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 8hrs

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)

Unit 6: Product Life Cycle Management and Product Data Management 7 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.
Case study based for design and development of any mechanical product.

Reference Books:

1. A. K. Chitale; R.C. Gupta, Product Design and Manufacturing, Prentice Hall India.
2. Dieter George E., Engineering Design McGraw Hill Pub. Company, 2000.
3. Kevin Otto and Kristin Wood, Product Design : Techniques in Reverse Engineering and New Product Development ,Pearson Education Inc.
4. Grieves, Michael, Product Lifecycle Management McGraw Hill
5. Bralla, James G., Handbook of Product Design for Manufacturing, McGraw Hill Pub.
6. Karl Ulrich, product design and development, TMH.

402045C Operation Research (ELECTIVE II)

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut.	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
402045 C	Operation Research	3	---	--	30 (1 hr)	70 (2 ½ hrs)	--	--	--	100

Pre-Requisites: Engineering Mathematics, Theory of probability, Statistics.

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: Learner will be able to.....
- Illustrate the need to optimally utilize the resources in various types of industries.
- Apply and analyze mathematical optimization functions to various applications.
- Demonstrate cost effective strategies in various applications in industry.

Unit 1: Introduction: Operation Research 8 hrs

Introduction: Definition, Evolution and Classification of Quantitative Methods and Operations Research Techniques, Methodology, Advantages and Limitations.
Linear Programming: Introduction, Formulation, Simplex Method (Big – M and Two Phase Methods), Dual Simplex Method (Conversion of primal to dual)
Introduction to Sensitivity Analysis.
Decision Theory: Meaning and Steps in Decision Making, Types of Management Decisions, Decision under Certainty, under Risk, under Uncertainty, Decision Trees.

Unit 2: Transportation Model 8 hrs

Introduction, Formulation, Basic Method of Solving Transportation Problem, Optimization Methods like UV and Stepping Stone Method, Concept of Trans-shipment Methods as an Extension of Transportation.
Assignment Problem- Hungarian Method to solve Assignment Problem, Travelling Salesman as an Extension of Assignment Problem.

Unit 3: Theory of Games and Investment Analysis 8 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.
Investment Analysis: Break-Even Analysis, Payback Period Method, A (A) R Method, DCF Method, IRR Method, Introduction to Probabilistic Models.

Unit 4: Inventory Control and Replacement Analysis 8 hrs

Inventory Control - Deterministic Models- Shortage, without shortage; Probabilistic Inventory Models, Introduction to Concept of Service level.
Replacement Analysis - Replacement of Items that Deteriorate, Replacement of Items that Fail Suddenly.

Unit 5: Queuing Theory and Sequencing models 8 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: Network Models 8 hrs

Network Models: Fulkerson's rule, concept and types of floats, CPM and PERT, Introduction to crashing.
Simulation: Introduction, Monte-Carlo Simulation method, Simulation of Inventory and Queuing Problems.
Introduction to Multi Object Decision Making: Goal Programming Formulation.

Text Books:

1. N. D. Vora, Quantitative Techniques.
2. Prem Kumar Gupta, D. S. Hira, Problems in Operations Research: Principles and Solutions, S. Chand, 1991
3. J. K. Sharma, Operations Research : Theory And Application, Laxmi pub. India.
4. Operations Research, S. D. Sharma, Kedar Nath Ram Nath-Meerut.

Reference Books:

1. Belegundu, " Optimization Concepts and Applications in engineering, Cambridge Uni. Press, India
2. Hillier F.S., and Lieberman G.J., Operations Research, Eight Edition, Mc. Tata McGraw Hill, India
3. Ravindran, "Engineering optimization Methods and Appliations", 2nd edition, Wiley, India
4. Ravindran, Phillips and Solberg, Operations Research Principles and Practice, Second Edition, Mc. WSE Willey,
5. Operations Research - An introduction, Hamdy A Taha, Pearson Education.

(402045D) Advanced Manufacturing Processes (Elective II)

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut.	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
402045 D	Advanced Manufacturing Processes	3	---	--	30 (1 hr)	70 (2 ½ hrs)	--	--	--	100

Prerequisite: Fluid Mechanics, Heat transfer

Course Objectives:

1. To Introduce the students with Advanced Manufacturing Processes
2. To Introduce the student with Measurement techniques for micro machining
3. To Introduce the student

Course Outcomes:

1. Selection of appropriate manufacturing process for advance components
2. Characterization of work pieces

Unit I: Metal Forming **8 hrs**

Roll forming, High velocity hydro forming, High velocity Mechanical Forming, Electromagnetic forming, High Energy Rate forming (HERF), Spinning, Flow forming, Shear Spinning

Unit II: Advanced Welding, casting and forging processes **8 hrs**

Friction Stir Welding – Introduction, Tooling, Temperature distribution and resulting melt flow
Advanced Die Casting - Vacuum Die casting, Squeeze Casting

Unit III: Advanced techniques for Material Processing **8 hrs**

STEM: Shape tube Electrolytic machining, EJT: Electro Jet Machining, ELID: Electrolytic In process Dressing, ECG: Electrochemical Grinding, ECH: Elctro-chemical Etching
Laser based Heat Treatment

Unit IV: Micro Machining Processes **8 hrs**

Diamond micro machining, ultrasonic micro machining, micro elctro discharge machining

Unit V: Additive Manufacturing Processes **8 hrs**

Introduction and principles, Development of additive manufacturing Technologies, general additive manufacturing processes, powder based fusion process, extrusion based system, sheet lamination process, direct write technologies

Unit VI: Measurement Techniques in Micro machining **8 hrs**

Introduction, Classification of measuring System, Microscopes : Optical Microscope, Electron Microscopes, Laser based System, Interference Microscopes and comparators, Surface profiler, Scanning Tunneling Microscope, Atomic force micro scope, Applications.

Reference Books:

1. Principles of Modern Manufacturing -- Groover, WILEY, India
2. Technology of Metal Forming processes -- Surender Kumar PHI Publication

3. Sheet metal forming: Processes and Applications -- Tayalan Atlan ASM International USA
4. Friction Stir welding and Processing -- Rajiv S.Mishra ASM International
5. High Integrity Die casting Processes -- Edward J vinarcik John Wiley and Sons
6. Advanced Methods of Machining -- J.A. Mcgeough Chapman & Hall
7. Electro Chemical Machining --A.E. De Barr and D.A Oliver Mac Donald and company Publisher Ltd.
8. Micro machining of Engineering Materials -- Joseph Mcgeough Marcel Dekker, Inc.
9. Additive Manufacturing Techniques -- Ian Gibson Springer

(402046) PROJECT STAGE I*

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut.	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
402046	Project Stage I	--	2	--	---	----	50*	--	--	50

*** Assessment should be carried out by panel of examiners from same Institute**

INSTRUCTIONS FOR DISSERTATION 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 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 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. 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)

(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 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 of the thesis
(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 [2015-16]
(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. Lele M.M.* , has successfully completed the Project Stage – I entitled "Performance analysis of……." 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 ___________________

Head Department ___________________
and Institute Name

Principal, ___________________
Institute Name

Seal

SEMESTER II

(402047) Power Plant Engineering

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut.	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
402047	Power Plant Engineering	4	---	2	30 (1 hr)	70 (2 ½ hrs)	2	--	50	175

Prerequisites:
Thermodynamics, Basic Mechanical Engineering, Turbo Machine, and Internal Combustion Engine

Course Objectives:
- To develop an ability to apply knowledge of mathematics, science, and engineering.
- To develop an ability to design a system, component, or process to meet desired needs within realistic constraints.
- To develop an ability to identify, formulate, and solve engineering problems.
- To develop an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Course Outcomes:
- Ability to have adequacy with Design, erection and development of energy conversion plants.
- Optimization of Energy Conversion plant with respect to the available resources.
- Scope of alternative erection of optimized, suitable plant at the location depending upon geographical conditions.

Unit 1: Introduction **8 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) Economics of Power Generation: Introduction, Cost of electric energy, Fixed and operating cost, (with numerical treatment), Selection and Type of generation, Selection of generation equipment, Performance and operation characteristics of power plants and Tariff methods.

Unit 2: Thermal Power Plant **10 hrs**

A)Introduction: General layout of modern power plant with different circuits, working of thermal power plant, coal classification, coal, ash and dust handling, selection of coal for Thermal Power Plant, FBC boilers, high pressure boiler, Rankine cycle with reheat and regeneration, cogeneration power plant (with numerical)

B)Steam Condenser: Necessity of steam condenser, Classification, Cooling water requirements, Condenser efficiency, Vacuum efficiency, Cooling towers, air Leakage, Effects of Air Leakage on condenser performance, (Numerical Treatment)

Unit 3: Hydroelectric and Nuclear power plant **8 hrs**

A)Hydroelectric Power Plant: Introduction, Site Selection, Advantages and Disadvantages of HEPP, Hydrograph , Flow duration curve ,Mass Curve, Classification of HEPP with layout.

B)Nuclear Power Plants: Elements of NPP, Nuclear reactor & its types, fuels moderators, coolants, control rod, classification of NPP, N-waste disposal

Unit 4: Diesel & Gas Turbine Power plant **8 hrs**

A) Diesel Engine Power Plants: Plant Layout, Diesel Engine Power Plant Performance Analysis, application, selection of engine size, advantages & disadvantages of diesel power plant.

B) Gas Turbine Power Plant : Introduction, fuels, materials selection for GTPP, Brayton Cycle analysis, Thermal Efficiency, Work ratio, maximum & optimum pressure ratio, Actual cycle effect of operating variables on thermal efficiency, inter-cooling reheating, & regeneration cycle, Open, Closed & Semi Closed cycles Gas Turbine Plant , combined cycle plant (Numerical Treatment).

Unit 5: Non-Conventional Power Plants **8 hrs**

Wind Power plant : Introduction, wind availability measurement, types of wind machines, site selection, and wind power generation.

Solar Power Plant : Introduction, components ,Types of Collectors & Solar Ponds, Low & High Temperature Solar Power Plant. Photovoltaic Power System, Heliostat

Tidal, OTEC, geothermal, magneto hydrodynamics, fuel cell, hybrid power plants, Challenges in commercialization of Non-Conventional Power Plants.

Unit 6: Instrumentation and Environmental Impact **8 hrs**

A) Power Plant Instrumentation

Layout of electrical equipment, generator, exciter, short circuits & limiting methods, switch gear, circuit breaker, power transformers, methods of earthling, protective devices & Control system used in power plants, Control Room.

B) Environmental impact due to power plants.

Environmental aspects, introduction, constituents of atmosphere, different pollutants due to thermal power plants and their effects of human health, Environmental control of different pollutant such as particulate matter, Oxides of sculpture, nitrogen, global warming & green house effect, thermal pollution of water & its control. Noise pollution by power plants.

Term Work: Any Eight experiments from No.1 to 9 of the following.

1) Visit to thermal Power plant /Co-generation Power plant.
2) Visit to HEPP/GTPP/Non-Conventional Power Plants.
3) Study of FBC system.
4) Study of High Pressure boilers.
5) Trial on steam power plant.
6) Trial on Diesel Power Plant.
7) Study of power plant instruments.
8) Study of Nuclear Power Plants.
9) Study of Environmental Impact of Power Plants.

   (No. 10 & 11 are optional, to facilitate placement for students in Power Plants)

10) Assignment on simulated performance of steam power plant with suitable software.
11) Assignment on simulated performance of Diesel Power Plant with suitable software.

Reference Books:

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. K K Ramalingam ,” Power Plant Engineering, SCITECH Publications Pvt Ltd.
4. Domkundwar & Arora, “Power Plant Engineering”, Dhanpat Rai & Sons, New Delhi.
5. R.K.Rajput, “Power Plant Engineering”, Laxmi Publications New Delhi.
6. R.Yadav , “Steam and Gas Turbines” ,Central Publishing House, Allahabad.
7. D.K.Chavan & G.K.Phatak, “Power Plant Engineering” , Standard Book House, New Delhi.
8. G.D.Rai, “ Non-Conventional Energy Sources” Khanna Publishers,Delhi
9. S.P.Sukhatme, “Solar Energy” Tata McGraw-Hill Publications, New Delhi

(402048) Mechanical System Design

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut.	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
402048	Mechanical System Design	4	---	2	30 (1 hr)	70 (2 ½ hrs)	--	--	50	150

Pre-requisite: Manufacturing Process, Machine design, Engineering Mathematics, TOM, 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:
- The student will understand the difference between component level design and system level design.
- Ability to design various mechanical systems like pressure vessels, machine tool gear boxes, material handling systems, etc. for the specifications stated/formulated.
- Ability to learn optimum design principles and apply it to mechanical components.
- Ability to to handle system level projects from concept to product.

Unit 1: Design of Machine Tool Gearbox — 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, deviation diagram, difference between numbers of teeth of successive gears in a change gear box.

Unit 2: Statistical considerations in design — 6 hrs

Frequency distribution-Histogram and frequency polygon, normal distribution - units of 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 conveyer 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 — 10 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. S. 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 and DFMA 8 hrs

Optimum Design

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).

Design for manufacture, assembly and safety

General principles of design for manufacture and assembly (DFM and DMFA), principles of design of castings and forgings, design for machining, design for safety.

Term work: Term work shall consists of

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.

2. Assignments

The assignment shall be internally presented in the form of power point presentation by a group of two or three 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:

1. Design review of any product/ system for strength and rigidity considerations.
2. Design review of any product/system for manufacturing, assembly and cost considerations.
3. Design review of any product/system for aesthetic and ergonomic considerations.
4. Analysis of any product/system using reverse engineering.
5. Case study of one patent from the product design point of view.
6. Failure mode and effect analysis of one product/component.
7. Design of Experiments (DOE)
8. Selection of gear box for various mechanical system like epicyclic gear trains , differential gear boxes , speed reducer etc
9. Design of Human Powered system.
10. Application of composite material for different mechanical components.
11. Design of material handling system for specific / various applications such as chain and screw conveyors
12. Concurrent engineering

Text Book

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

Reference Books

1. Shigley J. E. and Mischke C.R., "Mechanical Engineering Design", McGraw Hill Pub. Co
2. M. F. Spotts, "Mechanical Design Analysis", Prentice Hall Inc.
3. Black P.H. and O. Eugene Adams, "Machine Design" McGraw Hill Book Co. Inc.
4. Johnson R.C., "Mechanical Design Synthesis with Optimization Applications", Von Nostrand Reynold Pub.

5. S.K. Basu and D. K. Pal, “Design of Machine Tools,,, Oxford and IBH Pub Co.
6. Rudenko,”Material Handling Equipment”, M.I.R. publishers, Moscow
7. P. Kannaiah ,”Design of Transmission systems”, SCIETCH Publications Pvt Ltd.
8. Pandy, N. C. and Shah, C. S., “Elements of Machine Design“, Charotar Publishing House.
9. Mulani, I. G., “Belt Conveyors”
10. Singiresu S. Rao, Engineering Optimization: Theory and Practice, , John Wiley & Sons.
11. M.V. Joshi, Process Equipment Design, Mc-Millan.
12. Design Data“, P.S.G. College of Technology, Coimbatore.
13. Bhandari, V. B. Machine Design data book, Tata McGraw Hill Publication Co. Ltd.
14. I.S. 2825: Code for unfired pressure vessels.

(402049A) Refrigeration and Air Conditioning Equipment Design (Elective III)

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut.	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
402049 A	Refrigeration and Air Conditioning Equipment Design	4	---	--	30 (1 hr)	70 (2 ½ hrs)	--	--	--	100

Pre-requisite:

Refrigeration and Air Conditioning, Engineering Thermodynamics,

Course Objectives:

- Study of refrigeration cycles i.e. trans-critical cycle, cascade cycle, etc.
- Understanding of materials and designs of refrigeration and air conditioning equipment like controls, evaporators, condensers, cooling towers
- Learning of low temperature systems and heat pipe

Course Outcomes: At the end of this course the students should be able to

- Select the different components of refrigeration system i.e. condensers, evaporators, controls etc. for given applications
- Demonstrate the concepts of design of evaporators and condensers for unitary systems
- Analyses the performance of cooling tower and heap pipe.
- Illustrate the methods for production of ultralow temperature

Unit 1: Advanced Vapour Compression Cycles 8 hrs

Review of vapour compression cycle, Transcritical cycle and their types, presentation of cycle on P-h and T-s chart, Multi evaporator and multi compression systems, ammonia-CO_2 cascade cycle.

Compressor: classifications, applications, Characteristic curves & capacity controls for reciprocating & centrifugal compressors, sizing of reciprocating compressor.

Unit 2: Safety Controls 8 hrs

HP/LP and Oil pressure failure control, Thermal overload protection for hermetic motors, reduced voltage protection, motor over current protection, adjustable speed drives, variable frequency drives, flow failure switches, safety valves, purge valves, level controller

Operating Control **-** Solenoid valve, regulating valves

Defrost methods for sub-zero applications

Methods of defrosting: manual and auto, water, electric, hot gas, re-evaporator coils, defrosting: multiple evaporator systems, reverse cycle defrosting, vapor defrosting

Unit 3: Introduction to Cryogenics 8 hrs

Introduction, Figure of Merit, Limitations of VCS for the production of low temperatures, Joule-Thompson effect, Linde and Claude system, Liquefaction of gases such as N2 and He. Properties of cryogenic fluid,

Insulation: Types and materials

Unit 4: Condensers and Evaporators 8 hrs

Condensers

Types, thermal design and operational considerations: Shell and tube condensers - horizontal & vertical types,

Evaporators

Ttypes, rating & selections, and design considerations, Standards for evaporators & condensers

Unit 5: Cooling Towers **8 hrs**

Types - basic relation - heat balance and heat transfer - characteristics, effects of - packing - geometry, design of cooling towers, spray design, cooling tower thermal performance, cooling tower theory, tower efficiency.

Unit 6: Heat Pipes **8 hrs**

Structures - applications - basic relations - performance characteristics - effects of working fluid and operating temperature, wick - selection of material - pore size (basic concepts only)
Non-Conventional Refrigeration systems: vortex tube, pulse tube, thermoelectric refrigeration, magnetic refrigeration, steam-jet refrigeration.

Text Books:

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

Reference Books:

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

(402049B) Robotics (Elective III)

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut.	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
402049 B	Robotics	4	---	--	30 (1 hr)	70 (2 ½ hrs)	--	--	--	100

Pre-Requisite: Engineering Mechanics, TOM, Mechatronics, Basics of Electrical Engineering, Control system.

Course Objective: To teach students,

1. Basics of robotics (Links, Actuators, Sensors etc).
2. Statistics & Kinematics of robots.
3. Desired motion of robot.
4. Control system necessary for accurate operation of the robot.

Course Outcomes: After completion of the course student would be able to,

1. Understand the complete design procedure of the robot.
2. Select correct mechanism for operation of the robot.
3. Select necessary actuators, sensors, control for satisfactory performance of the robot.

Unit 1: Introduction **8 hrs**

Robots: Introduction, Structure, Classification and Application.
Joints & Links: Position and orientation of a rigid body, Homogeneous transformations, Representation of joints, link representation using Denavit-Hartenberg parameters.
Actuators: Brushless DC Motor (construction, working and selection)
Sensors: GPS, IMU, Vision, PVDF Tactile (construction, working and selection)
Grippers: Hydraulic and Servo (construction, working and selection)

Unit 2: Kinematics and Kinematics of Robot **10 hrs**

Kinematics of serial robots: Direct and inverse kinematics problems, workspace of a serial robot, Inverse kinematics of constrained and redundant robots, Inverse kinematics solution for the general 6R serial manipulator.
Kinematics of parallel robots: Degrees-of-freedom of parallel mechanisms and manipulators, Active and passive joints, Constraint and loop-closure equations, Direct kinematics problem, Mobility of parallel manipulators, Closed-from and numerical solution, Inverse kinematics of parallel manipulators

Unit 3: Statics of Robot Manipulators **10 hrs**

Statics of robot manipulators: Linear and angular velocity of links, Velocity propagation, Manipulator Jacobians for serial and parallel manipulators, Velocity ellipse and ellipsoids, Singularity analysis for serial and parallel manipulators, Loss and gain of degree of freedom, Statics of serial and parallel manipulators, Singularity analysis and statics.

Unit 4: Dynamics of Robot **8 hrs**

Dynamics of serial and parallel robots: Mass and inertia of links, Lagrangian formulation for equations of motion for serial and parallel manipulators, Generation of symbolic equations of motion using a computer, Simulation (direct and inverse) of dynamic equations of motion, Examples of a planar 2R and four-bar mechanism, Recursive dynamics.

Unit 5: Motion Planning and Control **8 hrs**

Motion planning and control: Joint and Cartesian space trajectory planning and generation, potential field method for motion planning, independent joint PID control (parallel form) and its tuning (ZN step response method), Control of a multi-link manipulator, Control of constrained manipulators, Force control and hybrid position/force control

Unit 6: Artificial Intelligence and Image Processing **10 hrs**

Linear Kalman Filter: Algorithm, Application

Artificial Intelligence: Introduction, Need and Application, Problem solving through forward and backward search.

Image Processing: Introduction, Need, Image acquisition, Masking, Sampling and quantization, Image Processing Technique-edge detection, noise reduction; Image Segmentation.

Text Books:

1. S B Niku, *Introduction to Robotics, Analysis, Control, Applications*, 2nd Edition, Wiley Publication, 2015.
2. John Craig, *Introduction to Robotics, Mechanics and Control*, 3rd Edition, Pearson Education, 2009
3. Mathia, *Robotics for Electronics Manufacturing*, Cambridge Uni. Press, India
4. A Ghosal, *Robotics: Fundamental Concepts and Analysis*, Oxford University Press, 2013.
5. R K Mittal & I J Nagrath, *Robotics and Control*, McGraw Hill Publication, 2015.
6. K Astrom & T Hagglund, *PID Controllers: Theory, Design and Tuning*, 2nd Edition, The Instrumentation, Systems, and Automation Society, 1995.
7. Asfahl, *Robots and Manufacturing Automation*, Wiley, India, 2012

(402049C) Industrial Engineering (Elective III)

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut.	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
402049 C	Industrial Engineering	4	---	--	30 (1 hr)	70 (2 ½ hrs)	--	--	--	100

Pre-requisite: Manufacturing Process, Engineering Mathematics.

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.

Course Outcomes: Learner will be able to.....
- Apply the Industrial Engineering concept in the industrial environment.
- Manage and implement different concepts involved in methods study and understanding of work content in different situations.
- Undertake project work based on the course content.
- Describe different aspects of work system design and facilities design pertinent to manufacturing industries.
- Identify various cost accounting and financial management practices widely applied in industries.
- Develop capability in integrating knowledge of design along with other aspects of value addition in the conceptualization and manufacturing stage of various products.

Unit 1: Introduction to Industrial Engineering and Productivity 7 hrs

Introduction: Definition and Role of Industrial Engineering, Contribution of Taylor and Gilbreth, Organisation : Concept of organisation, characteristics of organisation, elements of organisation, organisational structure, organisation charts; Types of organisation- formal line, military organisation, functional organization, line & staff organisation; Introduction to management principles, authority and responsibility, span of control, delegation of authority.

Productivity : Definition of productivity, Productivity of materials, land, building, machine and power. Measurement of productivity: factors affecting the productivity, Productivity Models and Index (Numerical), productivity improvement programmers.

Unit 2: Method Study 7 hrs

Work Study : Definition, objective and scope of work-study. Human factors in work-study.

Method Study : Definition, objective and scope of method study, activity recording and exam aids, Charts to record moments in shop - operation process charts, flow process charts, travel chart, two handed chart and multiple activity charts. Charts to record movement at work place - principles of motion economy, classification of moments, SIMO chart, and micro motion study.

Definition and installation of the improved method, brief concept about synthetic motion studies.(Numerical); Introduction to Value Engineering and Value Analysis;

Unit 3: Work Measurements 7 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 **7 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)
Supply Chain Management: Concept, Strategies, Supply Chain Network, Push and Pull Systems, Logistics, Distribution; Order Control strategies: MTO, MTA, MTS.

Unit 5: Facility Design **7 hrs**

Facility Location Factors and Evaluation of Alternate Locations; Types of Plant Layout; Computer Aided Layout Design Techniques; Assembly Line Balancing (Numerical);
Material Handling: Principles, Types of Material Handling Devices; Stores Management
Inventory Control: Functions, costs, classifications- deterministic and probabilistic inventory models, Concept of EOQ, purchase model without shortages (Numerical); ABC and VED Analysis.

Unit 6: Engineering Economy, Human Resource and Industrial Safety **7 hrs**

Engineering Economy and Costing: Elementary Cost Accounting and Methods of Depreciation; 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, 360^0).
Industrial Safety: Safety Organisation, Safety Programme, General Safety Rules.

Text Books:

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 Organisation & Engineering Economics, Khanna publication.

Reference Books:

1. Introduction to Work Study by ILO, ISBN 978-81-204-1718-2, Oxford & IBH Publishing 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, CRC Press,2002
5. Martin Murry, SAP ERP: Functionality and Technical Configuration, SAP Press; 3rd New edition (2010).
6. Barnes, Motion and time Study design and Measurement of Work, Wiley India

(402050 A) Computational Fluid Dynamics (Elective IV)

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut.	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
402050 A	Computational Fluid Dynamics	4	---	2	30 (1 hr)	70 (2 ½ hrs)	25	--	--	125

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 discretize the governing differential equations and domain by Finite Difference Method.
- 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 career in industry in CAE through use of software tools.
- To prepare the students for research leading to higher studies.

Course Outcomes:

- Ability to analyze and model fluid flow and heat transfer problems.
- Ability to generate high quality grids and interprete the correctness of numerical results with physics.
- Ability to use a CFD tool effectively for practical problems and research.
- Ability to conceptualize the programming skills.

Unit 1: Introduction to CFD 8 hrs

CFD – a research and design tool, CFD as third dimension of engineering supplementing theory and experiment, Steps in CFD solution procedure, strengths and weakness of CFD, Flow modelling using control volume - finite and infinitesimal control volumes, Concept of substantial derivative, divergence of velocity, Basic governing equations in integral and differential forms – conservation of mass, momentum and energy (No derivations), Physical interpretation of governing equations, Navier-Stoke's model and Euler's model of equations.

Unit 2: Basic Discretization Techniques 10 hrs

Introduction to grid generation (Types of grids such as structured, unstructured, hybrid, multiblock, Cartesian, body fitted and polyhedral etc.), Need to discretize the domain and governing equations, Finite difference approximation using Taylor series, for first order (Forward Difference Approximation, Backward Difference Approximation, Central difference Approximation) and second order (based on 3 node, 4 node and 5 node points),explicit and Implicit approaches applied to 1D transient conduction equation, Couette flow equation ($\frac{\partial p}{\partial x} = 0$) using FTCS and Crank Nicholson's Method, Stability Criteria concept and physical interpretation, Thomas Tri-diagonal matrix solver.

Unit 3: Two Dimensional Steady and unsteady heat conduction 8 hrs

Solution of two dimensional steady and unsteady heat conduction equation with Dirichlet, Neumann, robbins and mixed boundary condition – solution by Explicit and Alternating Direction Implicit method (ADI Method), Approach for irregular boundary for 2D heat conduction problems.

Unit 4: Application of Numerical Methods to Convection – Diffusion System 10 hrs

<u>Convection:</u> first order wave equation solution with upwind, Lax–Wendroff, Mac Cormack scheme, Stability Criteria concept and physical interpretation

<u>Convection –Diffusion:</u> 1D and 2D steady Convection Diffusion system – Central difference approach, Peclet Number, stability criteria, upwind difference approach, 1 D transient convection-diffusion system

Unit 5: Incompressible Fluid Flow **8 hrs**

Solution of Navier-Stoke's equation for incompressible flow using SIMPLE algorithms and its variation (SIMPLER), Application to flow through pipe, Introduction to finite volume method.

Unit 6: CFD as Practical Approach **8 hrs**

Introduction to any CFD tool, steps in pre-processing, geometry creation, mesh generation, selection of physics and material properties, specifying boundary condition, Physical Boundary condition types such as no slip, free slip, rotating wall, symmetry and periodic, wall roughness, initializing and solution control for the solver, Residuals, analyzing the plots of various parameters (Scalar and Vector contours such as streamlines, velocity vector plots and animation). Introduction to turbulence models. Reynolds Averaged Navier-Stokes equations (RANS), k-ϵ , k-ω. Simple problems like flow inside a 2-D square lid driven cavity flow through the nozzle.

Term Work: Practicals to be performed: Any 8 in the given list below (from 1-9) should be performed with mini project (Sr.No.10) compulsory.

1 Generation of different meshes

a. Structured mesh
b. Unstructured mesh,
c. Multiblock, etc.

2. Program on 1D transient heat conduction by FTCS OR Crank Nicholson scheme
3. Program on 1-D (first order)wave equation by Upwind scheme and study the impact of CFL number on the stability and solution .
4. Program on 2D Transient Conduction equation / 2D Convection-Diffusion Equation
5. Numerical simulation and analysis of boundary layer over a flat plate (Blausius Equation) are using any CFD software or computer programming.
6. Numerical simulation and analysis of boundary layer for a a). Developing flow through a) Pipe b) Fully developed flow through a pipe.
7. Numerical simulation and analysis of 2D square lid driven cavity using any CFD software. Effect of Reynolds number on the vorticity patterns.
8. CFD Analysis of external flow: Circular Cylinder or Aerofoil (NACA 0012)
9. CFD analysis of heat transfer in pin fin.
10. Mini project on any practical application. Students should take a problem of their choice and verify the CFD solution with experimental data / research paper.

Reference Books:

1. John D Anderson: Computational Fluid Dynamics- The Basics with Applications, McGraw-Hill
2. J. Tu, G.-H. Yeoh and C. Liu: Computational Fluid Dynamics: A practical approach, Elsevier.
3. A. W. Date: Introduction to Computational Fluid Dynamics, Cambridge University Press, India
4. P. S. Ghoshdastidar: Computer Simulation of Fluid flow and heat transfer, Tata McGraw-Hill.
5. Bates, Computational Fluid Dynamics, Wiley India
6. C. Hirsch: Numerical Simulation of internal and external flows Vol. 1, John Wiley
7. Tannehill, Anderson, and Pletcher: Computational Fluid Mechanics and Heat transfer, CRC Press.
8. J. H. Ferziger and M. Peric: Computational Methods for Fluid Dynamics, 3rd Edition, Springer
9. Zikanov, Essential Computational Fluid Dynamics, Wiley India
10. Batchelor, An Introduction to fluid Dymanics, Cambridge Uni. Press, india

(402050B) Finite Element Analysis (Elective IV)

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut.	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
402050 B	Finite Element Analysis	4	---	2	30 (1 hr)	70 (2 ½ hrs)	25	--	--	125

Pre-Requisites:
- Mechanics of materials
- DME I and DME II (Static and dynamic failure theories)
- Engineering Graphics
- Fundamentals of Programming Language

Course Objectives:
- 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:
Upon completion of this course, the student will be able to:
- 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.
- 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.

Unit 1: Fundamentals Concepts of FEA **10hrs**
Introduction– Brief History of FEM, Finite Element Terminology (nodes, elements, domain, continuum, Degrees of freedom, loads & constraints) General FEM procedure, Applications of FEM in various fields, P & h formulation, Advantages and disadvantages of FEM. Consistent units system.
Review of Solid Mechanics Stress equilibrium equations, Strain-Displacement equations, Stress-Strain-Temperature Relations, Plane stress, plane strain and axi-symmetric problems, Strain energy, Total potential energy. Essential and natural boundary conditions
Review of Matrix Algebra (Vectors, Matrices, Symmetric banded matrix, Determinants, Inverses), banded skyline solutions. Introduction to solvers (Sparse solver, iterative solver, PCG, block Lanczos).
Introduction to different approaches used in FEA such as direct approach, Variational approach, weighted residual, energy approach, Galerkin and Raleigh Ritz approach.

Unit 2: 1D Elements **8hrs**
Types of 1D elements. Displacement function, Global and local coordinate systems, Order of element, primary and secondary variables, shape functions and its properties.
Formulation of elemental stiffness matrix and load vector for spring, bar, beam, truss and Plane frame.
Transformation matrix for truss and plane frame, Assembly of global stiffness matrix and load vector, Properties of stiffness matrix, half bandwidth, Boundary conditions elimination method and penalty approach, Symmetric boundary conditions, Stress calculations.

Unit 3: 2D Elements **10 hrs**

Types of 2D elements, Formulation of elemental stiffness matrix and load vector for Plane stress/strain such as Linear Strain Rectangle (LSR), Constant Strain Triangles (CST), Pascal's triangle , primary and secondary variables, properties of shape functions. Assembly of global stiffness matrix and load vector, Boundary conditions, solving for primary variables (displacement), Overview of axi-symmetric elements

Unit 4: Isoparametric Elements **10 hrs**

Concept of isoparametric elements, Terms Isoparametric, super parametric and subparametric. Isoparmetric formulation of bar element.

Coordinate mapping - Natural coordinates, Area coordinates (for triangular elements), higher order elements (Lagrangean and serendipity elements). Convergence requirements- patch test, Uniqueness of mapping - Jacobian matrix. Numerical integration – 2 and 3 point Gauss Quadrature, full and reduced integration. Sub-modeling, substructuring.

Unit 5: 1D Steady State Heat Transfer Problems **8 hrs**

Introduction, Governing differential equation, steady-state heat transfer formulation of 1D element for conduction and convection problem, boundary conditions and solving for temperature distribution.

Unit 5: Dynamic Analysis **8 hrs**

Types of dynamic analysis, General dynamic equation of motion, point and distributed mass, lumped and Consistent mass, Mass matrices formulation of bar and beam element.

Undamped-free vibration- Eigenvalue problem, Evaluation of eigenvalues and eigenvectors (natural frequencies and mode shapes).

Term Work: The term work shall consist of record of any three from 1 to 4* and any three from 5 to 8** assignments of the problems based on following topic-

1. Computer program for stress analysis 2-D truss subjected to plane forces
2. Computer program for modal analysis 1-D beam (simply supported or cantilever beams)
3. Computer program for frames subjected to transverse forces and moments
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. 2D Forced convection problem using FEA software.
7. Modal analysis of any machine component using FEA software.
8. Stress and deflection analysis of any machine component consisting of 3-D elements 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 FEA software such as Abaqus, ANSYS, Msc-Nastran, Optistruct/Radioss, Comsol-Multiphysics

** 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.

Text Books:

1. A First Course in the Finite Element Method, Daryl L. Logan
2. Concepts and Applications of Finite Element Analysis, R. D. Cook, et al. Wiley, India

Reference Books:

1. Chandrupatla T. R. and Belegunda A. D., "Introduction to Finite Elements in Engineering", Prentice Hall India.
2. Seshu P., "Text book of Finite Element Analysis", PHI Learning Private Ltd. New Delhi, 2010.
3. Bathe K. J., "Finite Element Procedures", Prentice-Hall of India (P) Ltd., New Delhi.

4. Fagan M. J., “Finite Element Analysis, Theory and Practice”, Pearson Education Limited
5. Kwon Y. W., Bang H., “Finite Element Method using MATLAB”, CRC Press, 1997
6. S. Moaveni, “Finite element analysis, theory and application with Ansys”,
7. Fundamental of Finite Element Analysis, David V. Hutton, Tata McGraw-Hill
8. Gokhale N. S., Deshpande S. S., Bedekar S. V. and Thite A. N., “Practical Finite Element Analysis”, Finite to Infinite, Pune

(402050C) Design of Pumps, Blowers and Compressors (Elective IV)

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut.	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
402050C	**Design of Pumps, Blowers and Compressors**	**4**	**---**	**2**	**30 (1 hr)**	**70 (2 ½ hrs)**	**25**	**--**	**--**	**125**

Pre-Requisite: Turbo Machines, Engineering Thermodynamics,

Course Objectives: To teach students.
- Different applications of Pumps, Fans, blowers & Compressors.
- Different types of Pumps, Fans, blowers & Compressors.
- How to design Pumps, Pumps, Fans, blowers & Compressors..

Course Outcomes: After completion of the course students would be able to
- Select suitable Pump, Blower, fan or compressor for a given application.
- Design Pump, Blower, fan or compressor for a given application

Unit 1: Fundamentals of Fluid Machinery 8 hrs

Introduction to pumps, Introduction to blowers and compressors, Basic equations of energy transfer between fluid and rotor, Performance characteristics, Dimensionless parameters, Specific speed, stage velocity triangles, work and efficiency.

Unit 2: Reciprocating Pumps 8hrs

Introduction: Types, Component and Working of Reciprocating pump, Discharge, Work done and power required to drive for single acting and double acting, Coefficient of discharge, slip, Effect of acceleration of piston on velocity and pressure, indicator diagram, Air Vessel, Operating characteristics.

Unit 3: Design of Pumps 10 hrs

Design procedure and design optimization of Pumps, selection of pumps, Thermal design- Selection of materials for high temperature and corrosive fluids. Hydraulic design- Selection of impeller and casing dimension using industrial manuals.

Unit 4: Theory of Fans and Blowers 8 hrs

Classification of blowers, Basics of stationary and moving air, Eulers characteristics, velocity triangles and operating pressure conditions, Equations for blowers, Losses and hydraulic efficiency, flow through impeller casing, inlet nozzle, Volute, diffusers, leakage, mechanical losses, surge and stall, Applications of blowers and fans.

Unit 5: Design of Fans and Blowers 10 hrs

Rotor design airfoil theory, vortex theory, cascade effects, degree of reaction, Design procedure for selection and optimization of Blowers. Stage pressure rise, stage parameters and design parameters. Design of impeller and casing dimension in aerodynamic design.

Unit 6: Design of Compressors 8 hrs

Basic theory, classification and application, Working with enthalpy-entropy diagram, construction and approximate calculation of centrifugal compressors, impeller flow losses, slip factor, diffuser analysis, performance curves of centrifugal compressors, Basic design features of axial flow compressors; velocity triangles, enthalpy-entropy diagrams, stage losses and efficiency, work done factor, simple stage of axial flow compressors.

Term Work:

Assignments:

A. Assignments using suitable software on any one of following
   1. Computer programs for iterative and interactive design of pumps.
   2. Computer programs for iterative and interactive design of fan / blower.

B. Any four Assignments

C. Industrial visit or case study

Textbooks:

1. Turbine, “Compressors and Fans“ S.M.Yahya, Tata Mc-Graw Hill Publishing Company, 1996R. K. Rajput, “Fluid Mechanics and Hydraulic Machines” S. Chand
2. R. K. Bansal, “Fluid Mechanics and Hydraulic Machines”, Laxmi Publication
3. V. Ganeshan “Gas Turbines” II edition, Tata Mc-Graw Hill Publishing Company
4. R.. Yadav”Steam and Gas Turbine” Central Publishing House, Allahabad

Reference Books:

1. Shepherd, D.G., “Principles of Turbomachinery“, Macmillan, 1969.
2. John Tuzson, “Centrifugal Pump Design,“ John Wiley
3. Stepanff, A.J., "Blowers and Pumps ", John Wiley and Sons Inc., 196
4. Austin H. Chruch, “Centrifugal pumps and blowers“, John Wiley and Sons, 1980.
5. Val S.Labanoff and Robert Ross, “Centrifugal Pumps Design and Applications“ Jaico P House.
6. Igori Karassik, “Pump Hand Book,“ McGraw-Hill International Edition.
7. G.K.Sahu “Pumps“ New age international publishers.

(402051) PROJECT STAGE II

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut.	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
402051	Project Stage II	--	6	--	--	--	150	--	50	200

INSTRUCTIONS FOR DISSERTATION 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’’	25.4 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 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 [2015-16]
(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. Lele M.M.* , has successfully completed the Dissertation entitled "Performance analysis of…….." under my supervision, in the partial fulfilment of Bachelor of Engineering - Mechanical Engineering of University of Pune.

Date :

Place :

Guide's Name ___________________
Guide

External Examiner ___________________

Head Department ___________________
and Institute Name

Principal, ___________________
Institute Name

Board of Studies in Civil Engineering

Structure and Syllabus for B.E. Civil 2012 Course (w.e.f.June, 2015)

Savitribai Phule Pune University

Savitribai Phule Pune University

Board of Studies in Civil Engineering

Structure for B.E. Civil 2012 Course (w.e.f.June 2015)

Subject code	**Semester – I**								
	Subject	**Teaching Scheme Hrs/Week**			**Examination Scheme**				
		Lect	**Tu**	**Pr**	**In-Semester Assessment**	**TW**	**Or**	**End - Semester Exam**	Total
401 001	Environmental Engineering II	3		2	30	--	50	70	150
401 002	Transportation Engineering	3		2	30	50	--	70	150
401 003	Structural Design and Drawing III	4		2	30	--	50	70	150
401 004	Elective I	3		2	30	50		70	150
401 005	Elective II	3			30			70	100
401 006	Project	--	2			50			50
	Total →	16	2	8	150	150	100	350	750

Subject code	**Semester – II**								
	Subject	**Teaching Scheme Hrs/Week**			**Examination Scheme**				
		Lect	**Tu**	**Pr**	**In-Semester Assessment**	**TW**	**Or**	**End - Semester Exam**	Total
401 007	Dams and Hydraulic Structures	3	--	2	30	---	50	70	150
401 008	Quantity Surveying,Cotracts and Tenders	3	--	2	30	--	50	70	150
401 009	Elective III	3	--	2	30	50	--	70	150
401 010	Elective IV	3	--	2	30	50	--	70	150
401 006	Project	--	6		--	50	100	--	150
	Total →	12	6	8	120	150	200	280	750

Following will be the list of electives..

Semester I

Elective-I 401 004	**Elective-II 401 005**
1.Structural Design of Bridges 2. Systems Approach in Civil Engineering 3.. Advanced Concrete Technology 4. Architecture and Town Planning 5. Advanced Engineering Geology with Rock Mechanics	1. Matrix Methods of Structural Analysis 2. Integrated Water Resources and Planning 3. TQM & MIS in Civil Engineering 4. Earthquake Engineering 5. Advanced Geotechnical Engineering

Semester II

Elective-III 401 009	**Elective-IV 401 010**
1. Advanced Structural Design 2.Advanced Foundation Engineering 3. Hydropower Engineering 4. Air Pollution and control 5. Finite Element Method in Civil Engineering	1 Construction Management 2. Advanced Transportation Engineering 3. Statistical Analysis and Computational Methods in Civil Engineering **4.Open Elective** a). Plumbing Engineering b) Green Building Technology c) Ferrocement Technology d) Sub sea Engineering e)Wave Mechanics

401 001 Environmental Engineering – II

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 hr)
Oral : 50 Marks

Unit I (6Hrs)

Sewage quantity: Collection and conveyance of sewage, sources of sewage, variations in sewage flow, Flow quantity estimation, Design of circular sanitary sewers. Pumping of sewage, necessity, location. Effect of change of life style on sewage quality.
Characteristics of sewage: Physical, chemical and biological characteristics, effluent discharge standards as per CPCB norms, interpretation and practical significance of test results.
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).

Unit II (6Hrs)

Sewage treatment: Introduction to sewage treatment, preliminary, primary, secondary and tertiary treatment, 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 (6Hrs)

Theory & design of secondary treatment units: Introduction to unit operations and processes for secondary treatment. Principles of biological treatments, important microorganisms in waste water & their importance in waste water treatment systems, bacterial growth, general growth pattern, growth in terms of bacterial numbers and bacterial mass. Kinetics of biological growth, cell growth, substrate limited growth, cell growth and substrate utilization, effect of endogenous metabolism.
Activated sludge process: Theory and design of ASP, sludge volume index, sludge bulking & control, modifications in ASP.
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 contractors.

Unit IV (6Hrs)

Low cost treatment methods:
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 **(6Hrs)**

Onsite Sanitation and Introduction to Package Sewage Treatment Plant: Working principle, advantages and disadvantages

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: Methods of sampling. 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.

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**.

1. Solids -Total solids, suspended solids, volatile solids, settleable solids & non settleable 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 Cr^{6+} 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 hours/week
Practical: 2 hrs

Examination scheme
In semester exam: 30 marks---1 hour
End semester exam: 70 marks—2.5 hours
Term Work: 50 marks

Highway Engineering

Unit I (6 hrs)

Introduction:
Role of transportation, scope of road transportation, highway development in India, necessity of highway planning and development plans e.g. Bombay plan, Lucknow plan.

Classification of road:
Classification of roads, road patterns, planning surveys and preparation of master plan based on saturation system, determination of road length by 3rd road development plan.

Traffic engineering:
Traffic characteristics-road user characteristics, vehicular characteristics (only name and significance) Traffic studies –name of various studies and their uses, accident studies-objectives, causes of accident, condition and collision diagram, and measures for the reduction in accidents. Traffic regulation and control devices-traffic signs, traffic signals (types merits and demerits) road markings. Traffic islands, types of road intersections (sketch merits and demerits). Parking facilities.

Unit II (6 hrs)

Highway alignment:
Basic requirements of an ideal alignment and factors controlling it, engineering survey for highway location, special requirements for hill roads,

Geometric design and traffic engineering:
Design controls and criteria for geometric design, cross sectional elements, sight distance requirements, stopping distance, overtaking sight distance, overtaking zones with IRC recommendations, attainment of super elevation, radius of curves, methods of introduction of extra widening, widening of pavement on horizontal curves, horizontal transition curves- objects, necessity, types of transition curves, length and shift of transition curves. Design of vertical alignment, gradient and its type, IRC recommendations, grade compensation on horizontal curve, vertical curves: - crest and sag curves, types of summit curves, length of summit curve for SSD and OSD. Requirements, types of valley curves, length of valley curve for comfort and head light sight distance criteria.

Highway drainage:
Importance of highway drainage, subsurface and surface drainage systems, scope of arboriculture for highway.

Unit III (6 hrs)

Highway materials:
Importance and properties of sub-grade, pavement component materials. Tests on aggregates. Bitumen: Types--cut back, tar, emulsion and tests, modified binders, bitumen mix design by Marshall Stability test, viscosity based gradation of bitumen

Pavement design:

Objects and requirements, types of pavements structures, functions of pavement components factors affecting pavement design, Design of flexible pavement by C.B.R. Method, IRC 37- guidelines design of rigid pavements, actors affecting design & analysis of stress- wheel load stress & temp. Stress, critical combination of stress, IRC 58- design guidelines, types of joints, requirements of joints.

Construction:

Construction process of WBM, WMM, GSB (Mix design). Introduction to bituminous works such as prime coat, tack coat, seal coat, MPM, AC or BC, BM, DBM and premix carpet.

Section II Airport Engineering:

Unit IV (6 hrs)

Introduction:

Advantages and limitations of air transportation. Aeroplane component parts and important technical terms.

Airport planning:

Aircraft characteristics, which influence judicious and scientific planning of airports, Selection of sites, survey and drawings to be prepared for airport planning.

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.

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. Airport classification by ICAO.

Unit V (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 VI **(6 hrs)**

Types of bridges

Various types of bridges:

a. Culvert: Definition, waterway of culvert and types.
b. Temporary bridges: Definition, materials used brief general ideas about timber, floating and pantoon bridges.
c. Movable Bridges: Bascule, cut boat, flying, swing, lift, transporter and transverse bridges, their requirement and suitability.
d. 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 the following:

A. Practicals:

I. Tests on Aggregate (Any Six) :

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 + No. 8 compulsory):

1. Penetration Test
2. Ductility Test
3. Viscosity Test
4. Softening Point Test
5. Flash Point & Fire Point Test
6. Specific Gravity Test
7. Bitumen Extraction Test
8. Marshall Stability Test

B. Technical visits to 1) Bridge site/Airport and 2) Hot mix Plant with detailed report

Text Books

1. Principles of Highway Engineering and Traffic Analysis (4^{th} edition)
   - F. L. Mannering, Scott S. Washburn, Wiley India
2. Highway engineering – S.K. Khanna and C.E.G. Justo, Nem Chand and Brothers, Roorkee

3. Principles and practices of Highway engineering –Dr. L.R. Kadiyali, Khanna Publishers Delhi.
4 .Essentials of Bridge Engineering – D. Johnson and Victor, Oxford and IBH publishing co . Pvt. Ltd. , New Delhi.
5.Bridge engineering – S. Ponnuswamy, Tata Mc Graw – Hill publishing co. Ltd. New Delhi.
6.Airport planning and design – S.K. Khanna , M.G. Arora , S.S. Jain, Nem Chand and Brothers, Roorkee.
7.Airport Engineering - Rangawala, Charotar publishing House, Anand 388001 (Gujrat)

Reference Books:

1. A Course in Highway Engineering – S.P. Bindra, Dhanpat Rai and Sons, Delhi.
   Principles of Transportation Engineering – G.V. Rao Tata MacGraw Hill Publication
2. Highway Engineering – Rangawala, Charotar publishing House, Anand 388001 (Gujrat)
3. Principles of Transportation Engineering – Partha Chakraborty ,Animesh Das, Prentice Hall of India Pvt. Ltd., New Delhi.
4. Highway and Bridge Engineering – B.L. Gupta, Amit Gupta Standard publishers Distributors, Delhi. 8) Principles and practice of Bridge Engineering – S.P. Bindra, Dhanpatrai and Sons, Delhi.
5. Bridge engineering – Rangawala, Charotar Publishing House, Anand –388 001.

Codes:

1. I.S. 1201 TO 1220-1978, IS 73, IS 2386 PART I toV
2. I.R.C. 58, IRC37
3. Specifications for Road and Bridge works (MORTH)-IRC, New Delhi.

Hand Books:

1. Handbook of Road Technology_Lay M.G., Gorden Breach Science Pub.Newyork
2. Civil Engineering Handbook-Khanna S.K.

e – Resources:

1. www.nptel.iitm.ac.in/courses/iitkanpur
2. www.cdeep.iitb.ac.in/nptel

@@@

401 003 Structural Design III

Teaching Scheme:
Lectures: 4 Hrs / week
Practical: 2 Hrs/week

Examination Scheme:
In sem :30 + End sem : 70Marks
Oral : 50 Marks
Duration : Insem : 1.5 Hr
End sem : 3 Hrs

Unit 1
Prestressed concrete - Analysis
Introduction, Basic concepts, materials-various Pretensioning and post tensioning systems, concept of losses, Stress calculations, and concept of cable profile.

Unit 2
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
Earthquake force calculation and analysis and design of frames
Review of methods of analysis for frames subjected to gravity and lateral loads. Earthquake loads by seismic coefficient method. 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

Unit 4
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
Combined footings
Introduction, necessity and types of combined footings, design of slab type and slab-beam type of combined footing.

Unit 6
Liquid retaining structures
Introduction, types, function, codal provisions, methods of analysis and design of circular, square, and rectangular water tanks resting on ground.

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 Loss calculation unit 1
2) Assignment on stress calculation unit 1

3) Design and detailing of design of prestressed girder from Unit 2
4) Assignment on Earthquake force calculation from unit 3
5) Design and detailing of frame(beam only) from Unit 3
6) Design and detailing of retaining wall for any type of loading from Unit 4
7) Design and detailing combined footing from Unit 5
8) Design and detailing of ground resting water tank from Unit 6
9) Minimum five full imperial sheets based on four projects of RCC and one project of pre-stressed concrete.
10) **Report on analysis of assignment on unit 3 by software or computer program**
11) Two site visit reports one each of R.C.C. and another P.S.C. Oral Examination: Oral based on above term work
12) **There should separate design data for a group size of maximum four students.**

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.

Reference Books

6. Comprehensive RCC Design - Punmia, Jain & Jain - Laxmi Publications.
7. Design of design of reinforced Concrete structures- M. L. Gambhir -PHI
8. Reinforced Concrete, Vol I- Dr.H J. Shah Charotar Publishing House
9. Prestressed Concrete – A Fundamental Approach- Edward Nawy – PHI.
10. Reinforced concrete design- Pillai and Menon TMH

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 hours per week
Practical : 2 hours per week

Examination scheme:
Term work: 50 marks
In-sem. Exam.: 30 marks (1 hrs)
End Sem. Exam.: 70 marks (2.5 hrs)

Unit 1

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

RC highway bridges: T-beam deck slab bridges – Deck slab: Structural configuration, Piegaud's method, analysis and design of deck slab.

Unit 3

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

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

Bearings: Function of bearings, types of bearings, design of steel bearings and elastomeric bearings.

Unit 6

Sub-structure: Function, loads, analysis and design of RC abutments and piers.

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) One of the above projects can be done using any drafting software.

Reference Books

Design of Bridges, N. Krishna Raju, Oxford and IBH Publishing Company Pvt. Ltd.

Design of Bridge Structures, M.A. JayaramPrentice-Hall Of India Pvt. Limited

Prestressed Concrete, N. Krishna Raju, Tata-McGraw Hill

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 hours/week	**In semester exam: 30 marks---1 hour**
Practical: 2 hrs/week	**End semester exam: 70 marks—2.5 hours**
	Term Work: 50 marks

Unit 1: Introduction of systems approach (6 Hrs)

Introduction to System approach, Operations Research and Optimization Techniques, Use of systems approach in Civil Engineering, Methods, Introduction to Linear and Non linear programming methods (with reference to objective function, constraints), Local & Global optima, unimodal function, convex and concave function

Unit 2: Non linear programming (6 Hrs)

Single variable unconstrained optimization: Sequential Search Techniques-Dichotomous, Fibonacci, Golden section

Multivariable optimization without constraints-The gradient vector and Hessian Matrix, Gradient techniques, steepest ascent/decent technique, Newton's Method

Multivariable optimization with equality constraints - Lagrange Multiplier Technique

Unit 3: Stochastic Programming (6 Hrs)

Sequencing– n jobs through 2, 3 and M machines

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 chanel Queuing theory : Model I (Single channel Poisson Arrival with exponential services times, Infinite population (M/M/1) : (FCFS/∞/∞)

Simulation : Monte Carlo Simulation

Unit 4: Dynamic programming: (6 Hrs)

Multi stage decision processes, Principle of optimality, recursive equation, Applications of D.P.

Unit 5: Linear programming (A) (6 Hrs)

Formulation of Linear optimization models for Civil engineering applications. The simplex method, Method of Big M, Two phase method, duality

Unit6: Linear programming (B) (6 Hrs)

The Transportation Model and its variants, Assignment Model, and its variants

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. Engineering Optimization: Methods and Application-- A. Ravindran, K. M. Ragsdell— Wiley India

2. Engineering Optimization by S.S.Rao

3. Operations Research by Hamdy A. Taha

4. Quantitative Techniques in Management by N.D. Vohra (Mc Graw Hill)

5 Operations Research by Premkumar Gupta and D.S.Hira, S. Chand Publications (2014).

Reference Books

6.Topics in Management Science by Robert E. Markland(Wiley Publication)

7. An Approach to Teaching Civil Engineering System by Paul J. Ossenbruggen

8 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

@@

401 004 Elective I (3)- Advanced Concrete Technology

Teaching scheme
Lectures: 3 hours/week
Practical: 2 hrs/week

Examination scheme
In semester exam: 30 marks---1 hour
End semester exam: 70 marks—2.5 hours
Term Work: 50 marks

Unit I

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

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.

Unit III

Design of high strength concrete mixes, design of light weight aggregate concrete mixes, design of flyash cement concrete mixes, design of high density concrete mixes, Design of pumpable 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

Historical development of fibre reinforced concrete, properties of metallic fibre, polymeric fibres, carbon fibres, glass fibres and naturally occurring fibres. Interaction between fibres and matrix (uncracked and cracked matrix), basic concepts and mechanical properties: tension and bending.

Unit V

Properties of hardened frc, behavious under compression, tension and flexure of steel fibres and polymeric fibres,GFRC, SFRC, SIFCON,-development, constituent materials, casting, quality control tests and physical properties.

Unit VI

Ferrocement: Properties & specifications of ferrocement materials ,analysis and design of prefabricated concrete structural elements,manufacturing process of indusrrial concrete elements, precast construction, errection 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. 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.

2. Cost analysis (material, labour, equipment, others) of any type of concrete for lab, in-situ and RMC production.
3. Perform any two Fresh (workability tests – Slump Flow Test, T-50, J-Ring, Visual Stability Index, Column Segression, L-Box, U-box) and Hardened (Compressive, tensile, flexural) properties tests on any high performance concrete.
4. 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.
5. Write a review on any recent research article from standard peer-reviewed journal.
6. Visit reports on minimum two site visits - exploring the field and practical aspects of concrete technology.
7. Report on at least one patent (national/international)– on any topic related to 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. Properties of concrete by A. M. Neville, Longman Publishers.
3. Concrete Technology by R.S. Varshney, Oxford and IBH.
4. Concrete technology by A M. Neville, J.J. Brooks, Pearson
5. Ferrocement Construction Mannual-Dr. D.B.Divekar-1030,Shivaji Nagar,Model Colony, Pune
6. Concrete Mix Design-A.P.Remideos--Himalaya Publishing House (ISBN-978-81-8318-996-5
7. Concrete, by P. Kumar Metha, Gujrat Ambuja.
8. Learning from failures ---- R.N.Raikar
9. Structural Diagnosis ---- R.N.Raikar
10. 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 hour**

Practical: 2 hrs/week | **End semester exam: 70 marks—2.5 hours**

Term Work: 50 marks

Unit I:

- 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:

- 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:

- Goals and Objectives of planning; components of planning; benefits of planning
- Levels of planning: Regional plan , Development Plan, Town Planning Scheme,
- Neighbourhood plan ; Types of Development plans: Master Plan, City Development Plan, Structure Plan

Unit IV:

- 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:

- Legislative mechanism for preparation of DP: MRTP Act 1966
- UDPFI guidelines (for land use, infrastructure etc),SEZ, CRZ, Smart City Guidelines

Unit VI :

- 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 landuse , 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:

--Town Planning By G K Hiraskar
--Town Planning By S Rangwala
---Building Drawing and Built Environment- 5 Th Edition – Shah , Kale , Patki
---Planning Legislation By Koperdekar And Diwan.
---G. K. Bandopadhyaya , "Text Book of Town Planning".
---Climate Responsive Architecture – Arvind Krishnan.
---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
- NRSA
- CIDCO, MHADA, MIDC, MMRDA, PMRDA

@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@

401 004 Elective I-(5) Advanced Engineering Geology with Rock Mechanics

Teaching scheme
Lectures: 3 hours/week
Practical: 2 hrs/week

Examination scheme
In semester exam: 30 marks---1 hour
End semester exam: 70 marks—2.5 hours
Term Work: 50 marks

Unit I : Indian Stratigraphy, Geology applied to Civil Engineering Practices

1	***Indian Stratigraphy:*** Distribution and Geological characters of Major rock formations of India, Geological Map of India with special reference to Maharashtra, Seismic Zones of India, Engineering characters of major rock formations of India.	**4**
2	***Geology applied to Civil Engineering Practices:*** Importance of geological studies in engineering investigations, precautions necessary to avoid misleading conclusions likely to be drawn while interpreting drilling data, dependence of design on geological features of project site.	**2**

Unit II: Subsurface Explorations for Water Retaining Structures; Geological Foundation Treatments for various Civil Engineering Projects, Tail Channel Erosion.

3	***Subsurface Explorations for Water Retaining Structures:*** Various Physical and Mechanical properties of rocks affecting strength & water tightness of them from foundation point of view. Effect of weathering, deterioration of rock masses on exposure to atmosphere & hydrothermal alteration of rocks on water retaining structures & suitable treatment for such rocks. Case studies illustrating economics made possible by proper geological studies & wasteful expenditure or difficulties resulting from their negligence.	**2**
4	***Geological Foundation Treatments for various Civil Engineering Projects:*** Foundation investigations during construction for determining the foundation treatment for adverse geological features. Determination of foundation levels. Correction of adverse features by means of various techniques such as grouting etc. for improving strength of weak & fragmented rocks. Curtain grouting for preventing leakage through foundation rocks. Determining depths & zones of consolidation & curtain grouting. Foundation treatment for fractures having different manifestation, jointed rocks.	**2**
5	***Erosion of Tail Channels:*** Erosion of tail channel as factor in selecting site for spillway. Causes of rapid erosion of tail channels of side spillways. Geological conditions leading to tail channel erosion. Case studies	**2**

Unit III: Geohydrological characters of major rock formations of India; Geological process of Soil formations

6	***Geohydrological characters of major rock formations of India:***	**4**

Geohydrological characters and factors affecting the water bearing structures of various rocks in India. Introduction to morphometric analysis of river system. Various methods of water conservation techniques, adverse aspects of tube wells, bore wells and dug wells. Geological aspects of conservation of water, artificial recharge, rainwater harvesting and watershed development & necessity of geological studies for such schemes. Illustrative case studies.

7 ***Geological Process of Soil formations:*** **2**

Rock weathering conditions favorable for decomposition & disintegration, Residual & transported soils. Effect of climate on formation of soil. Soil profile of various states in India.

UNIT IV Rock Mechanics and Geophysical techniques.

8 ***Rock Mechanics:*** **4**

General principles of rock mechanics. Dependence of physical and mechanical properties of rocks on geological characters. Various laboratory testing methods. Calculation of R.Q.D. 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. and computation of representative rock formation such as DTB.

9 ***Geophysical techniques :*** **2**

Various methods of Geophysical Exploration like Electrical Resistivity methods, Seismic method of exploration as applied to engineering investigations such as determination of thickness of overburden, locating ground water potential zones

Unit V: Engineering Geological investigation for Tunnels and Bridges

10 ***Engineering Geological investigation for Tunnels:*** **4**

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 unfavourable 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 & contact grouting above permanent steel supports on geological conditions. Illustrative case studies.

11 ***Bridges:*** **2**

Investigation for bridge foundation, difference in objectives of investigation of bridge foundation. Computing safe bearing capacity for bridge foundation based on nature & structure of rock. Foundation settlements. Case studies.

UNIT VI : Resource Engineering ,Role of Geology in planning and development

12 ***Resource Engineering:*** **2**

Deccan Trap basalts as construction material. Use of compact basalt & amygdaloidal basalts as rubble for masonry & metal for concrete & pavement quality concrete. Use of Basalt fibre during construction.

Illustrative case studies.

13 ***Role of Geology in planning and development:*** **2**

Influence of geological factors upon urban development & planning ,locating non-renewable resources and geothermal energy.

14 ***Earthquakes and tectonics:*** **2**

Seismicity of Indian sub continent. Earthquakes occurring in the areas of some dams & RIS theories.

Practical Work / Term Work

I) Study of Geological map and seismic zonation map of India **(2 Practical)**

II) Interpretation of drill hole data

Logging of drill core, 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 on Igneous rocks
5. Tunnels in Tectonic areas
6. Tunnels and open cuts in non-tectonic areas **(6 Practical)**

III) Study of some parameters of Morphometric Analysis of some tributaries of river, (Toposheet will be made available by the college) **(1 Practical)**

IV) Study of Soil Profile of any region. **(1 Practical)**

V) Use of electrical resistivity method for determining depth of bedrock. **(1 Practical)**

VI) Computation of RQD & Joint Frequency Index **(1 Practical)**

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:

**** Class test will be held in the last week of every month**

**** Field visits will be made to different places around study area and one long study tour to important geological place.**

The practical journal will be examined as term work.

Reference Books and Text Books:

1. Jaeger – Rock Mechanics in Engineering, Cambridge Univ Press London, 1990.
2. Goodmann – Principles of Rock Mechanics.
3. Bieniawski Z. T. - Engineering Classification of jointed Rock Masses.
4. Dr. Dobbrin - Introduction to Geophysics.
5. Goodmann – Engg. Geology.
6. Megaw T. M.& Tunnels: Planning, Design, Construction
7. J. V. Bartlett - Int. ED, Ellis Horwood ltd. John Willey & Sons .
8. Skinner B. J: The Dynamic Earth, An Introduction to Phy & Porter S. C Geology John Willey & Sons. NY 1989
9. Introduction to Rock Mechanics by B. P. Verma-Khanna Pub New Delhi

10. Environmental Geology by Waldiya
11. Environmental Geology – Keller, Prentice – Hall Publication.

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 Geological terms, geology and Physical Geology, David page, University of Michigan. USA.
e. Handbook of Geology in Civil engineering, Robert Fergussion , Legget, Mc-Graw hill.
f. Geotechnical Engineering handbook, Robert day, Mc- Graw hill, ISBN 0-07-137782-4

I. S. Codes

i) IRC code of practice for Road Tunnels. IRC-78-2000; IS-12070; IS-1336 Part I and II.
ii) I. S. 4453-1967 Code of practice for Exploration, pits, trenches, drifts & shaft.
iii) I. S. 6926-1973 Code of practice for diamond drilling for site investigation river valley project.
iv) I. S. 4078-1967 Code of practice for Logging and Storage of Drilling Core.
v) 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

@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@

401 005 Elective II (1)- Matrix Methods of Structural Analysis

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: 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 trusses, beams and frame 6 Hrs

Degree of static indeterminacy, flexibility, selection of redundant, flexibility matrix, analysis of pin jointed indeterminate trusses, 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, structure approach, member approach, analysis of determinate/indeterminate bars involving not more than three unknowns

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

Unit IV: Stiffness matrix method for beams and frames 6 Hrs

a) Stiffness matrix for a beam member, member and structure approach problems involving not more than three unknowns

b) Stiffness matrix for a portal frame member, transformation matrix, member and structure approach problems involving not more than three unknowns

Unit V: Stiffness matrix method for grid structures 6 Hrs

Stiffness matrix method for analysis of orthogonal grid structure, member stiffness matrix, transformation matrix, member and structure approach, problems involving not more than three unknowns

Unit VI: Stiffness matrix method for 3D structures and FDM 6 Hrs

a) Stiffness matrix method for the analysis of space truss, member stiffness matrix, problems involving not more than three unknowns, Formation of stiffness matrix of space frame element (no numerical),

b) Applications of finite difference method (FDM): Determine deflection and moments in beams, critical buckling load of columns.

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

Reference Books

[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 – Meghare&Deshmukh- Charotar Publishing House, Anand.

@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@

401 005 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.

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.

Unit3: Basin scale hydrology (6 Hrs)

a) Estimation of surface water, estimation of ground water draft/recharge import/export of water (inter basin water transfer), 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, 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.

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.

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

Reference Books

6) Economics of Water Recourses Planning, L. D. James & R.R.Leo, McGraw Hills, NY 1971.
7) Water Resources Systems Engineering, W. A. Hill & J. A. Dracup.
8) Water shed Management – B.M. Tideman
9) Watershed management –J. V. S. MURTY, new Age International Publisher.
10)Integrated Watershed Management Perspectives and Problems - Beheim, E., Rajwar, G.S., Haigh, M., Krecek, J. (Eds.) , Springer Publication.
11)Managing Water in River Basins: Hydrology, Economics and Institutions -- M. Dinesh Kumar, Publisher: Oxford Universit Press
12)Water Resources Design Planning Engg and Economic; Edward Kuiper, Butterworth & Co.
13)ANN in Hydrology; Govinda Raju & Ramachandra Rao; PHI
14)Integrated Water Resources Management in Practice: Better Water Management for Development - R. L. Lenton, Mike Muller , Publisher Earthscan.
15)Sustainability of Integrated Water Resources Management - Editors**:** Setegn, Shimelis Gebriye, Donoso**,** Maria Concepcion (Eds.) Publisher Springer International Publishing .
16)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.
17)Key Concepts in Water Resource Management: A Review and Critical Evaluation - Jonathan Lautze, publisher Routledge.
18)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 hours/week

Examination scheme
In semester exam: 30 marks---1 hour
End semester exam: 70 marks—2.5 hours

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.
b) Factors affecting quality of construction, reasons for poor quality & measures to overcome.

Unit II: MIS (6 Hrs)

a) Introduction to Management Information systems (MIS) Overview, Definition.
b) MIS and decision support systems, Information resources, Management subsystems of MIS.

Unit III: TQM & Defects in Construction (6 Hrs)

a) TQM – Necessity, advantages, Six sigma as a tool in TQM.
b) Defects & it's classification in construction. Measures to prevent and rectify defects.

Unit IV: TQM, ISO & Quality Manual (6 Hrs)

a) Difference between, quality control, quality assurance, total quality control and total quality management (TQM).
b) Process based approach for achieving TQM. Study of ISO 9001 principles.
c) Quality manual – Importance, contents, documentation. Importance of check-lists in achieving quality. Typical checklist for concreting activity, formwork activity, steel reinforcement activity.

Unit V: Management Control (6 Hrs)

a) Management information system structure based on management activity whether for Operational control, management control or strategic planning.
b) Supply chain management as a tool in TQM, Benchmarking in TQM, Kaizen in TQM
c) Categories of cost of Quality.

Unit VI: Modern tools in TQM Implementation (6 Hrs)

a) Development of an MIS for a construction organization associated with building works, study and use of various modules of ERP software for construction.
b) Introduction to smart phone technology & incorporating GIS, GPS, Android subsystems for documentation and monitoring of construction projects.

***** Units IV, V & VI to be supplemented with case studies***

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 | **Examination scheme**
Lectures: 3 hours/week | **In semester exam: 30 marks---1 hour**
End semester exam: 70 marks—2.5 hours

Unit I

Introduction to earthquakes:

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

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

Seismic design of RC structure:

Introduction to IS1893 (Part-I): 2002, Seismic design Philosophy, provision, Seismic coefficient method. Response Spectra, Basic requirement, 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. IS code provision to response spectrum.
Concept of ductile detailing, IS 13920 (1993) provisions for RC frame.

Unit IV

Seismic foundation design:

Type of forces generated due to earthquake, effects on different types of foundation, design of RCC isolated footing for earthquake loading, liquefaction, causes and its remedial measure.

Unit V

Introduction of different control systems: Passive control: base isolation and active control: bracing system, TMD etc and some latest invention.
Introduction to Disaster Management: Types of Disaster, Phases of disaster management, Disaster rescue, psychology and plan of rescue operations.

Unit VI

Strengthening and Retrofitting: Need of retrofitting, Evaluation of existing buildings, aging, weathering, development of cracks, improper load Path, asymmetry, materials and equipments for restoring and retrofitting, methodology of retrofitting for walls, slabs roofs columns, foundations etc. for buildings in stones, bricks, RCC.
Concept of shear wall,

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.

Reference Books

5 Dynamics of structure by Clough R.W. and Penzin J. McGraw Hill Civil Engineering Series
6. Dynamics of structure by Anil Chopra, Prentice Hall India Publication
7. Dynamics of structure by Mario Paz, CBSPD Publication
8. Geo-technical Earthquake Engineering by Kramer S. L. Prentice Hall India Publication
9. Introduction to Structural Dynamics by John M. Biggs
10. Mechanical Vibrations by V. P. Singh
11. Relevant Latest Revisions of IS codes.

@@

Savitribai Phule Pune University, Pune

BE(Electronics & Telecommunication)
(2012 course revised syllabus)

(w.e.f. June 2015)

BE (E & TC) Structure
2012 Course w.e.f. June 2015
Semester-I

Subject Code	Subject	Teaching Scheme			Examination Scheme					Marks
		LECT	TUT	PR	In Semester Assessment Phase I	PR	OR	TW	End Semester Examination Phase II	Total
404181	VLSI Design & Technology	3			30				70	100
404182	Computer Networks	3			30				70	100
404183	Microwave Engineering	4			30				70	100
404184	Elective I	3			30				70	100
404185	Elective II	3			30				70	100
404186	Lab Practice I (CN & MWE)			4			50	50		100
404187	Lab Practice II (VLSI &Elective I)			4		50		50		100
404188	Project Phase I		2				50			50
	Total	**16**	2	8	150	50	100	100	350	750

Elective I

1. Digital Image Processing
2. Embedded Systems & RTOS
3. Software Defined Radio
4. Industrial Drives and Control

Elective II

1. Multi rate & Adaptive Signal Processing
2. Electronic Product Design
3. PLCs and Automation
4. Artificial Intelligence

Semester-II

Subject Code	Subject	Teaching Scheme			Examination Scheme					Marks
		LECT	TUT	PR	In Semester Assessment Phase I	PR	OR	TW	End Semester Examination Phase II	Total
404189	Mobile Communication	4			30				70	100
404190	Broadband Communication Systems	4			30				70	100
404191	Elective III	3			30				70	100
404192	Elective IV	3			30				70	100
404193	Lab Practice III(MC & BCS)			4			50	50		100
404194	Lab Practice IV(Elective III)			2		50		50		100
404195	Project Phase II		6			50		100		150
	Total	**14**	**6**	**6**	**120**	**100**	**50**	**200**	**280**	**750**

Elective III
1. Speech & Audio Signal Processing
2. RF Circuit Design
3. Audio Video Engineering
4. Soft Computing

Elective IV
1. Biomedical Signal Processing
2. Nano Electronics & MEMS
3. Detection & Estimation Theory
4. Wireless Networks
5. Open Elective*

***Any one subject 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). Repetition of subjects or topics is to be avoided.**

Dr. D. S. Bormane
Chairman, BOS(Electronics)

VLSI Design & Technology(404181)

Teaching Scheme: Lectures: 3 Hrs/ Week		**Examination Scheme:** In Semester Assessment: Phase I : 30 End Semester Examination: Phase II: 70

Course Objectives:

- To study HDL based design approach.
- To learn digital CMOS logic design.
- To nurture students with CMOS analog circuit designs.
- To realize importance of testability in logic circuit design.
- To overview SoC issues and understand PLD architectures with advanced features.

Course Outcomes:

Aftersuccessfully completing the course, students will be able to

- Model digital circuit with HDL, simulate, synthesis and prototype in PLDs.
- Understand chip level issues and need of testability.
- Design analog & digital CMOS circuits for specified applications.

Unit I: VHDL Modeling 7L

Data objects, Data types, Entity, Architecture & types of modeling, Sequential statements, Concurrent statements, Packages, Sub programs, Attributes, VHDL Test bench, Test benches using text files. VHDL modeling of Combinational, Sequential logics & FSM, Meta-stability.

Unit II: PLD Architectures 7L

PROM, PLA, PAL: Architectures and applications. Software Design Flow. CPLD Architecture, Features, Specifications, Applications. FPGA Architecture, Features, Specifications, Applications.

Unit III: SoC& Interconnect 6L

Clock skew, Clock distribution techniques, clock jitter. Supply and ground bounce, power distribution techniques. Power optimization. Interconnect routing techniques; wire parasitic, Signal integrity issues. I/O architecture, pad design. Architectures for low power.

Unit IV: Digital CMOS Circuits 7L

MOS Capacitor, MOS Transistor theory, C-V characteristics, Non ideal I-V effects, Technology

Scaling. CMOS inverters, DC transfer characteristics, Power components, Power delay product. Transmission gate. CMOS combo logic design. Delays: RC delay model, Effective resistance, Gate and diffusion capacitance, Equivalent RC circuits; Linear delay model, Logical effort, Parasitic delay, Delay in a logic gate, Path logical efforts.
Unit V: Analog CMOS Design 7L
Current sink and source, Current mirror. Active load, Current source and Push-pull inverters. Common source, Common drain, Common gate amplifiers. Cascode amplifier, Differential amplifier, Operational amplifier.
Unit VI: Testability6L
Types of fault, Need of Design for Testability (DFT), Testability, Fault models, Path sensitizing, Sequential circuit test, BIST, Test pattern generation, JTAG & Boundary scan, TAP Controller.
Text Books
1. Charles H. Roth, “Digital systems design using VHDL”, PWS. 2. Wyane Wolf, “Modern VLSI Design (System on Chip)”, PHI Publication.
Reference Books
1. Allen Holberg, “Analog CMOS Design”, Oxford University Press. 2. Neil H. E. Weste, David Money Harris, “CMOS VLSI Design: A Circuit & System Perspective”, Pearson Publication

Computer Networks(404182)

Teaching Scheme: Lectures:3 Hrs/ Week		**Examination Scheme:** In Semester Assessment: Phase I : 30 End Semester Examination: Phase II: 70

Course Objectives:

- Understand state-of-the-art in network protocols, architectures, and applications
- To provide students with a theoretical and practical base in computer networks issues
- Define the basic terminology of computer networks
- Recognize the individual components of the big picture of computer networks
- Outline the basic network configurations
- List the layers of the TCP/IP and OSI model and describe the duties of each layer
- Understand the transmission methods underlying LAN and WAN technologies.

Course Outcomes:

After successfully completing the course students will be able to

- Understand fundamental underlying principles of computer networking
- Describe and analyze the hardware, software, components of a network and the interrelations.
- Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies;
- Have a basic knowledge of the use of cryptography and network security;
- Have a basic knowledge of installing and configuring networking applications.
- Specify and identify deficiencies in existing protocols, and then go onto select new and better protocols.

Unit I: Physical Layer 6L

Data Communications, Networks, Network types, Protocol layering, OSI model, Layers in OSI model, TCP / IP protocol suite, Addressing, Guided and Unguided Transmission media. Switching: Circuit switched networks, Packet Switching, Structure of a switch.

Unit II: Data Link Layer 6L

Introduction to Data link Layer, DLC Services, DLL protocols, HDLC, PPP, Media Access Control: Random Access, Controlled Access, Channelization. Wired LAN:Ethernet Protocol, Standard Ethernet, Fast Ethernet, Giagabit Ethernet, 10 Gigabit Ethernet.

Unit III:Wireless LANS & Virtual Circuit Networks 6L

Introduction, Wireless LANS: IEEE 802.11 project, Bluetooth, Zigbee, Connecting devices and Virtual LANS: Connecting devices, Virtual LANS.

Unit IV:Network Layer6L

Network Layer Services, Packet Switching, Network layer performance, IPv4, addresses, Forwarding of IP packets, Network layer protocols: IP, ICMPv4, Mobile IP, Unicast Routing: Introduction, Routing Algorithms, Unicast Routing protocols, Multicast Routing Introduction, Next Generation IP:IPv6 Addressing, The IPv6 protocol, ICMPv6, Transition from IPv4 to IPv6.

Unit V:Transport Layer 6L

Introduction, Transport layer protocols and services, Port numbers User Datagram Protocol (UDP), Transmission Control protocol (TCP), SCTP, Quality of services: Dataflow characteristics, Flow Control.

Unit VI:Application Layer 6L

Introduction, World Wide Web and HTTP, FTP, Electronic mail, Telnet, Name System (DNS), Cryptography and Network Security: Introduction, Symmetric key ciphers and Asymmetric key Ciphers**,** Introduction to network security.

Text Books

1. Behrouz A. Foruzan, “Data communication and Networking”, Tata McGraw-Hill,5^{th} Edition
2. James F. Kurouse& W. Rouse, “Computer Networking: A Top down Approach”, 6^{th} Edition, 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. Greg Tomsho, Ed Tittel, David Johnson. “Guide to Networking Essentials”, fifth edition, Thomson India Learning, 2007.

Microwave Engineering(404183)

Teaching Scheme: Lectures: 4 Hrs/ Week		**Examination Scheme:** In Semester Assessment: Phase I : 30 End Semester Examination: Phase II: 70

Course Objectives:

- To lay the foundation for microwave engineering
- To understand the applications of microwave engineering
- Carryout the microwave network analysis.

Course Outcomes:

Aftersuccessfully completing the course students will be able to

- Formulate the wave equation in wave guide for analysis.
- Identify the use of microwave components and devices in microwave applications.
- Understand the working principles of all the microwave tubes
- Understand the working principles of all the solid state devices
- Choose a suitable microwave tube and solid state device for a particular application
- Carry out the microwave network analysis
- Choose a suitable microwave measurement instruments and carry out the required measurements.

Unit I : Transmission Lines and Waveguides 8L

Introduction to Microwaves engineering: History of Microwaves, Microwave Frequency bands. Applications of Microwave.

General solution for TEM, TE and TM waves,Parallel plate waveguide, and rectangular waveguide. Wave guide parameters. Introduction tocoaxial line, Rectangular waveguide cavity resonators, Circular waveguide cavity resonators

Unit II : Microwave Components 8L

Multi port junctions: Construction and operation of E-plane, H-plane, Magic Tee and Directional couplers.

Ferrites components: - Ferrite Composition and characteristics, Faraday rotation, Construction and operation of Gyrator, Isolator and Circulator.

Striplines: Structural details and applications of Striplines, Microstrip line, Parallel Strip line, Coplanar Strip line, Shielded Strip Line.

Unit III : Microwave Network Analysis 6L
Introduction and applications of Impedance and Equivalent voltages and currents, Impedance and Admittance matrices, The Transmission (ABCD) matrix **Scattering Matrix**:-Significance, formulation and properties. S-Matrix calculations for-2 port network junction, E plane, H-plane and E-H (Magic Tee) Tees, Directional coupler, Isolator and Circulator. Related problems.
Unit IV : Microwave Tubes 8L
Limitations of conventional tubes, O and M type classification of microwave tubes, reentrant cavity, velocity modulation. **O type tubes** **Two cavity Klystron**: Construction and principle of operation, velocity modulation and bunching process Applegate diagram. **Reflex Klystron**: Construction and principle of operation, velocity modulation and bunching process, Applegate diagram, Oscillating modes, o/p characteristics, efficiency, electronic & mechanical tuning. **M-type tubes** **Magnetron**: Construction and Principle of operation of 8 cavity cylindrical travelling wave magnetron, hull cutoff condition, modes of resonance, PI mode operation, o/p characteristics, Applications. **Slow wave devices** Advantages of slow wave devices, **Helix TWT**: Construction and principle of operation, Applications.
Unit V :Microwave Solid State Devices8L
Microwave bipolar transistor, FET, MESFET, Varactor Diode, PIN Diode, Shottky Barrier Diode, Tunnel Diode, TEDs, Gunn Diodes, IMPATT diode and TRAPATT diode. Structural details, Principle of operation, various modes, specifications, and applications of all these devices.
Unit VI : Microwave Measurements 6L
Measurement devices: Slotted line, Tunable detector, VSWR meter, Power Meter, S-parameter measurement, frequency measurements, Power measurement, Attenuation measurement, Phase shift measurement, VSWR measurement, Impedance measurement, Q of cavity resonator measurement

Text Books
1. Samuel Y. Liao, "Microwave Devices and Circuits", 3rd edition, Pearson 2. David M. Pozar, "Microwave Engineering", Fourth edition, Wiley.
Reference Books
1. M. Kulkarni, "Microwave and Radar engineering", 3rd edition, Umesh Publications 2. ML Sisodia& GS Raghuvamshi, "Microwave Circuits and Passive Devices"Wiley, 1987 3. M L Sisodia& G S Raghuvanshi, "Basic Microwave Techniques and Laboratory Manual", New Age International (P) Limited, Publishers.

Digital Image Processing(404184)

Teaching Scheme: Lectures:3 Hrs/ Week		**Examination Scheme:** In Semester Assessment: Phase I : 30 End Semester Examination: Phase II: 70

Course Objectives:

- To learn the fundamental concepts of Digital Image Processing.
- To study basic image processing operations.
- To understand image analysis algorithms.
- To expose students to current applications in the field of digital image processing.

Course Outcomes:

After successfully completing the course students will be able to

- Develop and implement algorithms for digital image processing.
- Apply image processing algorithms for practical object recognition applications.

Unit I : Fundamentals of Image Processing 6L

Steps in image processing, Human visual system, Sampling & quantization, Representing digital images, Spatial & gray-level resolution, Image file formats, Basic relationships between pixels, Distance Measures. Basic operations on images-image addition, subtraction, logical operations, scaling, translation, rotation. Image Histogram. Color fundamentals & models – RGB, HSI YIQ.

Unit II: Image Enhancement and Restoration 6L

Spatial domain enhancement: Point operations-Log transformation, Power-law transformation, Piecewise linear transformations, Histogram equalization. Filtering operations- Image smoothing, Image sharpening.

Frequency domain enhancement: 2D DFT, Smoothing and Sharpening in frequency domain.Homomorphic filtering.

Restoration: Noise models, Restoration using Inverse filtering and Wiener filtering

Unit III: Image Compression 6L

Types of redundancy, Fidelity criteria, Lossless compression – Runlength coding, Huffman coding, Bit-plane coding, Arithmetic coding. Introduction to DCT, Wavelet transform. Lossy compression – DCT based compression, Wavelet based compression. Image and Video Compression Standards – JPEG, MPEG.

Unit IV: Image Segmentation and Morphological Operations 6L

Image Segmentation: Point Detections, Line detection, Edge Detection-First order derivative – Prewitt and Sobel. Second order derivative – LoG, DoG, Canny. Edge linking, Hough Transform, Thresholding – Global, Adaptive. Otsu's Method. Region Growing, Region Splitting and Merging. Morphological Operations: Dilation, Erosion, Opening, Closing, Hit-or-Miss transform, Boundary Detection, Thinning, Thickening, Skeleton.

Unit V: Representation and Description 6L

Representation – Chain codes, Polygonal approximation, Signatures. Boundary Descriptors – Shape numbers, Fourier Descriptors, Statistical moments. Regional Descriptors – Topological, Texture. Principal Components for Description.

Unit VI: Object Recognition and Applications 6L

Feature extraction, Patterns and Pattern Classes, Representation of Pattern classes, Types of classification algorithms, Minimum distance classifier, Correlation based classifier, Bayes classifier. Applications: Biometric Authentication, Character Recognition, Content based Image Retrieval, Remote Sensing, Medical application of Image processing

Text Books

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", Third Edition, - Pearson Education
2. S Sridhar, "Digital Image Processing", Oxford University Press.

Reference Books

1. Rafael C. Gonzalez, Richard E. Woods, and Steven L. Eddins, "Digital Image Processing Using MATLAB", Second Edition, - Tata McGraw Hill Publication
2. S Jayaraman, S Esakkirajan, T Veerakumar, "Digital Image Processing", Tata McGraw Hill Publication

List of Experiments:

Note: Experiments are to be performed using software preferably open source.

1. To perform basic operations on images.
2. To perform conversion between color spaces.
3. To perform histogram equalization.
4. To perform image filtering in spatial domain.
5. To perform image filtering in frequency domain.
6. To perform image restoration.
7. To perform image compression using DCT / Wavelet transform.
8. To perform edge detection using various masks.
9. To perform global and adaptive thresholding.
10. To apply morphological operators on an image.
11. To obtain boundary / regional descriptors of an image.
12. To perform image classification / recognition

Embedded Systems & RTOS(404184)

Teaching Scheme:		**Examination Scheme:**
Lectures: 3 Hrs/ Week		In Semester Assessment: Phase I : 30 End Semester Examination: Phase II: 70

Course Objectives:

- To understand the Embedded system design issues.
- To learn real time operating system concepts.
- To understand the Embedded Linux environment
- To learn Embedded software development and testing process.

Course Outcomes:

Aftersuccessfully completing the course students will be able to

- Get insight of design metrics of Embedded systems to design real time applications to match recent trends in technology.
- Understand Real time systems concepts.
- Understand Linux operating system and device drivers.
- Get to know the hardware – software co design issues and testing methodology for Embedded system.

Unit I:Introduction to Embedded Systems 6L

Introduction to Embedded Systems, Architecture, Classification and Characteristics of Embedded System, Design Process, Design Metrics and optimization of various parameters of embedded system. Embedded processor technology, IC technology, Design technology. Software development life cycle. Various models like waterfall, spiral, V , Rapid Prototyping models and Comparison

Unit II: Real Time Systems Concepts 6L

Foreground/ Background systems, Critical section of code, Resource, Shared resource, multitasking, Task, Context switch, Kernel, Scheduler, Non-Preemptive Kernel , Preemptive Kernel, Reentrancy, Round robin scheduling, Task Priorities, Static & Dynamic Priority, Priority Inversion, Assigning task priorities, Mutual Exclusion, Deadlock, Clock Tick, Memory requirements, Advantages & disadvantages of real time kernels.

Unit III: μCOS II 6L

Features of μCOS II. Kernel structure. μCOS II RTOS services:Task management, Time management, Intertask Communication and Synchronization.

Unit IV: Embedded Linux Development Environment 6L

Need of Linux, Embedded Linux Today, Open Source and the GPL, BIOS Versus Boot loader, Anatomy of an Embedded System, Storage Considerations, Embedded Linux Distributions. Embedded Development Environment, Cross-Development Environment, Host System Requirements, Hosting Target Boards. Development Tools, GNU Debugger, Tracing and Profiling Tools, Binary Utilities.

Unit V: Linux Kernel Construction 6L

Linux Kernel Background, Linux Kernel Construction, Kernel Build System, Kernel Configuration. Role of a Bootloader, Bootloader Challenges. A Universal Bootloader: Das U-Boot. Porting U-Boot. Device Driver Concepts, Module Utilities, Driver Methods. Linux File System & Concepts

Unit VI : Embedded Software Development, Testing Process and Tools 6L

Embedded Software development process and tools, Host and Target Machines, linking and Locating Software, Getting Embedded Software into the Target System, Issues in Harware-Software Design and Co-design. Testing on Host Machine, Simulators, Laboratory Tools. Case study of Embedded system like Automatic Chocolate Vending Machine, Mobile Phone.

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.

Reference Books

1. Raj Kamal, "Embedded Systems – Architecture, Programming and Design" 2nd edition, McGraw Hill.
2. Frank Vahid and Tony Givargis, " Embedded System Design – A Unified hardware/ Software introduction " 3rd edition, Wiley.

List of Experiments:

Group A: ARM7/ ARM Cortex- M3&μCOS - II Based Experiments (any four)

1. Multitasking in μCOS II RTOS using minimum 3 tasks on ARM7/ ARM Cortex- M3.

2. Semaphore as signaling & Synchronizing on ARM7/ ARM Cortex- M3.
3. Mailbox implementation for message passing on ARM7/ ARM Cortex- M3.
4. Queue implementation for message passing on ARM7/ ARM Cortex- M3.
5 Implementation of MUTEXusing minimum 3 tasks on ARM7/ ARM Cortex- M3.

Group B: ARM9 & LINUX Based Experiments (any four)

6. Download pre-configured Kernel Image, File System, bootloader to target device- ARM9.
7. Writing simple application using embedded Linux on ARM9.
8. Writing “Hello World” device Driver. Loading into & removing from Kernel on ARM9 board.
9. Write a program for I2C based RTC using embedded Linux on ARM9.
10. Using Device driver for GPIO, write a program to blink LED onARM9.
11. Write a program for External InterruptonARM9.

Software Defined Radio(404184)

Teaching Scheme:		Examination Scheme:
Lectures: 3 Hrs/ Week		In Semester Assessment: Phase I : 30 End Semester Examination: Phase II: 70

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:

Aftersuccessfully completing the course students will be able to

- Compare SDR with traditional Hardware Radio HDR
- Implement modern wireless system based on OFDM, MIMO & Smart Antenna
- Build experiment with real wireless waveform and applications, accessing both PHY and MAC, Compare SDR versus MATLAB and Hardware Radio
- Work on open projects and explore their capability to build their own communication system.

Unit I : Software Defined Radio fundamentals 6L

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
Case study : AM/FM/BPSK/QPSK/OFDM Simulation in Matlab

Unit II : SDR Architecture 6L

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

Case Study : JTRS –Goals of SCA ,Architectural details ,SDR forum Architecture

Unit III : Multi Rate Signal Processing 6L

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 6L

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 V : Cognitive Radio 6L

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 6L

Application of 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

Reference Books:

1. Markus Dillinger , KambizMadani ,Nancy Alonistioti, Software Defined Radio : Architectures , Systems and Functions ,Wiley
2. Tony .J. Rouphael , RF and DSP for SDR, Elsevier Newness Press ,2008
3. Dr.TajStruman ,Evaluation of SDR –Main Document
4. SDR –Handbook , 8th Edition , PENTEK
5. Bruce a. Fette , Cognitive Radio Technology, Newness, Elsevier

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

Industrial Drives and Control(404184)

Teaching Scheme: Lectures: 3 Hrs/ Week Practical: 2 Hrs/ Week		**Examination Scheme:** In Semester Assessment: Phase I : 30 End Semester Examination: Phase II: 70

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:

- 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.
- Understand the operation of 1ф & 3ф 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.
- 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.
- Learn and understand working of cylindrical-rotor motor, salient-pole motor, reluctance motor, and permanent-magnet motors.
- Learn closed loop V/f control and load-commutated inverter (LCI) control. Variable reluctance & permanent magnet stepper motors & drives, switched reluctance motors & drives, brushless DC and AC motors & drives.

Unit I: DC Drives 6L

Basic characteristics of DC motors, Operating modes, Motor performance parameters, 1ф & 3ф 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 II: Induction Motor Drives & Control 6L

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 III: Special Motor Drives I 6L

Cylindrical rotor motor Drive, Salient pole motor Drive, Switched reluctance motor (SRM) drive, Synchronous Reluctance motor drive, self-controlled synchronous motor drives

Unit IV: Special Motor Drives II 6L

Permanent magnet Brushless DC motor drive, Permanent magnet AC synchronous motor drive, Variable reluctance & permanent magnet stepper motor, Stepper motor drives, Servo motor Drives.

Unit V: Drive Applications in Renewable Energy 6L

Power Electronics for wind power systems

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: Applications of Artificial neural network and fuzzy logic in Drives 6L

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. 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

List of Experiments (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. V/f controlled AC induction motor drive
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 drive using PSIM/Matlab/MathCad
10. Simulation of Closed loop controlled AC motor drive using PSIM / Matlab/MathCad/ open source software

.

Multi-rate and Adaptive Signal Processing(404185)

Teaching Scheme:		Examination Scheme:
Lectures: 3Hrs/ Week		In Semester Assessment: Phase I : 30 End Semester Examination: Phase II: 70

Course Objectives:

1. To extend students understanding of DSP concepts for designing filters and filter-banks
2. To understand various Multirate DSP applications
3. To extend MultirateconceptsintoMultiresolution analysis.
4. To make student learn the need of adaptive-ness in digital filters

Course Outcomes:

1. The student will use theory of multirate processing for design of basic systems.
2. The student will be able to performmultiresolutionanalysis using Haar wavelet.
3. The student will show skills for design of adaptive filter for Wiener filter.

Unit I: Basics Signal Processing 6L

Review of Fourier Transform ,Time and frequency averages, Time Bandwidth product, Stationary and Non-stationary signals. Limitations of Fourier Transform.
Review of Correlation: Auto and Cross, Covariance: Auto and Cross, Energy and Power signals, Spectral Density: Energy and Power, Parsevals Theorem. Concept of Function Space. Definition of Harr scaling and wavelet function. Difference between Fourier basis and Harr basis functions. Finding orthogonal projections of energy signals with finite support using Harr scaling and wavelet function.

Unit II: Multi-rate DSP6L

Need for Multi-rate DSP, Decimation by factor D , Interpolation by factor I, Sampling rate conversion by rational factor I/D, Design of practical sampling rate converters, software implementation of sampling rate converters (Decimators and Interpolators), sample rate conversion using poly-phase filter structures

Unit III: Time Frequency Representation of signals 6L

Time Frequency description of signals, Concept of Instantaneous frequency and Complex signal, Uncertainty principle, need for joint time frequency representation ,tiling diagrams. Short

Time Fourier Transform, Wigner Ville distribution, Continuous Wavelet Transform, Discretization of STFT & CWT, Spectrograms and Scalograms

Unit IV:Time-Frequency (Wavelet) Analysis of signals 6L

Discrete Wavelet Transform and its relation to multi-rate filter banks. Decomposition of signals using Harr two band filter bank structure. Perfect reconstruction conditions.Axiomatic definition of Multi Resolution Analysis (MRA).Wavelet Packet Analysis versus Wavelet analysis.Problems on Wavelet analysis and Wavelet packet analysis.

Unit V: Adaptive Filters 6L

Need of adaptive filters, adaptive filters as noise cancellation, configuration of adaptive filters, main components of adaptive filters, Basic Wiener filter theory-Wiener-Hopf Equation, Adaptive Algorithms: LMS basic adaptive algorithm, Implementation of basic LMS algorithm. Recursive least square algorithms (RLS).

Unit VI:Applications of Multi- rate and adaptive signal processing techniques 6L

Efficient D/A conversion in Hi-fi systems. Subband coding of speech signals. Adaptive telephone echo cancellation. Application of wavelets in compression and de-noising. Advantages of Harr Lifting scheme in signal filtering. Problems on Harr Lifting scheme and de-noising.

Text Books:

1. John G. Proakis, Manolakis, “Digital Signal Processing, Principles, Algorithms and Applications”, Pearson education, Fourth Edition, 2007.
2. E. C. Ifeachor and B. W. Jervis, “Digital Signal Processing- A Practical Approach”, 2nd Edition, Pearson education. 2007.
3. Leon Cohen, “Time-Frequency Analysis”, Prentice Hall,1995.

Reference Books:

1. S. D. Apte, “Advanced Digital Signal Processing,” Wiley Publications, 2014.
2. K.P Soman, K.I Ramchandran, N.G.Reshmi , “Insight into Wavelets- from theory to Practice,” PHI Learning Private Limited, Third Edition, 2010.

Electronic Product Design(404185)

Teaching Scheme:		Examination Scheme:
Lectures: 3 Hrs./ Week		In Semester Assessment: Phase I : 30 End Semester Examination: Phase II: 70

Course Objectives:

- To understand the stages of product (hardware/ software) design and development.
- To learn the different considerations of analog, digital and mixed circuit design.
- To be acquainted with methods of PCB design and different tools used for PCB Design.
- To understand the importance of testing in product design cycle. `
- To understand the processes and importance of documentation.

Course Outcomes:

Aftersuccessfully completing the course students will be able to

- Understand various stages of hardware, software and PCB design.
- Importance of product test & test specifications.
- Special design considerations and importance of documentation.

Unit I: Introduction to Electronic Product Design 6L

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 6L

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 6L

Types of Software. Waterfall model of software development. Models, metrics and software limitations. Risk abatement and failure preventions. Software bugs and testing. Good programming practice. User interface .Embedded, Real time software.

Unit IV: PCB design   6L

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   6L

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 : Documentation6L

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 university press.
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”, CRC press.

PLC&Automation(404185)

Teaching Scheme:		**Examination Scheme:**
Lectures: 3 Hrs/ Week		In Semester Assessment: Phase I : 30 End Semester Examination: Phase II: 70

Course Objectives:

- Ability to recognize industrial control problems suitable for PLC control
- An over view of technology of advanced topics such as SCADA, DCS Systems, Digital Controller, CNC Machines.
- The ability to select the essential elements and practices needed to develop and implement the Engineering Automation using PLC approach.

Course Outcomes:

Aftersuccessfully completing the course students will be able to

- Understand PLC architecture, PLC addressing concepts.
- Develop PLC ladder programs for simple industrial applications.
- Design Automation systems for industrial applications.

Unit I: Process Control & Automation 6L

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 6L

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 6L

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: PLC and Human Machine Interface (HMI) 6L

Functions of PLC, Advantages, Architecture, working of PLC, Selection of PLC, Networking of PLCs, Ladder Programming, Interfacing Input and Output devices with PLC, PLC based automated systems. High frequency inputs. PLC programming standard IEC61131, Soft PLC techniques. **IT Interfaces required:** for ERP, MIS, MES. **Supporting Applications interfaces**: RFID, Barcode, Vision Systems**. HMI:** Block Diagram, Types, Advantages, Applications.

Unit V: SCADA & Distributed control system 6L

Elements of SCADA, Features of SCADA, MTU- functions of MTU, RTU- Functions of RTU, Applications of SCADA, Communications in SCADA- types & methods used, Mediums used for communication, Introduction to DCS, Architecture of DCS, Input and output modules, communication module, Specifications of DCS.

Unit VI: Automation and CNC (Computer Numeric Control) Machines 6L

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
3. Stuart A. Boyer, SCADA supervisory control and data acquisition, ISA Publication

Reference Books

1. John W. Webb, Ronold A Reis, "Programmable Logic Controllers, Principles and Applications"; 5th Edition, Prentice Hall of India Pvt. Ltd
2. Kilian, "Modern control technology: components & systems, Delmar 2nd edition.
3. Bela G Liptak, *Process software and digital networks,* 3rd edition, 2002.
4. Pollack. Herman, W & Robinson., T. "Computer Numerical Control", Prentice Hall. NJ.
5. Pabla, B.S. &Adithan, M. "CNC Machines", New Age Publishers, New Delhi

Artificial Intelligence(404185)		
Teaching Scheme: Lectures: 3Hrs/ Week		**Examination Scheme:** In Semester Assessment: Phase I : 30 End Semester Examination: Phase II: 70

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 emerging technology.
- To understand the concepts of machine learning, probabilistic reasoning, robotics, computer vision, and natural language processing.
- To understand the numerous applications and huge possibilities in the field of AI that go beyond the normal human imagination.

Course Outcomes:

After successfully completing the course students will be able to

- Design and implement key components of intelligent agents and expert systems.
- To apply knowledge representation techniques and problem solving strategies to common AI applications.
- Applyand integrate various artificial intelligence techniques in intelligent system development as well as understand the importance of maintaining intelligent systems.
- Build rule-based and other knowledge-intensive problem solvers.

Unit I : Foundation	6L

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	7L

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 6L
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, Ontological Engineering, Categories and objects, Actions - Simulation and events, Mental events and mental objects.
Unit IV : Learning 6L
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 : Perception and Expert System 5L
Visual perception-Waltz's algorithm, Introduction to Expert System, Architecture and functionality, Example Expert system
Unit VI : Natural Language Understanding 6L
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
1. Nils J. Nilsson, "Artificial Intelligence: A new Synthesis", Harcourt Asia Pvt. Ltd. 2. George F. Luger, "Artificial Intelligence-Structures and Strategies for Complex Problem Solving", Pearson Education/ PHI.

Lab Practice - I (404186)

CN and MWE

Teaching Scheme:		Examination Scheme:
Practical: 4 Hrs/week		OR: 50Marks TW:50Marks

Computer Networks

List of the Experiments(Minimum 8 experiments are to be performed).

1. Implementation of LAN using suitable multiuser Windows operating System and demonstrating client-server and peer to peer mode of configuration.
2. Installation and configuration of Web server.
3. Installation and configuration of FTP Server.
4. 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.
5. Socket Programming for client/Server application using Linux OS.
6. Installation and configuration of Telnet server for Telnet communication.
7. Installation and configuration of Proxy server.
8. Installation and configuration of DHCP server.
9. Study of IP Addresses subnetting and CIDR
10. Study of Network Protocol Analyzer tool/software.
11. Study of network monitoring tool/software.
12. Configuration of router & study of routing between LAN's
13. Simulating LAN or WAN using suitable network simulator.
14. Write a program for Encryption and Decryption
15. Write a program for implementation of Shortest Path algorithm.
16. Simulating LAN or WAN using suitable network simulator.
17. Study of wireless LANs (Demonstrating Data communication with Wi-Fi, Bluetooth networking etc).

Microwave Engineering

List of the Experiments(Minimum 8 experiments are to be performed):

1. Study of microwave components and equipments.
2. Reflex Klystron as a Microwave source in laboratory and plot its mode characteristics.
3. Measurement of the free space wavelength of the microwave (for TE 10 mode) with the help of the X-band microwave test bench and verify with its theoretical calculation.
4. Study of Gunn Diode & PIN Modulator as a Microwave source. Plot the V-I characteristics.

5. Verification of Port Characteristics of Microwave Tees (E, H, E-H Planes).
6. Verification of Port Characteristics of Directional Coupler. Calculation of coupling factor, insertion loss and directivity.
7. Verification of Port Characteristics of Isolator and Circulator. Also calculation of insertion loss and isolation in dB.
8. Study of slotted section with probe carriage. Measure the VSWR for various values of terminating impedances (open/short/matched termination).
9. Study the Network Analyzer, Carry out the measurements of s-parameter measurement for the various microstrip components.
10. Explain in detail the concept of RF power measurement. Carry out the RF power measurement using microwave bench
11. To test and verify Microwave Integrated Circuits using Microstrip trainer kit and finds parameters, and plot the frequency response.

Lab Practice - II (404187)

VLSI and Elective I

Teaching Scheme:		Examination Scheme:
Practical: 4 Hrs/week		PR: 50Marks TW:50Marks

VLSI

List of Experiments:

A. To write VHDL code, simulate with test bench, synthesis, implement on PLD. [Any 4].

1. 4 bit ALU for add, subtract, AND, NAND, XOR, XNOR, OR, & ALU pass.
2. Universal shift register with mode selection input for SISO, SIPO, PISO, & PIPO modes.
3. FIFO memory.
4. LCD interface.
5. Keypad interface.

B. To prepare CMOS layout in selected technology, simulate with and without capacitive load, comment on rise, and fall times.

1. Inverter, NAND, NOR gates, Half Adder
2. 2:1 Multiplexer using logic gates and transmission gates.
3. Single bit SRAM cell.
4. D flip-flop.

Elective I

Experiments to be chosen based on Elective I(Minimum 8 experiments are to be performed)

Project Phase-I (404188)

Teaching Scheme:		Examination Scheme:
Tutorial: 2Hrs/week		TW: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 work assessment.

2. The report consists of the Literature Survey, basic project work and the size of the report should be maximum of 40 pages.

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 certified copy of report is required to be presented to external examiner at the time of final examination.

Mobile Communication(404189)

Teaching Scheme: Lectures: 4Hrs/ Week		**Examination Scheme:** In Semester Assessment: Phase I : 30 End Semester Examination: Phase II: 70

Course Objectives:

- To learn and understand the basic principles of Telecommunication switching, traffic and networks
- To learn and understand basic concepts of cellular system, wireless propagation and the techniques used to maximize the capacity of cellular network.
- To learn and understand architecture of GSM and CDMA system.
- To understand mobile management, voice signal processing and coding in GSM and CDMA system

Course Outcomes:

Aftersuccessfully completing the course students will be able to

- Explain and apply the concepts telecommunication switching, traffic and networks
- Analyze the telecommunication traffic.
- Analyze radio channel and cellular capacity.
- Explain and apply concepts of GSM and CDMA system.

Unit I : Telecommunication Switching & Traffic 8L

Telecommunication switching: Message switching, Circuit switching, Manual System, Electronic Switching. Digital switching: Switching functions, 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.

Unit II: Switching Networksand Signaling 8L

Single Stage Networks, Gradings, Link Systems, Grades of service of link systems. Time Division Switching: Space and time switching, Time division switching networks, Synchronization, Call processing Functions, Common Control, Reliability, Availability and Security. Signaling: Customer line signaling. FDM carrier systems, PCM signaling, Inter-register signaling, Common channel signaling principles, CCITT signaling No. 6, CCITT signaling No. 7, Digital customer line signaling.

Unit III: Cellular Concepts6L
Evolution of Wireless systems, Introduction to cellular telephone system, Frequency reuse, Channel Assignment, Handoff strategies, Cell Splitting, Propagation Mechanism: Free space loss, Reflection, Diffraction, Scattering. Fading and Multipath: Small scale multipath propagation, Impulse response model of multipath channel. Multiple Access Techniques-TDMA, FDMA, CDMA
Unit IV: First and Second Generation Mobile Systems6L
First Generation Cellular Systems, AMPS, GSM Cellular Telephony: Introduction, Basic GSM Architecture, Basic radio transmission parameters in GSM system, Logical Channels, GSM time hierarchy, GSM burst structure, Description of call setup procedure, Handover, Modifications and derivatives of GSM.
Unit V: GSM Services 8L
GSM Physical layer: Speech Coding and decoding, GMSK modulation, Data transmission in GSM: Data Services, SMS, HSCSD, GPRS, EDGE.
Unit VI : CDMA Based Mobile Systems 8L
Motivation for CDMA use, Spreading Sequences, Basic Transmitter and Receiver schemes, Rake Receiver, IS-95 system: Frequency Range, Downlink transmission, Uplink transmission, Power control, Introduction to 3G mobile systems: W-CDMA and cdma-2000.
Text Books
1. J. E. Flood , "Telecommunications Switching, Traffic and Networks", Pearson Education 2. Krzysztof Wesolowski, "Mobile Communication Systems", Wiley Student Edition.
Reference Books
1. Theodore S Rappaport, "Wireless Communications Principles and Practice" Second Edition, Pearson Education 2. John C. Bellamy, "Digital Telephony", Third Edition; Wiley Publications 3. ThiagarajanVishwanathan, "Telecommunication Switching Systems and Networks"; PHI Publications 4. Wayne Tomasi, "Electronic Communications Systems"; 5th Edition; Pearson Education 5. Vijay K Garg, Joseph E Wilkes, "Principles and Applications of GSM" Pearson Education 6. Vijay K Garg, Joseph E Wilkes, "IS-95CDMA and CDMA 2000 Cellular/PCS Systems Implementation" Pearson Education 7. Mischa Schwartz, "Mobile Wireless Communications", Cambridge University Press

Broadband Communication Systems(404190)

Teaching Scheme:		Examination Scheme:
Lectures 3 Hrs/ Week		In Semester Assessment: Phase I: 30 End Semester Examination: Phase II:70

Course Objectives:

- To understand 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 their subject understanding in Link Design.

Course Outcomes:

After successfully completing the course students will be able to:

- Carry out Link power budget and Rise Time Budget by proper selection of components and check its viability.
- Carry out Satellite Link design for Up Link and Down Link.

UNIT I: Light wave System Components 6L

Key Elements of Optical Fiber Systems, 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. Photodetectors: Basic Concepts, Common Photodetectors.

UNIT II: Lightwave Systems6L

System Architectures, Point-to-Point Links: System Considerations, Design Guidelines: Optical Power Budget, Rise Time Budget, Long-Haul Systems.

UNIT III: Multichannel Systems6L

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 Launchers6L
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: Satellites 6L
Satellite Subsystems, Attitude and control systems (AOCS), Telemetry, Tracking, Commandand Monitoring, Power systems, Communication subsystems, Satellite antennas, EquipmentReliability and space qualification.
UNIY VI: Satellite Communication Link Design6L
Introduction, Basic transmission Theory, System Noise Temperature and G/T Ratio, Designof Downlinks, Satellite Systems using Small Earth Stations, Uplink Design, Design ofSpecified 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

Speech and Audio Signal Processing(404191)

Teaching Scheme:		Examination Scheme:
Lectures: 3 Hrs/ Week		In Semester Assessment: Phase I : 30 End Semester Examination: Phase II: 70

Course Objectives:

- To understand basic concepts and methodologies for the analysis and modeling of speech signal.
- To characterize the speech signal as generated by a speech production model
- To understand the mechanism of speech and audio perception
- To understand the motivation of short-term analysis of speech and audio
- 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 this field.

Course Outcomes:

After successfully completing the course students will be able to

- Design and implement algorithms for processing speech and audio signals considering the properties of acoustic signals and human hearing.
- Analyze speech signal to extract the characteristic of vocal tract (formants) and vocal cords (pitch).
- Write a program for extracting LPC Parameters using Levinson Durbin algorithm
- Formulate and design a system for speech recognition and speaker recognition

Unit I: Fundamentals of speech production6L

Anatomy and physiology of speech production, Human speech production mechanism, LTI model for speech production, Nature of speech signal, linear time varying model, articulatory phonetics, acoustic phonetics, Voiced and Unvoiced speech.

Unit II: Human auditory system 6L

Human auditory system, simplified model of cochlea. Sound pressure level and loudness. Sound intensity and Decibel sound levels. 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.

Unit III: Time and frequency domain methods for audio processing 6L

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 analysis 6L

Basic principles of linear predictive analysis. Autocorrelation method, covariance method. Solution of LPC equations: Cholesky decomposition, Durbin's recursive solution, lattice formulations and solutions. Frequency domain interpretation of LP analysis. Applications of LPC parameters as pitch detection and formant analysis.

Unit V: Cepstral Analysis 6L

Homomorphic speech processing, Real Cestrum: Long-term real cepstrum, short-term real cepstrum, pitch estimation, format estimation, Mel cepstrum. Complex cepstrum: Long-term complex cepstrum, short-term complex cepstrum.

Unit VI : Speech and Audio processing applications 6L

Speech recognition: complete system for an isolated word recognition with vector quantization /DTW. Speaker recognition: Complete system for speaker identification, verification. Introduction to speech enhancement, Speech enhancement using spectral subtraction method, Introduction to Text to speech conversion, Introduction to Musical instrument classification, Musical Information retrieval.

Text Books :

1. Deller J. R. Proakis J. G. and Hanson J. H., "Discrete Time Processing of Speech Signals", Wiley Interscience
2. Ben Gold and Nelson Morgan, "Speech and audio signal processing" Wiley

Reference Books :

1. L. R. Rabiner and S.W. Schafer, "Digital processing of speech signals" Pearson Education.
2. Thomas F. Quateri , "Discrete-Time Speech Signal Processing: Principles and Practice" Pearson
3. Dr. ShailaApte, "Speech and audio processing", Wiley India Publication
4. L. R. Rabiner and B. H. Juang, "Fundamentals of speech recognition"
5. Theodoros Giannakopoulos and Aggelospikrakis, " Introduction to audio analysis : A MATLAB Approach : Eleseiver Publication.

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 and find Energy and ZCR for different frame rates and comment on the result.
2. Record different vowels as /a/, /e/, /i/, /o/ etc. and extract the pitch as well as first three formant frequencies. Perform similar analysis for different types of unvoiced sounds and comment on the result.
3. Write a program to identify voiced, unvoiced and silence regions of the speech signal.
4. Record a speech signal and perform the spectrographic analysis of the signal using wideband and narrowband spectrogram. Comment on narrowband and wide band spectrogram.
5. Write a program for extracting pitch period for a voiced part of the speech signal using autocorrelation .
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.

RF Circuit Design(404191)

Teaching Scheme: Lectures: 3 Hrs/ Week		**Examination Scheme:** In Semester Assessment: Phase I : 30 End Semester Examination: Phase II: 70

Course Objectives:

- To study RF issues related to active and passive components.
- To study circuit design aspects at RF.
- To learn design and modeling of circuits at RF.

Course Outcomes:

After successfully completion of the course students will be able to -

- Understand behavior of passive components at high frequency and modeling of HF circuit.
- Design HF amplifiers with gain bandwidth parameters.
- Understand Mixer types and characteristics.
- Gain the knowledge about PLLs and Oscillators with respect to their circuit topologies.

Unit I : RF Behavior of Passive Components 6L

HF Resistors, HF Capacitors, HF Inductors, Chip Components. Circuit Board Considerations: Chip Resistors, Chip Capacitors, Surface Mounted Inductors.

Unit II : Bandwidth Estimation 6L

Open Circuit Time Constant Method: Observations & Interpretations, Accuracy of OCτs, Considerations, Design examples. Short Circuit Time Constant Method:Background,Observations & Interpretations, Accuracy of SCτs, Considerations. Delay of a system in cascade, Rise time of systems in cascade, Relation Between Rise Time and Bandwidth.

Unit III : High Frequency Amplifier Design 6L

Shunt Peaked Amplifier, Shunt Series peak Amplifier, Two port bandwidth enhancement, Design example. Bandwidth enhancement techniques. Tuned Amplifier: Common Source Amplifier with Single Tuned Load, Analysis of Tuned Amplifier. Neutralization and unilateralization. Characteristics of RF amplifier. Amplifier power relations. Stability considerations. Stabilization methods.

Unit IV: Low Noise Amplifier Design 6L

MOSFET two port noise parameters, LNA topologies, Power-constrained noise optimization. Design examples: Single ended LNA, Differential LNA. Linearity and large signal performance. Spurious free dynamic range.

Unit V : Oscillators 6L

Problem with Purely Linear Oscillators, Describing Functions, Describing Function for MOS. Colpitts Oscillator: Describing Function Model and Start-up Model of Colpitts Oscillator. Resonators: Quarter-Wave Resonators, Quartz Crystals. Tuned Oscillators: Basic LC Feedback Oscillators, Crystal Oscillator. Negative Resistance Oscillator.

Unit VI : Mixers 6L

Mixer Fundamentals. Significant Characteristics of Mixer: Conversion Gain, Noise Figure, Linearity and Isolation, Spurs. Non Linear Systems as Linear Mixers. Multiplier Based Mixers: Single Balanced Mixer, Linearization techniques of Mixer, Active Double Balanced Mixer. Passive Double Balanced Mixer, Diode Ring Mixers.

Text Books

1. Reinhold Ludwig, PavelBretchko, "RF Circuit Design Theory and Applications", Pearson Education.
2. Thomas H. Lee, "The Design of CMOS Radio-Frequency Integrated Circuits", Second Edition, Cambridge Publications.

Reference Books

1. T. Yettrdal, Yunhg Cheng, "Devices modeling for analog and RF COMS circuits design", John Wiley publication.
2. Calvin Plett, "Radio frequency Integrated Circuits Design", Artech house.

List of Experiments:

1. To plot frequency response of the impedance magnitude of series and parallel LC circuits.
2. To plot the resonant frequency behavior of parallel LC circuit, as a function of resistance R.
3. To determine stability regions of the device and sketch them in the Smith Chart. Assume suitable parameters.
4. To design, prepare layout and simulate CMOS amplifier for given voltage gain and bandwidth.

5. To design, prepare layout and simulate CMOS Collpitt oscillator.
6. To design, prepare layout and simulate CMOS mixer.
7. To design, prepare layout and simulate CMOS LNA.
8. To design, prepare layout and simulate double balance mixer.
9. To design, prepare layout and simulate diode Ring mixer.
10. To design, prepare layout and simulate local oscillator.

Audio Video Engineering(404191)

Teaching Scheme: Lectures: 3Hrs/ Week		**Examination Scheme:** In Semester Assessment: Phase I : 30 End Semester Examination: Phase II: 70

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 and they will be acquainted with different types of analog, digital TV and HDTV systems.
- The students will gate overview of fundamentals of Audio systems and basics Acoustics

Course Outcomes:

- To study the analysis and synthesis of TV Pictures, Composite Video Signal, Receiver, Picture Tubes and Television Camera Tubes.
- To study the various Colour Television systems with a greater emphasis on television standards.
- To study the advanced topics in Digital Television and High Definition Television.
- To study audio recording systems such CD/DVD recording, Audio Standards, and Acoustics principles.

Unit I :Fundamentals of Colour Television 8L

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, remote control. Fault finding and servicing equipments like Wobbuloscope, TV Pattern Generator, and Field Strength meter.

Unit II: Digital TV and Display Devices 6L

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: LED, LCD, TFT, Plasma,

Unit III: HDTV 6L

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, Digital broadcasting, case study (Cricket match, Marathon, Football match).

Unit IV: Advanced TV Systems8L

IP Audio and Video, IPTV systems, Mobile TV, Video transmission in 3G mobile System, IPod(MPEG4 Video player), Digital Video Recorders, Personal Video Recorders, Wi-Fi Audio / Video Transmitter and Receivers. Video Projectors, HD Video projectors, Video Intercom systems/ Video door phones.

Unit V : .Fundamentals of Audio-Video Recording6L

Methods of sound recording & reproduction, optical recording, CD recording, , audio standards. Digital Sound Recording, CD/ DVD player, MP3 player, Blue Ray DVD Players, MPEG, MP3 Player.

Unit VI : Fundamentals of Acoustics 6L

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. Video Demisified, Kelth jack, Penram International Publication.
3. Audio Video Systems, R.G. Gupta, TMH Publication

Reference Books

1. S. P. Bali, “Color TV Theory and Practice”.
2. Bernard Grobb, Charles E, “Basic TV and Video Systems”.

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 / IPTV 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

SOFT COMPUTING TECHNIQUES(404191)

Teaching Scheme: Lectures: 3Hrs/ Week		**Examination Scheme:** In Semester Assessment: Phase I : 30 End Semester Examination: Phase II: 70

Course Objectives:

- Introduce a relatively new computing paradigm for creating intelligent machines useful for solving complex real world problems.
- Insight into the tools that make up the soft computing technique: fuzzy logic, artificial neural networks and hybrid systemsTechniques.
- To create awareness of the application areas of soft computing technique
- Provide alternative solutions to the conventional problem solving techniques in image/signal processing, pattern recognition/classification, control system

Course Outcomes:

Having successfully completing the course students will be able to

- use a new tool /tools to solve a wide variety of real world problems
- find an alternate solution , which may offer more adaptability, resilience and optimization
- Identify the suitable antenna for a given communication system
- Gain knowledge of soft computing domain which opens up a whole new career option
- Tackle real world research problems

Unit I : Artificial Neural Network -I 8L

Biological neuron, Artificial neuron model, concept of bias and threshold , McCulloch- Pits Neuron Model , implementation of logical AND, OR, XOR functions Soft Topologies of neural networks, learning paradigms: supervised, unsupervised, reinforcement, Linear neuron model : concept of error energy , gradient descent algorithm and application of linear neuron for linear regression, Activation functions : binary , bipolar (linear, signup, log sigmoid, tan sigmoid) Learning mechanisms: Hebbian, Delta Rule o Perceptron and its limitations Draft

Unit II : Artificial Neural Network-II 8L

Multilayer perceptron (MLP) and back propagation algorithm o Application of MLP for classification and regression o Self- organizing Feature Maps, k- means clustering o Learning vector quantization Radial Basis Function networks: Cover's theorem, mapping functions

(Gaussian, Multi-quadrics, Inverse multiquadrics, Application of RBFN for classification and regression o Hopfield network, associative memories.
Unit III : Fuzzy Logic -I 6L
Concept of Fuzzy number, fuzzy set theory(continuous, discrete) o Operations on fuzzy sets, Fuzzy membership functions (core ,boundary ,support) , primary and composite linguistic terms , Concept of fuzzy relation, composition operation (T-norm,T-conorm) o Fuzzy if-then rules.
Unit IV : Fuzzy Logic -II 6L
Fuzzification , Membership Value Assignment techniques, De-fuzzification (Maxmembership principle, Centroid method, Weighted average method), Concept of fuzzy inference, Implication rules- Dienes-Rescher Implication, Mamdani Implication, Zadeh Implication, Fuzzy Inference systems -Mamdani fuzzy model , Sugeno fuzzy model , Tsukamoto fuzzy model, Implementation of a simple two-input single output FIS employing Mamdani model Computing.
Unit V : Fuzzy Control Systems 6L
CONTROL SYSTEM DESIGN PROBLEM 1.5, Control (Decision) Surface, Assumptions in a Fuzzy Control System Design V, Fuzzy Logic Controllers Soft o Comparison with traditional PID control, advantages of FLC, Architecture of a FLC: Mamdani Type , Example Aircraft landing control problem.
Unit VI : Adaptive Neuro-Fuzzy Inference Systems(ANFIS) 6L
ANFIS architecture, Hybrid Learning Algorithm, Advantages and Limitations of ANFIS Application of ANFIS/CANFIS for regression
Text Books
1. Fundamentals of Neural Networks: Architectures, Algorithms And Applications, LaureneFausett, Pearson Education, Inc, 2008 . 2. Fuzzy Logic With Engineering Applications, Third Edition Thomas, Timothy Ross, John Wiley & Sons,2010 3. Neuro- Fuzzy and Soft Computing, J.S. Jang, C.T. Sun, E. Mizutani, PHI Learning Private Limited. 4. Principles of Soft Computing , S. N. Sivanandam, S. N. Deepa, John Wiley & Sons, 2007
Reference Books
1. Introduction to the theory of neural computation, John Hertz, Anders Krogh, Richard Palmer, Addison –Wesley Publishing Company, 1991

2. Neural NetworksA comprehensive foundation,, Simon Haykin,Prentice Hall International Inc-1999
3. Neural and Adaptive Systems: Fundamentals through Simulations, José C. Principe Neil R. Euliano , W. Curt Lefebvre, John-Wiley & Sons, 2000
4. Pattern Classification, Peter E. Hart, David G. Stork Richard O.Duda,Second Edition,2000
5. Pattern Recognition, SergiosTheodoridis , KonstantinosKoutroumbas, Fourth Edition, Academic Press, 2008
6. A First Course in Fuzzy Logic, Third Edition, Hung T. Nguyen, Elbert A. Walker, Taylor & Francis Group, LLC, 2008
7. Introduction to Fuzzy Logic using MATLAB, S. N. Sivanandam , S.Sumathi, S. N. Deepa, Springer Verlag, 2007

Practical Sessions: (Use MATLAB / OCTAVE/ SCILAB /any appropriate open source software.)(any 8 experiments)

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 fuzzy membership functions (triangular, trapezoidal, gbell, PI, Gamma, Gaussian)
7. Implement defuzzyfication (Max-membership principle, Centroid method, Weighted average method)
8. Implement FIS with Mamdani inferencing mechanism
9. A small project: may include classification or regression problem, using any soft computing technique studied earlier

Biomedical Signal Processing(404192)

Teaching Scheme: Lectures:3Hrs/ Week		**Examination Scheme:** In Semester Assessment: Phase I : 30 End Semester Examination: Phase II: 70

Course Objectives:

1. To understand the basic signals in the field of biomedical.
2. To study origins and characteristics of some of the most commonly used biomedical signals, including ECG, EEG, evoked potentials, and EMG.
3. To understand Sources and characteristics of noise and artifacts in bio signals.
4. To understand use of bio signals in diagnosis, patient monitoring and physiological investigation
5. To explore research domain in biomedical signal processing.
6. To explore application of established engineering methods to complex biomedical signals problems.

Course Outcomes:

Aftersuccessfully completing the course students will be able to:

- The student will be able to model a biomedical system.
- The student will be able to understand various methods of acquiring bio signals.
- The student will be able to understand various sources of bio signal distortions and its remedial techniques.
- The students will be able to analyze ECG and EEG signal with characteristic feature points.
- The student will have a basic understanding of diagnosing bio-signals and classifying them.

Unit I : Biomedical Signals 6L

Bioelectric Signals and Electrodes: Bio-potentials and their origin: ECG, EEG, EMG, ENG, ERG, EOG, MEG. Biomedical Instrumentation System, biomedical transducers, electrodes and their characteristics. Origin of bio potentials. Sources and contamination of Noise in bio signals.Motion artifacts and skin Impedance. Classification of biomedical signals.

Unit II: Cardio Vascular and Nervous System 6L

Cardio Vascular System: Cardiovascular system, Coronary and Peripheral Circulation, Electrical

Activity of the heart, Lead configurations , ECG data acquisition, ECG recorder, Concept of Blood Pressure Measurement, Cardiac output, Heart Sounds. Nervous System: Nervous System, Structure and functions of Neurons, Electrical activity of nerve cell, Synapse, Reflex action and Receptors.
Unit III:Analysis of Electrical Activity of Heart 6L
ECG signal parameters & their estimation - Use of multiscale analysis for ECG parameters estimation, Noise & Artifacts, ECG Signal Processing: Baseline Wandering, Power line interference, Muscle noise filtering – QRS detection, Highlight the Feature points of ECG and its classification for Normal and Abnormal state using Multilayer Perceptron.
Unit IV: Analysis of Electrical Activity of Brain 6L
Electroencephalogram – Structure of brain, EEG signal acquisition,10-20 electrode placement, EEG rhythms & waveform - categorization of EEG activity - recording techniques - EEG applications- Epilepsy, sleep disorders, brain computer interface. Use of Fourier Transform in EEG Signal Analysis.
Unit V: Analog Signal Processing 6L
Basics of Instrumentation Amplifier, Isolation amplifier, Grounding and shielding techniques. Integer Filters: Basic design Concept, Low Pass and High Pass Filters, Band Pass, Band Stop and Band Reject Filters. Its application in Biomedical field. 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.
Unit VI: Digital signal Processing 6L
Characteristics, frequency domain representation; Stationary and non-stationary bio-signals, waveform detection, Sampling Theory, Finite data considerations (Edge effects), Z Transform, FIR and IIR filters specific to event detection of ECG.Computation of diagnostic signal parameters of ECG like Heart rate and QRS detection using Multivariate analysis like PCA and ICA.
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. John L Semmlow, “Bio-signal and Biomedical Image Processing”, Marcel Dekker.
References Books

1. R.S.Khandpur, “Handbook of Biomedical Instrumentation”, Tata McGraw Hill, New Delhi, 2003, Edition-II.
2. Joseph J. Carr and John M. Brown, “Introduction to Biomedical Equipment Technology”, 4th Edition, Prentice Hall, 2000.
3. Bruce, “Biomedical Signal Processing & Signal Modeling,” Wiley, 2001
4. Sörnmo, “Bioelectrical Signal Processing in Cardiac & Neurological Applications”, Elsevier.
5. C.Reddy “Biomedical Signal Processing: Principles and techniques”, Tata McGraw Hill, New Delhi, 2005.
6. Willis J Tompkins, “Biomedical Signal Processing”, ED, Prentice – Hall, 1993.

Nano Electronics and MEMS(404192)

Teaching Scheme: Lectures:3Hrs/ Week		**Examination Scheme:** In Semester Assessment: Phase I : 30 End Semester Examination: Phase II: 70

Course Objectives:

- To understand the processes in Nano electronic manufacturing.
- To understand the construction, characteristics and operation of Nano electronic devices.
- To get acquaint with MEMS technology.
- To gain the concepts of MEMS sensors and measurement methods.

Course Outcomes:

After successfully completing the course students will,

- Gain knowledge of Nano electronics material, and manufacturing of Nano devices.
- Be introduced to MEMS and its sensors and actuators.
- Understand various measuring methods and tools.

Unit I: Introduction to materials in Nano Electronics 6L

Band structures in Silicon, Historical development and basic concepts of crystal structure, defects, crystal growth and wafer fabrication, crystal planes and orientation. Modern CMOS technology, construction of MOS Field Effect Transistor, Electrical characterization: IV/CV characterization, temperature dependent characterization.

Unit II: Semiconductor Nano Electronic manufacturing 6L

Basic understanding of contaminations, Levels of contaminations, Wafer cleaning methods, Lithography: basic concepts of optics, photoresists, wager exposure systems, methods and equipment. Thermal Oxidation: formations of Si and SiO_2 interface, types of thermal oxidations and their comparisons. Dopant Diffusion and Ion implantation fundamentals, Thin film deposition, sputtering methods and types, etching process and types.

Unit III: Nano Electronic Devices 6L

Single Electron devices and Transistors, Quantum particle, Quantum Dot, Logic circuits using quantum dots, nanowires construction and applications, FinFETs, construction of FinFET, properties of FinFETs.

Unit IV: Introduction to MEMS 6L

Intrinsic characteristics of MEMS, miniaturization, Sensors and actuators, sensor noise and design complexity, packaging and integration, stress and strain, intrinsic stress, torsion deflections, types of beams and deflection of beams.

Unit V: MEMS based sensors and actuators 6L

Electrostatic sensors and Actuators, Thermal sensing and actuation, piezoresistive sensing and actuation, Magnetic actuation. Comparison of major sensing and actuation methods. Case studies of selected MEMS: Acceleration sensors, gyros etc.

Unit VI: Measurements methods and tools 6L

Electrical methods: Hot probe method, Sheet resistance, Hall effect measurements. Physical measurements: Fourier Transform Infrared Spectroscopy, Electron microscopy, Atomic Force Microscope, X-Ray photoelectron Spectroscopy, Profilometers, Reflectrometers.

Text Books

1. James D Plummer, Michael d Deal and Peter B Griffin, Silicon VLSI Technology, Fundamentals, Practice and Modeling, Pearson Education.
2. George W Hanson, Fundamentals of Nanoelectronics, Pearson education
3. Chang Liu, Foundations of MEMS, Pearson Education.

Reference Books

1. MinhangBao, Analysis and Design Principles of MEMS Devices, Elsevier
2. Byung-Gook Park, Sung Woo Hwang, Young June Park, Nanoelectronic Devices, Pan Stanford Publishing Pte. Ltd.
3. Niraj K. Jha, Deming Chen , " Nano Circuit Design", Springer.

Detection and Estimation Theory(404192)

Teaching Scheme:		**Examination Scheme:**
Lectures:3Hrs/ Week		In Semester Assessment:
		Phase I : 30
		End Semester Examination:
		Phase III: 70

Course Objectives:

- To understand concepts of statistical decision theory and parameter estimation.
- To study application of detection and estimation theory in filtering, communication and radar.

Course Outcomes:

After successfully completing the course students will be able to

- Apply suitable hypothesis testing criteria for signal detection problems.
- Use parameter estimation in signal processing and communication problems.
- Design a estimator and detector.

Unit I : Statistical Decision Theory	6L
Introduction, Bayes' Criterion-Binary Hypothesis Testing, *M*-ary Hypothesis Testing, Minimax Criterion, Neyman-Pearson Criterion, Composite Hypothesis Testing, Sequential Detection.	

Unit II : Parameter Estimation-I	6L
Introduction, Some Criteria for Good Estimators, Maximum Likelihood Estimation, Generalized Likelihood Ratio Test, Bayes' Estimation	

Unit III : Parameter Estimation-II	6L
Cramer-Rao Inequality, Multiple Parameter Estimation, Best Linear Unbiased Estimator, Least-Square Estimation, Recursive Least-Square Estimator.	

Unit IV : Filtering	6L
Introduction, Linear Transformation and Orthogonality Principle, Wiener Filters, Discrete Wiener Filters, Kalman Filter.	

Unit V : Detection and Parameter Estimation 6L

Introduction, Signal Representation, Binary Detection, M-ary Detection, Linear Estimation.

Unit VI : Detection Theory in Radar 6L

Introduction, Radar Elementary concepts- Range, Range Resolution, and Unambiguous Range, Doppler Shift, Principles of Adaptive CFAR Detection- Target Models, Review of Some CFAR Detectors.

Text Books

3. MouradBarkat, “Signal detection and Esimation”, Artec House, second edition
4. S M Kay, “Fundamentals of ststistical Signal Processing, Estimation Theory” PHI Signal Processing Series.
5. S M Kay, “Fundamentals of ststistical Signal Processing, Detection Theory” PHI Signal Processing Series.

Reference Books

8. H.Vincent Poor, “An Introduction to Signal Detection and Estimation”, Springer, Second Edition.
9. Harry L.,Van Trees, “Detection, Estimation and Modulation Theory”, John Wiley & Sons.

Wireless Networks(404192)

Teaching Scheme: Lectures: 3Hrs/ Week		**Examination Scheme:** In Semester Assessment: Phase I : 30 End Semester Examination: Phase II: 70

Course Objectives:

- To study the evolving wireless technologies and standards
- To understand the architectures of various access technologies such as 3G, 4G, WiFi etc.
- To understand various protocols and services provided by next generation netwoks.

Course Outcomes:

After successfully completing the course student will be able to

- Keep himself updated on latest wireless technologies and trends in the communication field
- Understand the transmission of voice and data through various networks.

Unit I : Introduction to Wireless Networks 7L

Introduction, Technology and service trends of Emerging Wireless technologies, The Amazing Growth of Mobile Communications, A Little History, Mobile Communications Fundamentals, Mobile Data, WiFi, Bluetooth, Cable Systems, Wireless Migration Options, Harmonization Process.

Unit II: WiFi and Next Generation WLAN 7L

WiFi (802.11), 802.11 Standards, WiFi Protocols, Frequency Allocation, Modulation and Coding Schemes, Network Architecture, Typical WiFi Configurations, Security, 802.11 Services, Hot Spots, Virtual Private Networks (VPNs), Mobile VPN, VPN Types, WiFi Integration with 3G/4G, Benefits of Convergence of WiFi and Wireless Mobile.

Unit III: Third Generation Mobile Services 6L

Introduction, Universal Mobile Telecommunications Service (UMTS), UMTS Services, The UMTS Air Interface, Overview of the 3GPP Release 1999 Network Architecture, Overview of the 3GPP Release 4 Network Architecture, Overview of the 3GPP Release 5, All-IP Network Architecture, Overview CDMA2000, TD-CDMA, TD-SCDMA, Commonality among WCDMA, CDMA2000, TD-CDMA, and TD-SCDMA

Unit IV : LTE	8L
LTE Ecosystem, Standards, Radio Spectrum, LTE Architecture, User Equipment (UE), Enhanced Node B (eNodeB), Core Network (EPC), Radio Channel Components, TD-LTE, Multiple Input Multiple Output, LTE Scheduler, Carrier Aggregation, Cell Search, Cell Reselection, Attach and Default Bearer Activation, Handover (X2, S1, Inter-MME), Self-Organizing Networks (SONs), Relay Cells, Heterogeneous Network (HetNET), Remote Radio Heads (RRH), VoLTE, LTE Advanced	
Unit V : WiMAX	6L
Introduction, Standards, Generic WiMAX Architecture, Core Network, Radio Network, WiMAX Spectrum, Modulation, Channel Structure, Mixed Mode, Interference Mitigation Techniques, Frequency Planning, Features and Applications, Security, QoS, Profiles, Origination, Handover, Femto and SON	
Unit VI : VOIP	7L
Why VoIP?, The Basics of IP Transport, VoIP Challenges, H.323, The Session Initiation Protocol (SIP), Distributed Architecture and Media Gateway Control, VoIP and SS7, VoIP Quality of Service.	
Text Books	
1. Clint Smith, P.E., Daniel Collins, "Wireless Networks: Design and Integration for LTE, EVDO, HSPA, and WiMAX", McGrawHill Education, Third Edition 2. EldadPerahia, Robert Stacey, "Next Generation Wireless LANs", Cambridge University Press, Second Edition.	
Reference Books	
1. Yi-Bang Lin, ImrichChlamtac, "Wireless and Mobile Network Architecture", Wiley India Edition. 2. DipankarRaychaudhary, Maria Gerla, "Emerging Wireless Technologies and the Future Mobile Internet", Cambridge University Press..	

Lab Practice - III (404193)

MC & BCS

Teaching Scheme: Practical: 4 Hrs/week		**Examination Scheme:** OR: 50Marks TW:50Marks

Mobile Communication

List of the Experiments(Minimum 8 experiments are to be performed).

1. Set up and carry out experiment on PSTN TST switch.
2. Set up and carry out experiment on analysis of telecommunication traffic.
3. Simulation of a wireless channel model.
4. Set up and carry out experiment on Mobile phone.
5. Set up and carry out experiment on GSM.
6. Set up and carry out experiment on AT commands.
7. Simulation of Speech coding and decoding.
8. Set up and carry out experiment on GMSK modulation.
9. Set up and carry out experiment on spreading Sequences.
10. Set up and carry out experiment on CDMA.
11. Set up and carry out experiment on3G Mobile.
12. Set up and carry out experiment on VOIP implementation
13. Visit to Mobile Telephone Switching Office (MTSO).

Broadband Communication Systems

List of the Experiments(Minimum 8 experiments are to be performed).

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 areport of visit.(Optional)

Lab Practice - IV (404194)		
Teaching Scheme: Practical: 2Hrs/week		**Examination Scheme:** PR: 50Marks TW:50Marks
Elective III		
Experiments to be chosen based on Elective III. **(Minimum 8 experiments are to be performed).**		

Project Phase-II (404195)		
Teaching Scheme: Tutorial: 6Hrs/week		**Examination Scheme:** TW:100 Marks OR: 50 Marks

1. Group Size

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 the work.

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 is preferable.

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.

Faculty of Engineering

Syllabus

B.E. (Information Technology) 2012 Course

(With effect from Academic Year 2015 - 16)

SAVITRIBAI PHULE PUNE UNIVERSITY

THE SYLLABUS IS PREPARED BY:

B.O.S. in Information Technology, Savitribai Phule Pune University

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.

2. Possess knowledge and skills in the field of Computer Science & Engineering 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 & Engineering 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 computing, mathematics including discrete mathematics as well as probability and statistics, science, and 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 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 computer science 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) 2012 Course to be implemented from June 2015

SEMESTER – I

Subject Code	Subject	Teaching Scheme			Examination Scheme					Total Marks
		Lecture	Practical	Tutorial	In-Semester Assessment Phase - I	TW	PR	OR	End Semester Examination Phase - II	
414453	Information and Cyber Security	3			30				70	100
414454	Software Modeling and Design	3			30				70	100
414455	Machine Learning	4			30				70	100
414456	Elective – I	3			30				70	100
414457	Elective – II	3			30				70	100
414458	Software Laboratory - III	--	4	--		50	--	50		100
414459	Software Laboratory - IV	--	4	--		--	50	50		100
414460	Project Phase I	--	--	2		50	--	--		50
Total		16	8	2	150	100	50	100	350	750

Software Laboratory – III: (Information and Cyber Security + Machine Learning)
Software Laboratory – IV: (Software Modeling and Design + Testing)

Elective – I	Elective – II
414456 A : Soft Computing	414457 A : Business Intelligence
414456 B : Usability Engineering	414457 B : Service Oriented Architecture
414456 C : Modern Compilers	414457 C : E&M Governance
414456 D : Parallel Algorithms and Design	414457 D : Geo Informatics Systems
414456 E : Cloud Computing	414457 E : Natural Language Processing

SEMESTER – II

Subject Code	Subject	Teaching Scheme			Examination Scheme					Total Marks
		Lecture	Practical	Tutorial	In-Semester Assessment Phase - I	TW	PR	OR	End Semester Examination Phase - II	
414461	Distributed System	3			30				70	**100**
414462	Advanced Databases	3			30				70	**100**
414463	Elective – III	3	2	--	30	25	--	25	70	**150**
414464	Elective – IV	3			30				70	**100**
414465	Software Laboratory - V	--	2	--		25	25	--		**50**
414466	Software Laboratory - VI	--	4	--		--	50	50		**100**
414467	Project Work	--	--	6		50	--	100		**150**
Total		**12**	**8**	**6**	**120**	**100**	**75**	**175**	**280**	**750**

Software Laboratory – V: (Distributed Systems)
Software Laboratory – VI: (Advanced Databases)

Elective – III	**Elective – IV**
414463 A :Mobile Computing	414464 A :Bio Informatics
414463 B :Advanced Graphics and Animation	414464 B :Real Time and Embedded Systems
414463 C :Information Storage and Retrieval	414464 C :Green IT - Principles and Practices
414463 D :IT Enabled Services	414464 D :Internet of Things
414463 E :Advanced Computer Networks	414464 E :Open Elective

SEMESTER - I

414453 : INFORMATION AND CYBER SECURITY

Teaching Scheme:	Examination Scheme:	
Lectures: 3 Hours/Week	In-Semester Assessment Phase I – 30 Marks	End-Semester Assessment Phase II – 70 Marks

Prerequisites: Data Communication and Computer Networks

Course Objectives :

1. Understand the essentials of information security.
2. Learn the algorithms for implementing security
3. To provide an understanding of principal concepts, major issues, technologies, and basic approaches in information security

Course Outcomes :

The learning outcomes are:

- Students shall be able to understand what are the common threats faced today
- What is the foundational theory behind information security
- What are the basic principles and techniques when designing a secure system
- How today's attacks and defenses work in practice
- How to assess threats for their significance and
- How to gauge the protections and limitations provided by today's technology

UNIT - I SECURITY FUNDAMENTALS **6 Hours**

Introduction, Terminology, Attacks, Security Goals : Authentication, Authorization, Cipher Techniques: Substitution and Transposition, One Time Pad, Modular Arithmetic, GCD, Euclid's Algorithms, Chinese Remainder Theorem, Discrete Logarithm, Fermat Theorem, Block Ciphers, Stream Ciphers. Secret Splitting and Sharing.

UNIT - II CRYPTOGRAPHY **6 Hours**

Symmetric Key Algorithms: DES, AES, BLOWFISH, Attacks on DES, Modes of Operations, Linear Cryptanalysis and Differential Cryptanalysis, Public Key Algorithms: RSA, Key Generation and Usage.

UNIT - III MESSAGE DIGEST AND KEY MANAGEMENT **6 Hours**

Hash Algorithms: SHA-1, MD5, Key Management: Introduction, Key Management: Generations, Distribution, Updation, Digital Certificate, Digital Signature, PKI. Diffie-Hellman Key Exchange. One Way Authentication, Mutual Authentication, Kerberos 5.0.

UNIT IV NETWORK SECURITY **6 Hours**

Layer Wise Security Concerns, IPSEC- Introduction, AH and ESP, Tunnel Mode, Transport Mode, Security Associations, SSL- Introduction, Handshake Protocol, Record Layer Protocol. IKE- Internet Key Exchange Protocol. Intrusion Detection Systems: Introduction, Anomaly Based, Signature Based, Host Based, Network Based Systems.

UNIT - V INTRODUCTION TO CYBER SECURITY **6 Hours**

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, Cyberstalking, Cloud Computing and Cybercrime

UNIT – VI   TOOLS AND METHODS USED IN CYBERCRIME   6 Hours

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.

Text Books

1. BruiceSchneier, "Applied Cryptography- Protocols, Algorithms and Source code in C", 2nd Edition, Wiely India Pvt Ltd, ISBN 978-81-265-1368-0
2. Nina Godbole, SunitBelapure, "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

Reference Books

1. Nina Godbole, " Information Systems Security", Wiley India Pvt. Ltd, ISBN -978-81-265-1692-6
2. Willaim Stallings, "Computer Security : Principles and Practices", Pearson Ed. ISBN :978-81-317-3351-6
3. Mark Merkow, " Information Security-Principles and Practices", Pearson Ed. 978-81-317-1288-7
4. CK Shyamala et el., "Cryptography and Security", Wiley India Pvt. Ltd, ISBN 978-81-265-2285-9
5. Berouz Forouzan, "Cryptography and Network Security", 2 edition, TMH, ISBN :9780070702080

414454 : SOFTWARE MODELING AND DESIGN

Teaching Scheme:
Lectures: 3 Hours/Week

Examination Scheme:
In-Semester Assessment
Phase I – 30 Marks
End-Semester Assessment
Phase II – 70 Marks

Prerequisites : Problem Solving & Object Oriented Programming, Software Engineering

Course Objectives :

1. Based on user requirements, create a requirement model using UML class notations and use-cases.
2. Create an OO design of a system from the requirements model in terms of a high-level design description, and low-level models of structural organization and dynamic behavior using relevant UML diagrams.
3. Comprehend the importance of GOF design patterns by implementing few simple design patterns.
4. Validate software implementation for its correctness and quality using appropriate testing.

Course Outcomes :

Students will be able to

1. understand the usage of various UML diagrams to build a model
2. prepare an object oriented model in business domain of an application.
3. prepare an object oriented model in solution domain.
4. apply object oriented principles in the design of software system.
5. get started on study of GOF design patterns.
6. understand different types of software testing.

UNIT – I INTRODUCTION TO MODELING AND CLASS MODEL — 6 Hours

Modeling as a design technique, abstraction, three models, object and class concepts, links and association concepts, generalization and inheritance concepts, navigations in class models, advanced object and class concepts, association ends, n-ary association, aggregation, abstract classes, multiple inheritance, metadata, reification, constraints, derived data, packages.
UML diagrams: Object, class, package diagram.

UNIT – II STATE MODELING AND INTERACTION MODEL — 6 Hours

Events, states, transitions and conditions, state diagram, state diagram behavior, nested state diagram, nested states, signal generalization, concurrency, state model case study, relation of class and state model, Use case models, sequence models, activity models, use case relationships, procedural sequence model, and special constructs for activity models
State, activity, use case, sequence diagrams.

UNIT – III SYSTEM ANALYSIS — 6 Hours

Find classes, prepare data dictionary, find associations, find attributes of objects and links, organize and simplify classes using inheritance, verification of access paths, reconsider the level of abstraction, group classes into packages, determine system boundary, find actors, find use cases, find initial and final events, prepare normal scenarios, add variation and exception scenarios, find external events, prepare activity diagram for use cases.

UNIT – IV SYSTEM DESIGN **6 Hours**

Estimate system performance, make a reuse plan, organize the system into subsystem, identify concurrency inherent in the problem, allocate subsystems to hardware, manage data stores, handle global resources, choose a software control strategy, handle boundary conditions, set trade off priorities, select an architectural style, Component and deployment diagram.

UNIT – V DESIGN PATTERNS **6 Hours**

Types of design patterns, design pattern documentation, study of GOF design patterns namely strategy, observer, state, and adaptor.

UNIT - VI SOFTWARE TESTING **6 Hours**

Testing Terminologies: Verification and validation, Fault, error, bugs and failure, test case and test suite, white box testing and black box testing. V-test model: User Acceptance testing, integration testing, unit testing, and Introduction to test driven development.

Text Books

1. Michael R Blaha, James Rumbaugh, "Object Oriented Modeling and Design with UML", Second Edition, Pearson Education System.
2. Dennis, Wixom, Tegarden, "System Analysis and design - an Object oriented approach with UML", 5th Edition, Wiley publication.
3. M G Limaye, "Software Testing Principle, Techniques and Tools", TMH.

Reference Books

1. Grady Booch, "Object oriented analysis and design with application, third edition", Pearson Education.
2. Dan Pilone, " UML 2.0 in a Nutshell", O'Reilly.
3. Grady Booch, James Rumbaugh, Ivor Jacobson, "The Unified Modeling Language User Guide", Second Edition, Addison Wesley Object Technology Series.
4. Jim Arlow, "UML 2 and the Unified Process: Practical Object Oriented Analysis and design", Second Edition, , Addison Wesley Object Technology Series.
5. Erich Gamma and others, "Design Patterns: Reusable elements of object oriented software", Pearson Education Series.
6. Hasan Gomma, Software Modeling and Design, Cambridge University Press India.

414455 : MACHINE LEARNING

Teaching Scheme:	Examination Scheme:	
Lectures: 4 Hours/Week	In-Semester Assessment Phase I – 30 Marks	End-Semester Assessment Phase II – 70 Marks

Prerequisites : Linear Algebra and Calculus, Probability Basics

Course Objectives :

1. Understanding Human learning aspects.
2. Understanding primitives in learning process by computer.
3. Understanding nature of problems solved with Machine Learning.

Course Outcomes :

1. Students will be able to model the learning primitives.
2. Students will be able to build the learning model.
3. Student will be able to tackle real world problems in the domain of Data Mining, Information Retrieval, Computer vision, Linguistics and Bioinformatics.

UNIT – I INTRODUCTION TO MACHINE LEARNING — 7 Hours

Why Machine learning, Examples of Machine Learning Problems, Structure of Learning, Learning versus Designing, Training versus Testing, Characteristics of Machine learning tasks, Predictive and descriptive tasks, Machine learning Models: Geometric Models, Logical Models, Probabilistic Models. Features: Feature types, Feature Construction and Transformation, Feature Selection.

UNIT – II CLASSIFICATION AND REGRESSION — 8 Hours

Classification: Binary Classification- Assessing Classification performance, Class probability Estimation- Assessing class probability Estimates, Multiclass Classification.

Regression: Assessing performance of Regression- Error measures, Overfitting- Catalysts for Overfitting, Case study of Polynomial Regression.

Theory of Generalization: Effective number of hypothesis, Bounding the Growth function, VC Dimensions, Regularization theory.

UNIT – III LINEAR MODELS — 7 Hours

Least Squares method, Multivariate Linear Regression, Regularized Regression, Using Least Square regression for Classification. Perceptron, Support Vector Machines, Soft Margin SVM, Obtaining probabilities from Linear classifiers, Kernel methods for non-Linearity.

UNIT – IV LOGIC BASED AND ALGEBRAIC MODELS — 6 Hours

Distance Based Models: Neighbours and Examples, Nearest Neighbours Classification, Distance based clustering-K means Algorithm, Hierarchical clustering,

Rule Based Models: Rule learning for subgroup discovery, Association rule mining.

Tree Based Models: Decision Trees, Ranking and Probability estimation Trees, Regression trees, Clustering Trees.

UNIT – V PROBABILISTIC MODELS — 6 Hours

Normal Distribution and Its Geometric Interpretations, Naïve Bayes Classifier, Discriminative learning with Maximum likelihood, Probabilistic Models with Hidden variables: Estimation-Maximization Methods, Gaussian Mixtures, and Compression based Models.

UNIT – VI TRENDS IN MACHINE LEARNING 8 Hours

Model and Symbols- Bagging and Boosting, Multitask learning, Online learning and Sequence Prediction, Data Streams and Active Learning, Deep Learning, Reinforcement Learning.

Text Books

1. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.
2. Hastie, Tibshirani, Friedman: Introduction to Statistical Machine Learning with Applications in R, Springer, 2nd Edition-2012.

Reference Books

1. C. M. Bishop : Pattern Recognition and Machine Learning, Springer 1st Edition-2013.
2. Ethem Alpaydin : Introduction to Machine Learning, PHI 2nd Edition-2013.
3. Parag Kulkarni : Reinforcement and Systematic Machine Learning for Decision Making, Wiley-IEEE Press, Edition July 2012.

414456 A - ELECTIVE I : SOFT COMPUTING

Teaching Scheme:
Lectures: 3 Hours/Week

Examination Scheme:

In-Semester Assessment	End-Semester Assessment
Phase I – 30 Marks	Phase II – 70 Marks

Prerequisites: Linear Algebra and Calculus 2. Probability Theory

Course Objectives :
1. Understanding differential behavior of Human and Intelligence Systems.
2. Understanding nature of problems solved with Soft Computing.
3. Understanding components of Soft Computing.

Course Outcomes :
1. Students will be inspired to solve complex real-world problems.
2. Students will correlate human-like processing in problem solving with current technologies in various domains like Bio Informatics, Multimedia Systems, Big Data Analytics, etc.
3. Student will be able to tackle problems of interdisciplinary nature.

UNIT – I INTRODUCTION TO INTELLIGENT SYSTEMS AND SOFT COMPUTING 5 Hours
Characteristic behavior of Intelligent systems, Knowledge based systems, Knowledge Representation and Processing, Soft Computing characteristics, Constitutes of Soft Computing-Fuzzy Logic and Computing, Neural Computing, Evolutionary Computing, Rough Sets, Probabilistic Reasoning and Machine Learning.

UNIT – II NEURO COMPUTING- SUPERVISED LEARNING 6 Hours
Biological background, Pattern recognition tasks, Features of artificial neural networks, Activation functions, Perceptron model, Perceptron for classification and its limitations, Architectures of multilayer feed-forward neural networks, Back-propagation learning algorithm, Limitations of MLP.

UNIT - III NEURO COMPUTING- UNSUPERVISED LEARNING 7Hours
Hebb's learning rule for competitive learning, Kohonen's self-organizing map and network topology, applications of SOM, Hopfield network and its topology, Boltzman Machines, Adaptive Resonance Theory.

UNIT - IV FUZZY LOGIC AND FUZZY SYSTEMS 7 Hours
Evolution of fuzzy logic, fuzzy sets, fuzzy logic operations, fuzzy relations, Fuzzy arithmetic and fuzzy measures. Fuzzy rules and reasoning, Fuzzy inference systems, Fuzzy modeling and decision making, Neuro-fuzzy modeling.

UNIT – V EVOLUTIONARY COMPUTING 6 Hours
Biological background and Overview of evolutionary computing, Genetic algorithm and search space, Operators in genetic algorithm- encoding, selection, crossover, and mutation, Classification of GA, Evolutionary Programming and Strategies.

UNIT - VI APPLICATIONS OF SOFT COMPUTING TECHNIQUES 5 Hours
Applications of fuzzy in pattern recognition-character recognition. Applications of evolutionary computing in Image processing and computer vision, Soft computing in mobile ad-hoc networks, soft computing in Information Retrieval and Semantic web, Soft Computing in Software Engineering.

Text Books

1. Fakhreddine O. Karray, Clarence De Silva, 'Soft Computing and Intelligent systems design' Pearson Education, ISBN 978-81-317-2324-1.
2. B. K. Tripathy, J. Anuradha, 'Soft Computing: advances and applications', Cengage learning, ISBN-13: 978-81-315-2619-4.

Reference Books

1. S. N. Sivanandam, S. N. Deepa, Principles of Soft Computing, Wiley publications, 2nd Edition.
2. J. S. R. Jang, C. T. Sun, E. Mizutani, 'Neuro-Fuzzy and Soft Computing- A computational approach to Learning and Machine Intelligence' PHI,
3. David E. Goldberg , Genetic Algorithms - Pearson Education, 2006
4. Satish Kumar, "Neural Networks - A Classroom Approach", Tata McGraw,Hill

414456 B - ELECTIVE I : USABILITY ENGINEERING

Teaching Scheme:
Lectures: 3 Hours/Week

Examination Scheme:

In-Semester Assessment	End-Semester Assessment
Phase I – 30 Marks	Phase II – 70 Marks

Prerequisites : Human Computer Interaction and Usability

Course Objectives :

1. To introduce the need for human-computer-interaction study or human-centered software design.
2. To explain usability engineering lifecycle for designing a user-friendly software.
3. To familiarize information, interaction and GUI design process for enhancing user-experience.
4. To develop usability evaluation skills for software testing.
5. To explain industry standards for designing and evaluating use-interfaces.
6. To make aware of the current trends in usability engineering.

Course Outcomes :

At the end of this course, student should be able to:

1. Justify the need to study human-computer-interaction or human-factors while designing software.
2. Discuss the process of designing user-friendly software based on usability engineering guidelines.
3. Apply interaction design and UI design process in enhancing user-experience of an application.
4. Conduct usability evaluation of user-interfaces or software applications.
5. Discuss industry standards for designing and evaluating user-interfaces.
6. Discuss current trends in usability engineering

UNIT – I HCI AND USABILITY — 3 Hours

What is HCI design? Disciplines contributing to HCI, Psychology of everyday things, Importance of human factors in design, Need Satisfaction curve of technology, Levels of human computer interaction
What is Usability? benefits and cost savings, usability slogans, attributes of system acceptability, definition of usability, usability trade-Offs , categories of users and individual user differences, generations of user interfaces, scenario-based usability engineering case study - A Virtual Science Fair.

UNIT – II THE USABILITY ENGINEERING LIFECYCLE — 9 Hours

User research and requirements analysis → know the user, user-profile questionnaire, field-study methods, contextual inquiry and analysis, hierarchical task analysis, ethnography, cultural probe, affinity diagramming, persona, scenarios of use, use cases.
Iterative Design → setting usability criteria or goals, participatory design (getting users involved), guidelines and heuristic evaluation, prototyping and scenarios , examples of problem scenarios, iterative design, interface evaluation, meta methods.
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 – III INFORMATION DESIGN AND INTERACTION DESIGN — 6 Hours

Information design → Information architecture concepts, stages of action in human-computer interaction, perceiving information, interpreting information, making sense of information.
Interaction Design → selecting system goal, planning action sequence, executing action sequence, case

study of information and interaction design
User Interface Design → Goals of UID, User Interface Models , conceptual model and mock-ups of GUI, choosing prototyping alternatives - paper prototyping, rapid prototyping, storyboarding, wireframes, Cost/benefit of good interface design , Case Study.

UNIT – IV USABILITY EVALUATION **10 Hours**

Developing usability specifications for evaluation - case study, criteria for user feedback techniques, formative and summative techniques of evaluation
Usability Inspections (testing without users) → heuristic evaluation, user-interface guideline reviews, cognitive walkthrough, model-based analysis
Usability Testing (testing with users) → developing usability or test specifications with case study , 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 testing, usability laboratories, remote evaluation,
Methods beyond testing → observation, user satisfaction questionnaire (rating scale), interviews, system usability scale (SUS), focus groups, logging actual use, user feedback, choosing a methods.

UNIT – V USER-INTERFACE AND USABILITY STANDARDS **5 Hours**

User benefits, vendor benefits, dangers of standards, principles of good UI design, national-international standards, internationalization - international GUI, guidelines for internationalization , localization and multilocale interfaces, UI standards - control standards, window standards, dialog box standards, message box standards, device interaction standards, feedback standards, developing style guides and toolkits , user documentation- manuals, tutorials, information in the interface.

UNIT – VI RECENT ADVANCES AND TRENDS **3 Hours**

Theoretical solutions, technological solutions, CAUSE tools, emerging paradigms of user interaction-collaborative systems, ubiquitous computing , intelligent user-interfaces , simulation and virtual reality , case study , usability issues in organizations- case studies , organizational roles and structures , ethics of usability, web analytics.

Text Books

1. Nielsen, J. (1994), “Usability Engineering”, Elsevier.
2. Rosson, M. B., & Carroll, J. M. (2001), “ Usability Engineering: Scenario-Based development of human-computer interaction”, Elsevier.
3. Mayhew, D. (1999), “The Usability Engineering Lifecycle: A Practitioner's Handbook for user interface design”, Morgan Kaufmann

Reference Books

1. Cooper A. et. al. (2007), “ The Essentials of Interaction Design”, Wiley
2. Cooper, A. (1995),” The Essentials of User Interface Design”, IDG Books, New Delhi
3. Schneiderman, B. (2005), “ Designing the User Interface”, Pearson Education, New Delhi
4. Dix A. et. al.(1993), “ Human - Computer Interaction”, Prentice Hall, USA
5. Mandel, T. , “ Elements of User Interface Design”, John Wiley & Sons
6. Rogers et. al (2011), “ Interaction Design”, John Wiley & Sons
7. Norman, D. (1988), “The Design of Everyday Things”, Basic Books.
8. Donna Spencer<, “A Practical Guide to Information Architecture”
9. Galitz, W. (2002), “The Essential Guide To User Interface Design”, Wiley.

Web-links

1. http://www.usabilitybok.org/
2. http://www.usability.gov/
3. http://www.webmonkey.com/2010/02/information_architecture_tutorial/
4. http://www.measuringu.com/
5. http://user.medunigraz.at/andreas.holzinger/holzinger%20de/usability%20holzinger.html

414456 C - ELECTIVE I : MODERN COMPILERS

Teaching Scheme:
Lectures: 3 Hours/Week

Examination Scheme:

In-Semester Assessment	End-Semester Assessment
Phase I – 30 Marks	Phase II – 70 Marks

Prerequisites: Compiler Construction, System Programming

Course Objectives :

1. To develop an awareness of the function and complexity of modern compilers.
2. To introduce the major concept areas of language translation and compiler design
3. To give students hands-on experience with crafting a simple compiler, working on a sizeable software engineering project, using modern software tools, and most importantly correlating theory.

Course Outcomes :

1. Understand the performance characteristics of modern processors
2. Be familiar with compiler architecture and implementation.
3. Be familiar with register allocation.
4. Be exposed to compiler optimization.

UNIT – I FUNDAMENTALS OF COMPILATION — 6 Hours

Introduction: Modules and Interfaces, Tools and Software, Data Structure for Tree Language, Activation Record: Stack frames, Frames in the Tiger Compiler, Translation to Intermediate Code: Intermediate representation of trees, Translation into trees, Declaration

UNIT - II BASIC BLOCKS OF TRACES — 6 Hours

Canonical Trees, Taming Conditional branches, Instruction Selection: Algorithm for Instructional Selection, CISC Machine, Instruction selection for Tiger Compiler, Liveness Analysis: solution of dataflow equations, Liveness in Tiger compiler

UNIT - III REGISTER ALLOCATION & GARBAGE COLLECTION — 6 Hours

Coloring by simplification, Coalescing, precolored nodes, Graph Coloring implementation, Register allocation for trees, Garbage Collection: Mark and Sweep Collection, Reference Count, Copying Collection, Generational Collection, Incremental Collection, Baker's Algorithm, Interface to the compiler

UNIT - IV FUNCTIONAL PROGRAMMING LANGUAGES — 6 Hours

Canonical Trees, Taming Conditional branches, Instruction Selection: Algorithm for Instructional Selection, CISC Machine, Instruction selection for Tiger Compiler, Liveness Analysis: solution of dataflow equations, Liveness in Tiger compiler

UNIT - V INTER-PROCEDURAL ANALYSIS AND OPTIMIZATION — 6 Hours

Inter-procedural Control flow analysis: The Call Graph, Inter-procedural Dataflow analysis, Inter-procedural Constant Propagation, Inter-procedural Alias Analysis, Inter-procedural optimization, Register allocation, Aggregation and Global References, Other issues in inter-procedural program management Optimizing for memory Hierarchy: Impact on Data of Instruction Cache, Instruction Cache optimization

UNIT - VI POLYMORPHIC TYPE & DATAFLOW ANALYSIS 6 Hours

Parametric Polymorphism, Type Inference, representation of polymorphic variables, Resolution of static overloading, Intermediate representation of flow analysis , various dataflow analysis, speeding up dataflow analysis, Alias Analysis, Introduction to cloud, Hybrid compiler, cloud based hybrid compiler, architecture of hybrid compiler.

Text Books

1. Advanced Compiler Design Implementation By Steven S. Muchnick ISBN1-55860-320-4 Morgan Kaoufmann Publisher

Reference Books

1. Modern Compiler Implementation in C By Andrew W. Appel, Maia Ginsburg ISBN 0-521-58390
2. Starting Out With Modern Compiler Design (W/Cd) By David Gaddis, Scott Jone
3. Modern Compiler Design By Galles Person Publication, ISBN 978-317-0941-2
4. Compilers: Principles, Techniques and Tools by A. V. Aho, R. Sethi, J. D. Ullman. Addison-Wesley, 1986.
5. Web-based C++ Compiler Aleksander Malinowski, Bogdan M.Wilamowski Bradley University, Peoria, IL / University of Wyoming,Laramie, WY.
6. Shuai Zhang Shufen Zhang Xuebin Chen XiuzhenHuo, Cloud Computing Research and Development Trend, Future Networks, 2010. ICFN '10. Second International Conference.

414456 D - ELECTIVE I : PARALLEL ALGORITHMS AND DESIGN

Teaching Scheme:	Examination Scheme:	
Lectures: 3 Hours/Week	In-Semester Assessment Phase I – 30 Marks	End-Semester Assessment Phase II – 70 Marks

Prerequisites : Discrete Structures,Design and Analysis of Algorithms

Course Objectives :

1. To study the parallel architecture of the processor.
2. To study various parallel algorithmic strategies and their comparison with traditional algorithmic strategies.
3. To study the analysis of parallel algorithms in terms of time and space complexity.
4. To classify the parallel algorithm in complexity class.
5. To understand the recent applications of Parallel algorithms.

Course Outcomes :

At the end of this course, students will be able to:

1. Explain key concepts in parallel computational models.
2. Describe parallel algorithms, architectures and applications.
3. Implement different parallel algorithms, techniques and architectures.
4. Explain graph algorithms.
5. Understand dynamic programming strategy and its applications.

UNIT – I INTRODUCTION — 8 Hours

Introduction and motivation: key concepts, performance metrics, scalability and overheads.
Sequential model, need of alternative model, parallel computational models such as PRAM, LMCC, Hypercube, Cube Connected Cycle, Butterfly, Perfect Shuffle Computers, Tree model, Pyramid model, Fully Connected model, PRAM-CREW, EREW models, simulation of one model from another one.

UNIT - II CLASSIFICATION OF ALGORITHMS — 8 Hours

Classification of algorithms, architectures and applications: searching, divide and conquer, data parallel. Static and dynamic, message passing and shared memory, systolic
Performance Measures of Parallel Algorithms, speed-up and efficiency of PA, Cost-optimality, an example of illustrate Cost-optimal algorithms- such as summation, Min/Max on various models.

UNIT - III PARALLEL SORTING NETWORKS — 8 Hours

Parallel Sorting Networks, Parallel Merging Algorithms on CREW/EREW/MCC/, Parallel Sorting Networks on CREW/EREW/MCC/, linear array Sorting and searching algorithms: merge sort, quicksort and bitonic sort, implementation on different architectures. Parallel depth-first and breadth-first search techniques.

UNIT - IV PARALLEL SEARCHING ALGORITHM — 6 Hours

Parallel Searching Algorithm, Kth element, Kth element in X+Y on PRAM, Parallel
Matrix Transportation and Multiplication Algorithm on PRAM, MCC, Vector-Matrix
Multiplication, Solution of Linear Equation, Root finding.
Matrix algorithms: striping and partitioning, matrix multiplication, linear equations, eigenvalues, dense and sparse techniques, finite element and conjugate gradient methods.

UNIT - V GRAPH ALGORITHMS **6 Hours**

Graph Algorithms - Connected Graphs, search and traversal, Combinatorial Algorithms- Permutation, Combinations, Derangements.

Optimization: graph problems, shortest path and spanning tree

UNIT - VI DYNAMIC PROGRAMMING **6 Hours**

Dynamic programming, knapsack problems, scheduling. Element methods.

Synthesis of parallel algorithms: algebraic methods, pipelines, homomorphism.

Text Books

1. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar "Introduction to Parallel Computing", Second Edition, Addison Wesley, 2003. ISBN: 0-201-64865.
2. M.J. Quinn, "Designing Efficient Algorithms for Parallel Computer" by Mc Graw Hill.
3. S.G.Akl, "The Design and Analysis of Parallel Algorithms", PHI, 1989.

Reference Books

1. S.G. Akl, "Parallel Sorting Algorithm" by Academic Press
2. F.T.Leighton, "Introduction to Parallel Algorithms and Architectures: Arrays, Trees, Hypercubes", MK Publishers, San Mateo California, 1992.
3. Wilkinson, M.Allen,"Parallel Programming Techniques and Applications using networked workstations and parallel computers", Prentice Hall, 1999.
4. Michael J. Quinn, "Parallel Computer Theory and Practice", McGraw Hill, Second Edition, 1994.

414456 E - ELECTIVE I : CLOUD COMPUTING

Teaching Scheme:
Lectures: 3 Hours/Week

Examination Scheme:
In-Semester Assessment
Phase I – 30 Marks
End-Semester Assessment
Phase II – 70 Marks

Prerequisites : Operating System, Computer Networks, Web Technologies

Course Objectives :
1. To know the emerging trends in Cloud Computing.
2. To have thorough knowledge of Virtualization Technologies and Cloud architecture.
3. To integrate security in cloud applications.
4. To have systematic knowledge of Ubiquitous Computing.

Course Outcomes :
1. Understand and Familiar with the basic concepts of cloud computing.
2. Understand how to build large scale distributed systems and cloud applications.
3. Comprehend the importance of cloud security.
4. Understand Ubiquitous Computing and applications.

UNIT – I INTRODUCTION TO CLOUD COMPUTING — 6 Hours
Defining Cloud computing, Essential characteristics of Cloud computing, Cloud deployment model, Cloud service models, Multitenancy, Cloud cube model, Cloud economics and benefits, Cloud types and service scalability over the cloud, challenges in cloud NIST guidelines.

UNIT - II VIRTUALIZATION, SERVER, STORAGE AND NETWORKING — 6 Hours
Virtualization concepts, types, Server virtualization, Storage virtualization, Storage services, Network virtualization, Service virtualization, Virtualization management, Virtualization technologies and architectures, Internals of virtual machine, Measurement andprofiling of virtualized applications. Hypervisors: KVM, Xen, HyperV Different hypervisors and features.

UNIT - III MONITORING AND MANAGEMENT — 6 Hours
An architecture for federated cloud computing, SLA management in cloud computing: Service provider's perspective, performance prediction for HPC on Clouds, Monitoring Tools.

UNIT - IV SECURITY — 6 Hours
Cloud Security risks, Security, Privacy, Trust, Operating system security, Security of virtualization, Security risks posed by shared images, Security risk posed by a management OS, Trusted virtual machine monitor.

UNIT - V CLOUD IMPLEMENTATION AND APPLICATIONS — 6 Hours
Cloud Platforms: Amazon EC2 and S3, Cloudstack, Intercloud, Google App Engine, Open Source cloud Eucalyptus, Open stack, Open Nebulla, etc., Applications.

UNIT - VI UBIQUITOUS COMPUTING — 6 Hours
Basics and Vision, Applications and Requirements, Smart Devices and Services, Human Computer Interaction, Tagging, Sensing and controlling, Context-Aware Systems, Ubiquitous Communication, Management of Smart Devices, Ubiquitous System Challenge and outlook.

Text Books

1. Barrie Sosinsky, " Cloud Computing Bible", Wiley
2. Gautham Shroff, "Enterprise Cloud Computing", Cambridge.
3. Stefan Poslad, "Ubiquitous Computing: Smart Devices, Environments and Interactions" by John Wiley & Sons, 2011.
4. A.Shrinivasan, J.Suresh, "Cloud Computing: A practical approach for learning and implementation", Pearson.

Reference Books

1. Rajkumar Buyya, J.Broberg, A. Goscinski, "Cloud Computing Principles and Paradigms", Wiley.
2. Ronald Krutz,"Cloud Security: Comprehensive guide to Secure Cloud Computing", Wiley Publishing.
3. Anthony T. Velte, "Cloud Computing: Practical Approach", McGraw Hill.
4. Tim Mather, "Cloud Security and Privacy", O'REILLY.

414457 A - ELECTIVE II : BUSINESS INTELLIGENCE

Teaching Scheme:	**Examination Scheme:**	
Lectures: 3 Hours/Week	In-Semester Assessment Phase I – 30 Marks	End-Semester Assessment Phase II – 70 Marks

Prerequisites: Database Management System.

Course Objectives :
1. This course focuses on how to design and build a Business Intelligence solution.
2. Students will also learn how to design and build a data warehouse within the context of student BI projects.
3. Students can develop their own projects within collaborative teams or be assigned an existing data source to develop a project.
4. To ensure success during the implementation phase, students will plan for and gather business requirements, as well as design the data warehouse in order to develop an effective BI plan.

Course Outcomes :
1. Design and implement OLTP, OLAP and Warehouse concepts.
2. Design and develop Data Warehouse using Various Schemas & Dimensional modelling.
3. Use the ETL concepts, tools and techniques to perform Extraction, Transformation, and Loading of data.
4. Report the usable data by using various reporting concepts, techniques/tools, and use charts, tables for reporting in BI.
5. Use Analytics concepts like data mining, Exploratory and statistical techniques for predictive analysis in Business Intelligence.
6. Demonstrate application of concepts in BI.

UNIT - I IMPORTANT CONCEPTS 6 HOURS

Introduction to Data, Information, and Knowledge, Design and implementation aspect of OLTP, Introduction toBusiness Intelligence and Business Models, Design and implementation aspect of OLAP/Data Warehouse, BI Definitions & Concepts, Business Applications of BI, Role of DW in BI, BI system components, Components of Data Warehouse Architectures.

UNIT - II DIMENSIONAL MODELLING AND DW DESIGN 6 Hours

Star schema, Snow flake schema, and Fact Constellation schema, Grain of dimensional model, transactions, Recurring Snapshots, Accumulating Snapshots, Dimensions (SCD types, conformed dimensions)Clickstream Source Data (Google Analytics as a Clickstream Data Source), Facts (additive, semi-additive, non-additive), Hierarchy in dimensions, parent child relationships, Many-Many Dimensional relationship, Multi Valued Dimensions and Dimension Attributes.

UNIT - III ETL 6 Hours

Data Quality, Data profiling, Data enrichment, data duplication, ETL Architecture and what is ETL, Extraction concept and Change data capture, Transformation concept, lookups, time lag, formats, consistency, Loading concept, Initial and Incremental loading, late arriving facts, What is Staging, Data marts, Cubes, Scheduling and dependency matrix.

UNIT - IV REPORTING **6 Hours**

Metadata Layer, Presentation Layer, Data Layer, Use of different layers and overall Reporting architecture, Various report elements such as Charts, Tables, prompts Data aggregation: Table based, Materialized views, Query rewrite, OLAP, MOLAP, Dashboards, Ad-hoc reports, interactivity in analysis (drill down, drill up), Security: report level, data level (row, column),Scheduling.

UNIT - V ANALYTICS **6 Hours**

Analytics concepts and use in Business Intelligence, Exploratory and statistical techniques:- Cluster analysis, Data visualization, Predictive analysis :- Regression, Time series, Data Mining :- Hierarchical clustering, Decision tree Text analytics :- Text mining, In-Memory Analytics and In-DB Analytics, Case study: Google Analytics

UNIT - VI RECENT TRENDS **6 Hours**

Big data like HIVE, PIG and DW appliances like Netezza, Teradata, Smart Change data capture using log based techniques, Real time BI, Operational BI, Embedded BI, Agile BI, BI on cloud, BI applications (Case study on BI tools like: QlikView, Pentaho, Tableau, MyReport, Spotfire, OR any other BI tool).

Text Books

1. Reema Thareja, “Data Warehouse”, Publisher: Oxford University Press.
2. Jiawei Han, Micheline Kamber, Jian Pei “Data Mining: concepts and techniques”, 2nd Edition, Publisher: Elsevier/Morgan Kaufmann.
3. Ralph Kimball, Margy Ross, “The Data Warehouse Toolkit”, 3rd edition, Publisher: Wiley

Reference Books

1. William Inmon, “Building the Data Warehouse”, Wiley publication 4th edition.
2. Efrem G. Mallach, “**Decision Support And Data Warehouse Systems**”, 1st Edition Publisher: Tata McGraw-Hill Education,. ISBN-10: 0072899816.
3. Efraim Turban, Ramesh Sharda, Dursun Delen, David King, “**Business Intelligence**”, ISBN-10: 013610066X Publisher: Prentice Hall.ISBN-13: 9780136100669.
4. Dorian Pyle, “Business Modeling and Data Mining”, Elsevier Publication MK.

414457 B - ELECTIVE II : SERVICE ORIENTED ARCHITECTURE

Teaching Scheme:	**Examination Scheme:**	
Lectures: 3 Hours/Week	In-Semester Assessment Phase I – 30 Marks	End-Semester Assessment Phase II – 70 Marks

Prerequisites: Web Engineering and Technology.

Course Objectives :

1. Understand the concepts of Service Oriented Architecture along with the evolution of SOA.
2. Be aware of the key issues facing many organizations, especially dealing with integration among systems and providing architectural abstractions to them.
3. Integrate SOA technologies with Web Services paradigms.
4. Know related technologies and implementation basics of SOA.

Course Outcomes :

1. Students will be able to know the importance of SOA.
2. Students will be able to know SOA primitives.
3. Students will be able to analyze quality web services.
4. Students will be able to design and develop web services.

UNIT - I INTRODUCTION TO SOA — 6 Hours

Fundamental SOA- Common Misperceptions about SOA- Common tangible benefits of SOA- Common pitfalls of adopting SOA. The Evolution of SOA:-from XML to Web services to SOA, Comparing SOA with N-tier architecture, The continuing evolution of SOA, The roots of SOA.

UNIT - II WEB SERVICES AND PRIMITIVE — 6 Hours

Web Services and Primitive SOA: The Web services framework- Services, Service descriptions, messaging with SOAP.

Web Services and Contemporary SOA: Message exchange patterns- Service activity coordination- Atomic transactions- Business activities-Orchestration-Choreography.

UNIT - III SERVICE ORIENTATION AND SECURITY — 6 Hours

Web Services and Contemporary SOA: Addressing- Reliable messaging- Correlation- Policies Metadata exchange- Security- Notification and eventing. SOA and Service-Orientation: Principles of Service-Orientation-Service-orientation. Anatomy of a service-oriented architecture- Common principle of service-orientation-Service Layers –Service orientation.

UNIT - IV BUILDING SOA — 6 Hours

SOA Delivery Strategies- SOA delivery lifecycle phases. Service-Oriented Analysis: Introduction to service-oriented analysis- Benefits of a business-centric SOA Deriving business services- Service-Oriented Analysis: Service modeling, Service modeling guidelines- Classifying service model logic-Contrasting service modeling approaches.

UNIT - V SERVICE-ORIENTED DESIGN — 6 Hours

Introduction to service-oriented design- WSDL-related XML Schema language basics- WSDL language basics- SOAP language basics- Service interface, design tools. SOA Composition Guidelines: Steps to composing SOA Considerations for choosing service layers and SOA standards, positioning of cores and SOA extensions.

UNIT - VI RECENT TRENDS IN SOA 6 Hours

Overview-Service design of business service, application service, task centric service and guidelines. SOA Business Process Design: WS-BPEL language basics WS Coordination,QoS Compliance in SOA governance, Mapping of SOA and Cloud Computing, Case Study: Travel Insurance.

Text Books

1. Thomas Erl ," Service-Oriented Architecture: Concepts, Technology & Design", Pearson Education Pte Ltd 2008
2. Michael Rosen, Boris Lublin sky, Kevin T. Smith, Marc J. Balcer, "Applied SOA: Service Oriented Architecture and Design Strategies", Wiley, 2010.

Reference Books

1. Thomas Erl,"SOA Principles of Service Design"Pearson Exclusives 2007.
2. Tomas Erl and Grady Booch,"SOA Design Patterns"Prentice Hall 2008.111.
3. David S.Linthicum,"Cloud Computing and SOA Convergence in Your Enterprise",Pearson Addison-Wesley Information Technology Series.
4. Shankar Kambhampaty, "Service Oriented Architecture – for enterprise and cloud applications",Wiley Second Edition.
5. Douglas K. Barry, "Web Services, Service-Oriented Architectures, and Cloud Computing", Elsevier, 2003.
6. James Bean, "SOA and Web Services Interface Design: Principles, Techniques and Standards", Elsevier, 2010.

414457 C - ELECTIVE II : E & M GOVERNANCE

Teaching Scheme:	Examination Scheme:	
Lectures: 3 Hours/Week	In-Semester Assessment Phase I – 30 Marks	End-Semester Assessment Phase II – 70 Marks

Prerequisites : Information Technology Project Management

Course Objectives :

1. To understand What E-Commerce and M-Commerce is.
2. To study application of E-Commerce and M-Commerce.
3. To learn business models and governance structures in E & M Governance.
4. To study the effects of Information Technology on E & M Governance.
5. To learn mobile commerce technologies and to apply the same on E-Markets.

Course Outcomes :

At the end of this course, students will be able to:

1. Explain what E & M Governance is.
2. Understand the consequences of E-Commerce and M-Commerce.
3. Describe E-Procurements and E-Business Networks.
4. Define E-Commerce and M-Commerce services for consumers and businesses.
5. Understand E & M Governance standards and service development technology in M-Commerce.

UNIT - I INTRODUCTION TO E-BUSINESS — 6 Hours

e-Business: e-Business vs e-Commerce, Some critical factors, Characteristics of e-Business, Elements of an e-Business solution, e-Business roles and their challenges, e-Business requirements, Impacts of e-Business, Inhibitors of e-Business,

e-Business Strategy: Strategic positioning, Levels of e-Business strategy, The changing competitive agenda: business and technology drivers, The strategic planning process, Strategic alignment

The consequences of e-Business: theoretical foundations, Success factors for implementation of e-Business strategies

UNIT - II BUSINESS MODELS AND E-BUSINESS RELATIONSHIPS — 6 Hours

Pressures forcing business changes, Business models – definitions, Classifications of business models, Towards networked business models.

Modeling interdependent business activities: the value chain, Business processes and their management

Types and characteristics of e-Business relationships, Electronic links and the value chain.

UNIT - III GOVERNANCE STRUCTURES — 6 Hours

Markets versus hierarchies: theoretical contributions, The transaction cost perspective, Networks, A supply chain perspective: value-adding partnerships.

The effects of information technology on governance: e-Business Technological Infrastructure

Technical e-Business challenges, Basic infrastructure: client/server technology, Web technologies and applications, Collaborative technologies, The role of Enterprise Information Systems in e-Business

UNIT - IV E-MARKETS and E-PROCUREMENT 6 Hours

Electronic markets defined, The functions of electronic markets, electronic markets versus traditional markets? Effects of electronic markets, Electronic market success factors, e-Market technology solutions

E-procurement: The purchasing process, Developments in purchasing, IT and purchasing, e-Procurement.

E-Business Networks: Network organizations, Inter organizational information systems and network organizations, Supply chains and Integrated supply chains.

UNIT - V MOBILE COMMERCE OPPORTUNITIES 6 Hours

Mobile and Personal: The Emerging Mobile Lifestyle, Network Effects, Market Drivers, Beyond E-commerce.

Types of Mobile Commerce Services : Base Services Platform, Mobile Commerce Services for Consumers, Mobile Commerce Services for Businesses,

UNIT - VI MOBILE COMMERCE TECHNOLOGIES 6 Hours

Network Technologies, Mobile Devices, Service Development Technology, Mobile Commerce-Enabling Standards, Live Issues

Text Books

1. Michael P. Papazoglou, Pieter Ribbers, “e-Business: Organizational and Technical Foundations”, ISBN: 978-81-265-0796-2, Publisher: Wiley
2. Paul May , “Mobile Commerce: Opportunities, Applications, and Technologies of Wireless Business” ISBN: 978-0-521-79756-6, Cambridge University Press

Reference Books

1. Henry Chan, Raymond Lee, Tharam Dillon, Elizabeth Chang, E-Commerce: Fundamentals and Applications, ISBN: 978-0-471-49303-7, Publisher: Wiley
2. David Whiteley, E-Commerce: Strategy, Technologies and Applications, Tata McGraw Hill
3. Ravi Kalakota, Andrew Whinston, “ Frontiers of Electronic Commerce”, Addison Wesley Denial Amor “ The E Business revolution”, Addison Wesley
4. Sokol, “From EDI to Electronic Commerce: A Business Initiative”, TMH
5. Bajaj Nag, “E Commerce : The Cutting Edge of Business”, TMH
6. Bharat Bhasker, “Electronic Commerce Framework, Technologies and Applications”, ISBN-13: 978-1-25-902634-3, McGraw Hill Education.

414457 D - ELECTIVE II : GEO-INFORMATICS SYSTEMS

Teaching Scheme:	Examination Scheme:	
Lectures: 3 Hours/Week	In-Semester Assessment Phase I – 30 Marks	End-Semester Assessment Phase II – 70 Marks

Prerequisites: Database Management System, Computer Graphics.

Course Objectives :

1. To understand geographical Information system and its applications.
2. To understand sensing mechanism of different satellites.

Course Outcomes :

1. Students will understand basics of Remote Sensing & GIS.
2. Students will able to analyze GIS data and GIS applications.

UNIT – I INTRODUCTION TO GEO-INFORMATICS AND GIS — 6 Hours

Geo-Informatics: Introduction, Components of Geo-Informatics, Development and applications of remote sensing technology.

GIS: Definition, evolution, components, approaches, Geospatial data, GIS operations.

GIS architecture, models of GIS, framework for GIS, GIS categories, level / scales of measurement. types of map, spatial referencing system, map projections, grid systems, computer in map production.

UNIT – II FOUNDATIONS OF REMOTE SENSING — 6 Hours

Basic Principles of remote sensing, Electromagnetic remote sensing process, Microwave Remote Sensing: The radar Principle, factors affecting microwave measurements, radar wavebands, Side-Looking Airborne Radar (SLAR) Systems, Synthetic Aperture Radar (SAR), Interpreting SAR images, geometrical Remote Sensing platform and Sensors: Satellite system parameters, sensor parameters, imaging sensor systems, Earth resources satellite series. linkage of GIS to remote sensing

UNIT – III DIGITAL IMAGE PROCESSING FUNDAMENTALS — 6 Hours

Visual Image Interpretation: Types of pictorial data products, image interpretation strategy, image interpretation process, basic elements of image interpretation.

Basic character of digital images, preprocessing, registration, enhancement, spatial filtering, transformations, classification,

UNIT – IV SPATIAL DATA MANAGEMENT — 6 Hours

Existing GIS data, Metadata, conversion of existing data, creating new data, geometric transformations, Describing data quality and errors, Sources of errors in GIS, Finding and modeling errors in GIS, Managing GIS error, types of errors- RMS error, location error, topological error, spatial data accuracy. Attribute data in GIS, Spatial data processing.

UNIT – V DATA MODELING AND ANALYSIS — 6 Hours

Data Exploration, types of data queries, Vector data analysis- buffering, overlay, distance measurement, pattern analysis, Raster Data analysis- different types of operations, comparison of vector and raster based data analysis. Basic elements of GIS modeling- Binary models, Index models, Process models.

UNIT – VI APPLICATIONS AND DEVELOPMENT **6 Hours**

Urban and Municipal Applications- introduction and methodology.

GIS implementation and Project Management – Software Engineering. as applied to GIS, GIS project planning, System Analysis and user requirements studies, geospatial database design methodology Intelligent Transport Systems (ITS) -Components of ITS, Architecture and integration with GIS, Analysis and visualizations of traffic data in GIS, Integration of GPS and GIS.

Open source GIS.

Text Books

1. M. AnjiReddi, "Remote Sensing and Geographical Information Systems", B. S. Publications, Third Edition, 2006, Second reprint 2009
2. Kang-tsung Chang, "Introduction to Geographical Information Systems", Tata McGraw Hill, Fourth Edition, 2008

Reference Books

1. C.P.Lo, Albert K. W. Yeung, "Concept and techniques of Geographic Information Systems", PHI, Second Edition, 2007.
2. Lillesand, T. and Keifer R, ,1999: Remote sensing and Image Interpretation, Wiley, London
3. Peter A. Burrough, Rachael A. McDonnell" Principles of Geographical Information Systems", Oxford University Press.

414457 E - ELECTIVE II : NATURAL LANGUAGE PROCESSING

Teaching Scheme:	Examination Scheme:	
Lectures: 3 Hours/Week	In-Semester Assessment Phase I – 30 Marks	End-Semester Assessment Phase II – 70 Marks

Prerequisites : Basic understanding of probability theory, Theory of Computer Science, Systems Software

Course Objectives :

1. Understand the core concepts of Natural language processing and levels of language analysis.
2. Learning state of art NLP research areas such as parsing algorithms, ambiguity resolution and machine translation.

Course Outcomes :

1. Automatic processing and information extraction of human language using computer.
2. Learn applications of Natural Language Processing such as Information extraction, semantic web search, machine translation, text summarization, spam detection.

UNIT - I INTRODUCTION TO NATURAL LANGUAGE UNDERSTANDING — 6 Hours

The Study of Language Applications of Natural LanguageUnderstanding Evaluating Language Understanding Systems The Different Levels of Language Analysis, Representations and Understanding The Organization of Natural Language Understanding Systems.

UNIT - II LINGUISTIC BACKGROUND: GRAMMARS AND PARSING — 6 Hours

An Outline of English Syntax Words- The Elements of Simple Noun Phrases Verb Phrases and Simple Sentences Noun Phrases Revisited Adjective Phrases Adverbial Phrases, Grammars and Sentence Structure What Makes a Good Grammar A Top-Down Parser A Bottom-Up Chart Parser Top-Down Chart Parsing Finite State Models and Morphological Processing Grammars and Logic Programming Parsing tools such as Stanford Parser.

UNIT - III FEATURES AND AUGMENTED GRAMMARS — 6 Hours

Feature Systems and Augmented Grammars Some Basic Feature Systemsfor English Morphological Analysis and the Lexicon A Simple Grammar Using Features Parsing with Features, Augmented Transition Networks Definite Clause Grammars Generalized Feature Systems and Unification Grammars.

UNIT - IV TOWARD EFFICIENT PARSING — 6 Hours

Human Preferences in Parsing Encoding Uncertainty: Shift-Reduce Parsers Statistical Methods-Basic Probability Theory Estimating Probabilities Part-of-SpeechTagging Obtaining Lexical Probabilities Probabilistic Context-Free Grammars Best-First Parsing A Simple Context- Dependent Best-First Parser.

UNIT - V SEMANTIC INTERPRETATION AND AMBIGUITY RESOLUTION — 6 Hours

Semantics and Logical Form Word Senses and Ambiguity The Basic Logical Form, Language Encoding Ambiguity in Logical Form Verbs and States in Logical Form Case Relations.Representation of meaning – model theoretic representation, description logic, Lexical Resources such as WordNet, Semantic web Ontologies.

UNIT - VI APPLICATIONS AND RECENT TRENDS IN NLP — 6 Hours

Information Extraction, Question answering, Machine Translation, MT evaluation tools such as Bleu, (word error rate) WER etc. Automatic text summarization, Sentiment Speech Recognition, Semantic web search, Automatic text Clustering.

Text Books

1. James Allen, “Natural Language Understanding”, Pearson Publication, ISBN: 978-81-317-0895-8 2nd Edition
2. D. Jurafsky, J. H. Martin, “Speech and Language Processing”, Pearson Education, 2002.

Reference Books

1. Christopher D. Manning, HinrichSchutze, Foundations of Statistical Natural Language Processing, The MIT Press, Cambridge, Massachusetts, 1999.
2. Tanveer Siddiqui, US Tiwary, Natural Language Processing and Information Retrieval
3. Daniel M.Bikel, ImedZitouni, Multilingual Natural Language Processing Applications

414458 : SOFTWARE LABORATORY – III

Teaching Scheme:
Practical : 4 Hours/Week

Examination Scheme:
Term Work : 50 Marks
Oral : 50 Marks

Prerequisites: Knowledge of any Programming Language (Preferably Java).

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 :

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.

Contents

PART A : Cyber Laws and Information Security

Section A Programming

1. Write program in C++ or Java to implement RSA algorithm for key generation and cipher verification
2. Develop and program in C++ or Java based on number theory such as Chinese remainder or Extended Euclidean algorithm. (Or any other to illustrate number theory for security)
3. Write program in C++ or Java to implement Diffie Hellman key exchange algorithm.

Section B Cryptography Library (API)

1. Write a program in C++, C# or Java to implement RSA algorithm using Libraries (API).
2. Write a program in C++, C# or Java to implement SHA-1 algorithm using Libraries (API).

Section C Security Tools (Minimum one)

1. Configure and demonstrate use of IDS tool such as snort.
2. Configure and demonstrate use of vulnerability assessment tool such as NESSUS
3. Implement web security with Open SSL tool kit

Students should submit the term work in the form of a journal. Each assignment has to be well documented with problem definition, theory and code documentation. Staff in charge will assess the assignments continuously and grade or mark each assignment on completion date, declared for each assignment.

Note: Oral examination will be based on the term work submitted by the student and the associated theory of the subject.

Reference Books

1. William Stallings, "Computer Security: Principles and Practices", Pearson Ed. ISBN: 978-81-317-3351-6.
2. Mark Merkow, "Information Security-Principles and Practices", Pearson Ed. 978-81-317-1288-7.
3. CK Shyamalaet el., "Cryptography and Security", Wiley India Pvt. Ltd, ISBN 978-81-265-2285-9.
4. BerouzForouzan, "Cryptography and Network Security", 2 edition, TMH, ISBN: 9780070702080.

PART B : Machine Learning

GUIDELINES FOR STUDENTS AND TEACHERS:

Experiments should be performed with WEKA or R. Students are also encouraged to implement the experiments with **Java 1.6 and higher version (RJava Package).** Standard Data Sets available on line may be used. A few popular data sets are :

1) Olive Oil Data Set 2) Iris Data Set 3) UC Irvine ML Laboratory

#Create your own dataset from domain of your interest.

1) *Minimum five* experiments are to be performed by group of two students.
2) Assignment numbers 1, 2 and 3 are compulsory.
3) Any two assignments should be chosen from the remaining list.
4) Journal must be maintained and submitted by each student for all the four assignments.
5) Subject Teachers should encourage students to use the same DATA-SET (or subset of it as per the requirement) to perform all tasks.

REFERENCE : 1) Open source software-WEKA or R 2) JAVA 6.1 or more (for RJava Package)

Subject teachers are advised to frame proper assignment statements from the following list.

LIST OF ASSIGNMENTS:

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 or R or Rjava.

2) **Supervised Learning - Regression**
   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.**

3) **Supervised Learning - Classification**
Implement Naïve Bayes Classifier and K-Nearest Neighbor Classifier on Data set of your choice. Test and Compare for Accuracy and Precision.

4) **Unsupervised Learning**
Implement K-Means Clustering and Hierarchical clustering on proper data set of your choice. Compare their Convergence.

5) **Dimensionality Reduction**
Principal Component Analysis-Finding Principal Components, Variance and Standard Deviation calculations of principal components.

6) **Supervised Learning and Kernel Methods**
Design, Implement SVM for classification with proper data set of your choice. Comment on Design and Implementation for Linearly non separable Dataset.

Reference Books

1. Open source software-WEKA or R.
2. JAVA 6.1 or more (for RJava Package).
3. Dr. Mark Gardener, Beginning R The Statistical Programming Language, ISBN: 978-81-265-4120-1, 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.

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.

414459 : SOFTWARE LABORATORY – IV

Teaching Scheme:
Practical : 4 Hours/Week

Examination Scheme:
Practical : 50 Marks
Oral : 50 Marks

Prerequisites: Problem Solving and Object Oriented Paradigm, Software Engineering.

Course Objectives :

1. Prepare an analysis model of a system using UML 2 diagrams.
2. Implement an appropriate design pattern to solve a design problem.
3. Understand a test driven development approach for coding.
4. Understand Object Oriented Software Development life cycle activities.

Course Outcomes :

1. Students will be able to identify classes and collaboration from requirements.
2. Students will be able to prepare analysis and design model and implement.
3. Students will be able to use the test driven development approach in implementation.
4. Students will be able to experience Object Oriented Software Development life cycle activities.

Contents

The laboratory will be in form of assignments. Each assignment will have a laboratory pre work. Following are the guidelines to conduct the laboratories.

1. **Purpose: Understanding the implementation details of relationships among classes**
   Lab pre work: Prepare a class diagram from the given problem description using UML2.0 notations.
   Laboratory work: Implement the class diagram with a suitable object oriented language.
2. **Purpose: Implementation of a design model**
   Lab pre work: Prepare a design model from analysis model in the form of UML 2 class diagram.
   Laboratory work: Implement the design model with a suitable object oriented language
3. **Purpose: Implementation of a state model from the given description.**
   Lab pre work: Prepare a state model from the given problem description and draw a state diagram using UML2 notations
   Laboratory work: Implement the state model with a suitable object oriented language
4. **Purpose: Preparing an interaction model from the given details**
   Prepare a use case model, sequence model and activity model from the given description using UML 2 notations.
5. **Purpose: Implement a Strategy design pattern**
   Map the participants for the strategy design pattern from a given problem description and implement with a suitable object oriented language
6. **Purpose: Implement a State design pattern**
   Map the participants for the state design pattern from a given problem description and implement with a suitable object oriented language
7. **Purpose: Understand the concept of Test driven Development**
   Implement a design level class diagram (given as an input) with Test Driven Development approach.
8. **Objective: Understand and implement the Concept of a reusable component**
   Implement a reusable component in form of jar file (or in equivalent form for other OO languages). Use this component in a separate client implementation by importing the component as a jar file (or equivalent form for other OO language).

Reference Books

1. Software Architecture: Foundations, Theory and Practice by Richard N. Taylor, NenadMedvidovic, Eric M. Dashofy, Wiley India Pvt. Limited, 2010,
2. Software design: from programming to architecture, by Eric J. Braude, J. Wiley, 2004.
3. Pattern oriented software architecture: a pattern language for Distributed Computing, by By Fran Buschmann, Kelvin Henney, Douglas C Schmid, Wiley India Pvt. Limited volume-4.

All the assignments should be conducted on Latest version of Open Source Operating Systems, tools and Multi-core CPU supporting Virtualization and Multi-Threading.

414460 : PROJECT PHASE - I

Teaching Scheme:
Tutorial : 2 Hours/Week

Examination Scheme:
Term work : 50 Marks

Prerequisites: Project Based Seminar.

Course Objectives :

1. The practical implementation of theoretical knowledge gained during the study from FE to TE.
2. The student should be able implement their ideas/real time industrial problem/ current application of their engineering branch which they have studied in curriculum.
3. To build confidence in the student what he has learnt theoretically.
4. The dependent study of the state of the art topics in a broad area of his/her specialization.

Course Outcomes :

At the end of this course the student should be able to show preparedness to study independently in chosen domain of Information Technology and programming languages and apply to variety of real time problem scenarios.

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 as part of course **314456 : Seminar& Technical Communication Laboratory.** They also submitted a technical report summarizing state-of-the-art on an identified topic.

B.E. Projects can be two types: Projects based on implementation of any application oriented problem, which will be more or less experimental in nature, and the others will be based on some innovative/ theoretical work.

In Project Phase-I the student will undertake same 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 with approval from a committee formed by the department of senior faculty to check the feasibility and approve the topic.

Review Committee:

The Head of the department/Project coordinator shall constitute a review committee for project work for project group; project guide would be one member of that committee by default. There shall be at least two reviews in semester-I and semester-II by the 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.

Semester - I

Review 1: Finalization of scope – the objectives and scope of the project should be finalized in second week of their academic semester. Should finalize list of required hardware, software or other equipment for executing the project, test environment/tools.

Review 2: Finalization of SRS – High level design, planning with CPM/PERT chart etc in the sixth week of their academic semester.

Semester – II

Review 3: Implementation Status and testing document.

Review 4 : Final Project Demonstration, Project Report and proper Result analysis

Guidelines for Students and Faculty:

Project Review Committee:

1. This committee will be responsible for evaluating the timely progress of the projects and communicating the progress report to the students.
2. As far as possible Students should finalize the same project title taken for Project Based Seminar (PBS).
3. Review committee should conduct "Feasibility Review" in first week after commencement of the term. Review committee should finalize the scope of the project.
4. 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.

Term Work:

1. The term work will consist of a report prepared by the student on the project allotted to them.
2. They should use appropriate tools for the preparation of the report like project planning, UML diagram, testing tools, referencing tools etc.

Report Structure

- 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
    4. Project Requirements
    5. System Analysis Proposed Architecture/ high level design of the project
    6. Verification Validation
    7. Project Plan
    8. Conclusion
- References
- Appendices
    A. Base Paper(s)

B. Plagiarism Report from any open source

Evaluation Guidelines:

A panel of examiner will evaluate the viability of project / project scope. The panel will also verify that all the suggestions/comments in the review document are taken care and accordingly allot the term work marks. Oral examination in the form of presentation will be based on the project work completed by the candidates. Preliminary report must also be presented during the oral examination.

SEMESTER - II

414461 : Distributed System

Teaching Scheme:	Examination Scheme:	
Lectures: 3 Hours/Week	In-Semester Assessment Phase I – 30 Marks	End-Semester Assessment Phase II – 70 Marks

Prerequisites: Operating System, Computer Networks and Web Engineering & Technology.

Course Objectives :

1. To understand the fundamentals of distributed environment in complex application.
2. To get comprehensive knowledge of the architecture of distributed systems.
3. To make students aware about security issues and protection mechanism for distributed environment.

Course Outcomes :

1. Understand the principles and desired properties of distributed systems on which the internet and other distributed systems are based.
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 INTRODUCTION 5 Hours

Introduction, Examples of distributed systems, Trends in distributed systems, Focus on Resource Sharing, Challenges.

System Models: Physical models, Architectural Models, Fundamental Models.

Case Study: The World Wide Web

UNIT - II COMMUNICATION 6 Hours

Inter-process Communication: Introduction, The API for the Internet Protocols, External Data Representation and Marshalling, Multicast Communication, Network Virtualization: Overlay Networks,

Case Study: MPI

Remote Invocation: Request-reply Protocols, Remote Procedure Call, Remote Method Invocation,

Case Study: Java RMI

Indirect Communication: Group Communication, Publish-subscribe Systems, Message Queues, Shared Memory approaches.

UNIT - III MIDDLEWARE 6 Hours

Distributed Objects and Components: Introduction, Distributed Objects, Case Study: CORBA. From Objects to Components,

Case Studies: Enterprise JavaBeans and Fractal.

Web Services: Introduction, Web Services, SERVICE Descriptions and IDL for Web Services, A directory service for use with web services, XML security, Coordination of web services, Applications of Web Services.

Peer-To-Peer Systems: Introduction, Peer-to-peer middleware, Routing overlays Application,

Case Study: Squirrel.

UNIT - IV DISTRIBUTED ALGORITHMS 6 Hours

Time and Global States: Introduction, Clocks, Events and Process States, Synchronizing Physical Clocks, Logical Time and Logical Clocks, Global States.

Coordination and Agreement: Introduction, Distributed mutual exclusion, Elections, Coordination and Agreement in Group Communication, Consensus.
Replication: Introduction, System Model and the role of Group Communication, Fault-tolerant Services.
Case Study: Coda.

UNIT – V DISTRIBUTED STORAGE AND MULTIMEDIA SYSTEMS 6 Hours

Distributed File Systems: Introduction, File Service 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 - VI SECURITY IN DISTRIBUTED SYSTEMS 7 Hours

Introduction to Security: Security Threats, Policies, and Mechanisms, Design Issues, Cryptography.
Secure Channels: Authentication, Message Integrity and Confidentiality, Secure Group Communication,
Case Study: Kerberos.
Access Control: General Issues in Access Control, Firewalls, Secure Mobile Code, Denial of Service.
Security Management: Key Management, Secure Group Management, Authorization Management.
Emerging Trends In Distributed Systems: GRID COMPUTING, SOA, Cloud Computing.

Text Books

1. George Coulouris, Jean Dollimore, Tim Kindberg, & Gordon Blair, “Distributed Systems – Concept and Design”, 4th Edition, Publisher: Pearson.
2. Andrew S. Tanenbaum & Maarten van Steen”, Distributed Systems – Principles and Paradigms”, 2nd Edition, Publisher: PHI.
3. P. K. Sinha,”Distributed Operating Systems Concepts and Design”, Publisher: PHI.

Reference Books

1. Sunita Mahajan, Seema Shah, “Distributed Computing”, 2nd Edition, Publisher: Oxford University Press.
2. Advanced concepts in Operating Systems, Mukesh Singhal & N.G.Shivaratri, TMH.
3. Randay Chow, Theodore Johnson, “Distributed Operating System and Algorithm Analysis”, Publisher: Pearson (LPE).
4. Abhijit Belapurkar, Anirban Chakrabarti, Harigopal Ponnapalli, Niranjan Varadarajan, Srinivas Padmanabhuni, Srikanth Sunderrajan , " Distributed System Security: Issues, Processes and solutions", ISBN: 978-0-470-51988-2, Feb 2009, Publisher: Willey online Library.

414462 : Advanced Databases

Teaching Scheme:
Lectures: 3 Hours/Week

Examination Scheme:

In-Semester Assessment	End-Semester Assessment
Phase I – 30 Marks	Phase II – 70 Marks

Prerequisites: Database Management System.

Course Objectives :

1. To learn and understand Database Modeling, Database Architectures.
2. To learn and understand Object Oriented Databases.
3. To learn and understand web database language, XML, JDOQL.
4. To learn NoSQL Databases (Open source) and big data analytics.
5. To learn Web data and mining.
6. To learn current trends in databases.

Course Outcomes :

1. Understanding of Advances in Database Architectures for Big data.
2. Master the basics of web and object oriented database using XML and JDOQL.
3. Master the basic concepts of NoSQL Databases.
4. Understand how analytics and big data affect various functions now and in the future.
5. Appreciate the impact of analytics and big data on the information industry and the external ecosystem for analytical and data services.
6. Understanding of current trends in databases.

UNIT - I PARALLEL AND DISTRIBUTED DATABASES — 6 Hours

Parallel Database: Introduction, Architectures, Interquery and Intraquery Parallelism, Parallelism on Multicore processor, Parallel Query Optimization,
Distributed Database: Introduction, Data Storage, Distributed Transactions, Commit Protocol, Concurrency control, Distributed Recovery.

UNIT - II OBJECT-BASED DATABASE AND XML — 6 Hours

Overview, Complex databases, Structured data types, operations on structured and unstructured data. Encapsulation and ADTs. Inheritance, Objects, OIDs and Reference types, Database Design, ORDBMS Implementation challenges-Storage and Access methods, Query Optimization, ODMS-Object model. NOSQL object database-ObjectDB (JDO),JDO Data Model, XML Data Model ,DOM, XQuery, Efficient evaluation of XML Queries.

UNIT - III BIG DATABASES — 8 Hours

Introduction to Big Data, NoSQL database system – Columnbased and key value based
Column based Database (Cassandra) : Architecture, Managing data, Data Caching, Tuning, Data backup, Cassandra Query Language, CQL Data Model, Indexing
Key Value based Database (DynamoDB) : Data Model, Operations, Data Access, Indexing.

UNIT - IV BIG DATA ANALYTICS **8 Hours**

Introduction to data mining and analytics, Data Streams mining, Stream data management systems: Issues and solutions, Stream frequent pattern analysis, Stream classification, Stream cluster analysis, Graph based database, graph mining, Methods for Mining Frequent Sub graphs Mining Variant and Constrained Substructure Patterns, Social Network Analysis, Models of social network generation, mining on social network, Apache Flume NG - Microsoft StreamInsight as tools for Complex Event Processing (CEP) applications. Case Studies Big Data in E-Commerce and IT Energy Consumption, Social and Health Science.

UNIT - V MINING TEXT AND WEB **6 Hours**

Text mining : Introduction, natural language processing and information extraction: An Introduction Text categorization methods

Web Mining : Introduction, Web Contents and Usage, Data Modeling for Web Usage Mining, Mining Web linkage structures, **Discovery and Analysis of Web Usage Patterns:** Session and Visitor Analysis, Analysis of Sequential and Navigational patterns

Recommender Systems and Collaborative Filtering: The Recommendation Problem, Content-Based Recommendation, Collaborative Filtering using K-Nearest Neighbor KNN and Association Rules, Matrix Factorization.

UNIT - VI CURRENT TRENDS IN ADVANCED DATABASES **6 Hours**

Deductive Databases: Introduction, Semantics, Fix point operator, Safe data log programmers, Least Model, Least fixed point, Query Processing, Query Evaluation, Prototypes, and Deductive Vs RDBMS. Multimedia Database, Cloud Databases, Spatial Databases, Temporal Databases.

Text Books

1. Raghu Ramkrishanan, Johannes Gehrke 4th Edition "Database Management Systems"
2. Avi Silberschatz , Henry F. Korth , S. Sudarshan, "Database System Concepts, Sixth Edition", ISBN-13: 978-93-3290-138-4, MCGraw Hill

Reference Books

1. Shio Kumar Singh, Database Systems Concepts Design and Applications, ISBN- 978-81-317-6092-5, Pearson
2. Mario Piattini, Oscar Diaz "Advanced Database Technology and Design"- online book.
3. J. Han, M. Kamber Data mining: concepts and techniques. Morgan Kaufmann.
4. Bing Liu, Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data, Springer.
5. Big Data Black Book, DT Editorial Services, Wiley-Dreamtech Press, ISBN-9789351197577, May 2015.
6. http://nosql-database.org/

414463 A - ELECTIVE III : MOBILE COMPUTING

Teaching Scheme:
Lectures: 3 Hours/Week
Practical: 2Hours /Week

Examination Scheme:

In-Semester Assessment
Phase I – 30 Marks

End-Semester Assessment
Phase II – 70 Marks
Term work – 25 Marks
Oral – 25 Marks

Prerequisites: Computer Networks.

Course Objectives :

1. To understand the fundamentals involved in technologies of Mobile computing.
2. To study GSM Architecture and Services.
3. To learn about different architectures of mobile application development.
4. To know recent and future trends in mobile computing.

Course Outcomes :

1. Students will gain knowledge of GSM architecture.
2. Students will be able to understand mobility management.
3. Students will be able to understand working of wireless architectures and their applications.
4. Students will be able to understand recent trends and emerging technologies.

UNIT - I INTRODUCTION 6 Hours

Introduction – PCS Architecture, Cellular Telephony, Mobile Computing Architecture
Mobile devices: Device Overview, Input mechanism, Wireless communication, Mobile Device classification, Device Manufacturers
Mobile Generations: Devices and Applications for: 1G, 2G, 2.5G, 3G
Mobility Management :Handoff, Roaming Management, Roaming Management under SS7
Handoff Management :Handoff Detection, Strategies for Handoff Detection, Channel Assignment, Link Transfer Types, Hard Handoff, Soft Handoff

UNIT - II GSM AND MOBILITY MANAGEMENT 6 Hours

GSM System Overview: GSM Architecture, Data Services, Unstructured Supplementary Service Data
Mobility Management : GSM Location Update, Mobility Databases, Failure Restoration, VLR Identification Algorithm, VLR Overflow Control

UNIT - III GSM SERVICES 6Hours

GSM Service: SMS Architecture, SMS Protocol Hierarchy, Mobile-Originated Messaging, Mobile –Terminated Messaging
International Roaming for GSM: International GSM, Call Setup, Reducing the International Call Delivery Cost
Mobile Number Portability: Fixed Network Number Portability, Number Portability for Mobile Networks, Mobile Number Portability Mechanisms, Implementation Costs for Mobile Number
Mobile prepaid service: Wireless intelligent network approach, service node approach, hot billing approach, handset based approach

UNIT - IV GSM DATA LAYER 6 Hours

General Packet Radio Service (GPRS): GPRS Functional Groups, GPRS Architecture GPRS Network Nodes, GPRS Interfaces, GPRS Procedures, GPRS Billing, Evolving from GSM to GPRS

Wireless Application Protocol (WAP): WAP Model, WAP Gateway, WAP Protocols WAP UAProf and Caching, Wireless Bearers for WAP, WAP Developer Toolkits, Mobile Station Application Execution Environment

Third-Generation Mobile Services: Paradigm Shifts in Third-Generation Systems W-CDMA and cdma2000, Improvements on Core Network, Quality of Service in 3G Wireless Operating System for 3G Handset

UNIT - V MOBILE APPLICATION ARCHITECTURES 6 Hours

Choosing the right architecture: Application architecture, Device type, Enterprise connectivity, Enterprise data, Enterprise integration, User notification, security, battery life

Application Architectures: Wireless internet, Smart Client, messaging

Smart Client Overview: architecture

Smart Client Development process: Need analysis phase, design phase, implementation and testing phase, deployment phase

UNIT - VI RECENT AND FUTURE TRENDS 6Hours

Android OS and its Architecture, Mobile Applications, User Interface design for mobile Applications, Managing Application Data, Performance, Scalability, Modifiability, Availability and Security of Mobile Applications, Testing Methodologies for Mobile Applications.

Future Mobile Generations: 4G, 5G

Note: Instructor should design at least 08 assignments of sufficient complexity on Mobile application Development (Unit VI) and 04 study assignments on Units I to V.

Text Books

1. Yi Bang Lin, “Wireless and Mobile Network Architectures”, Wiley Publications.
2. Martyn Mallick, “Mobile and Wireless design essentials”, Wiley Publications.

Reference Books

1. Johen Schiller, “Mobile communications”, Pearson Publications.
2. Asoke Talukder and Roopa Yavagal”, Mobile Computing Technology, Applications and Service Creation”, Second Edition, ISBN-13: 978-0-07-014457-6, Tata McGraw Hill.
3. Iti Shah Mishra, “Wireless Communication and Networks 3G and Beyond”, Second Edition, ISBN-13: 978-1-25-906273-5, McGraw Hill Education
4. Theodore S. Rappaport, “Wireless Communications principles and practice”, 2nd edition, Pearson Education, ISBN – 978-81-317-3186-4.
5. Ke-Lin Du & M.N. S. Swamy, “Wirless Communication Systems, From RF Subsystems to 4G Enabling Technologies, ISBN: 978-0-521-18736-7, Cambridge University Press,

414463 B - ELECTIVE III : ADVANCED GRAPHICS AND ANIMATION

Teaching Scheme:	Examination Scheme:	
Lectures: 3 Hours/Week	In-Semester Assessment	End-Semester Assessment
Practical: 2 Hours /Week	Phase I – 30 Marks	Phase II – 70 Marks
		Term work – 25 Marks
		Oral – 25 Marks

Prerequisites :

1. Knowledge of C++ or linear algebra.
2. Computer Graphics, Multimedia Systems.
3. Strong software Engineering Skills.

Course Objectives :

1. Provide solid grounding in three dimensional modeling mechanisms.
2. Introduce students to techniques in virtual reality, solid modeling and animation
3. To gain first-hand experience for accurate modeling, rendering, and simulation, and the necessary data structures and algorithms.
4. To develop programming skills in 3D computer graphics.
5. Become acquainted with some advanced topics in computer graphics.

Course Outcomes :

At the end of this course students should be able to

1. Learn recent methods in rendering, modeling, and animation.
2. Understand the current models for the interaction of light and materials
3. Understand some areas of current computer graphics research.
4. Learn and use the production pipeline to create your own animation

UNIT – I 3D MODELING AND 3D OBJECT REPRESENTATION — 3 Hours

Brief Review of 3D modeling and 3D object Representation 3D display methods, Polygon surfaces, polygon meshes, Curved lines and surfaces, Quadratic surfaces, Spline representation and specification B-Spline curves and surfaces.

UNIT - II SOLID MODELING — 9 Hours

Representing solids, Primitive instancing, sweep representations, Boundary representations, spatial-partitioning representations, constructive solid geometry, user interfaces for solid modeling, comparison of representations.

UNIT - III RENDERING — 6 Hours

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 – IV OpenGL — 10 Hours

OpenGL over windows, SDK, Extensions, GLUT, GLU, OpenGL primitives,
Programming language: Blending, 3D Viewing (camera analogy), Lighting model, Culling, Fog, Texture mapping.
OpenGL over Linux, pBuffer rendering, Shadowing Techniques, a few examples and demos of OpenGL programs.

UNIT - V ANIMATION **5 Hours**

Introduction, Devices for producing animation , Conventional and Computer assisted animation, Animation languages, Basic rules of animation, Methods of controlling animation, frame-by-frame animation techniques, real-time animation techniques , Programming aspects in creating simple animation

UNIT – VI VIRTUAL REALITY **3 Hours**

Basics, Devices for Virtual Reality, Virtual Reality Languages, Virtual Reality Design, Omegalib And Applications

Text Books

1. Donald Hearn & M. Pauline Baker, "Computer Graphics C version", 2nd Ed, Pearson
2. Education.
3. David F. Rogers, "Procedural Elements for Computer Graphics", 2nd Ed - Tata McGraw Hill Edition.
4. "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. M.N. Sinha, A.D. Udai, "Computer Graphics",Tata McGraw Hill Edition.
2. Foley, Dam, Feiner, Hughes,"Computer Graphics Principles & Practice", 2nd Ed, Pearson Education.
3. Hill, Kelly, "Computer Graphics using OpenGL", 3rd Ed, Eastern Economy Edition.
4. "Advanced Animation and Rendering Techniques: Theory and Practice", Alan H. Watt and Mark Watt, Addison-Wesley, ACM Press, ISBN: 0201544121

Web-links

http://nptel.ac.in/syllabus/106106090/
http://studentnet.cs.manchester.ac.uk/ugt/COMP37111/syllabus
http://www.sci.tamucc.edu/~sking/Courses/COSC5328/syllabus.php

List of Practical

The lab course will be evaluated on the basis of five assignments framed by the faculty that primarily involve programming systems for rendering, simulation and animation concepts. These assignments need to be done individually by the students. Faculty can choose from the list below or frame new assignments based on the theory contents.

1. Implement an OpenGL program to draw different 2D shapes.
2. Implement an OpenGL program to draw 2 overlapped shapes and use alpha blending.
3. Implement an OpenGL program to draw 3D cube and apply transformations.
4. Implement an OpenGL program to draw 12 spheres and apply different light effects.
5. Implement an OpenGL program to draw scene and apply fog effect.
6. Implement an OpenGL program to draw 3D cube and apply different textures on different faces.
7. Program describing certain animation techniques like Basic Key-framing , Rigid Body Dynamics, Motion Capture (Can be implemented in the language / API of your choice)
8. Assignments based on virtual reality
9. Draw histogram of 256-color BMP image.

414463 C - ELECTIVE III : INFORMATION STORAGE AND RETRIEVAL

Teaching Scheme:
Lectures: 3 Hours/Week
Practical: 2 Hours /Week

Examination Scheme:

In-Semester Assessment	End-Semester Assessment
Phase I – 30 Marks	Phase II – 70 Marks
	Term work – 25 Marks
	Oral – 25 Marks

Prerequisites: Data Structures and Files, 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.
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 :

1. Student should be able to understand the concept of Information retrieval.
2. Student should be able to deal with storage and retrieval process of text and multimedia data.
3. Student should be able to evaluate performance of any information retrieval system.
4. Student should be able to understand importance of recommender system.
5. Student should be able to understand concept of multimedia and distributed information retrieval.

UNIT - I INTRODUCTION — 8 Hours

Basic Concepts of IR, Data Retrieval & Information Retrieval, IR system block diagram. **Automatic Text Analysis**: Luhn's ideas, Conflation Algorithm, Indexing and Index Term Weighing, Probabilistic Indexing, Automatic Classification. Measures of Association, Different Matching Coefficient, Classification Methods, Cluster Hypothesis, Clustering Algorithms, Single Pass Algorithm, Single Link Algorithm, Rocchio's Algorithm.

UNIT - II STORAGE AND SEARCHING TECHNIQUES — 6 Hours

Storage: Inverted file, Suffix trees & suffix arrays, Signature Files, Scatter storage or hash addressing, Clustered files.
IR Models: Basic concepts, Boolean Model, Vector Model
Searching strategies: Boolean Search, Serial search, cluster based retrieval, Query languages, Types of queries, Patterns matching, structural queries.

UNIT - III RETRIEVAL PERFORMANCE EVALUATION AND ONTOLOGY — 6 Hours

Performance evaluation: Precision and recall, alternative measures
Ontology: Ontology based information sharing, Ontology languages for semantic web, Ontology creation.

UNIT - IV DISTRIBUTED AND MULTIMEDIA IR — 6 Hours

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 6 Hours

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.

UNIT - VI RECOMMENDER SYSTEMS 6 Hours

Collaborative Filtering and Content Based Recommendation of Documents and Products, **Information Extraction and Integration**: Extracting Data from Text. Semantic Web, 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).
3. Heiner Stuckenschmidt, Frank van Harmelen, "Information Sharing on th Semantic Web", Springer International Edition, ISBN 3-540-20594-2.

Reference Books

1. Christopher D. Manning, PrabhakarRaghavan and HinrichSchutze"Introduction to Information Retrieval", Cambridge University Press, ISBN 978-0-521-86571-5
2. Mark leven, "Introduction to search engines and web navigation", John Wiley and sons Inc., ISBN 9780-170-52684-2.
3. V. S. Subrahamanian, Satish K. Tripathi "Multimedia information System", Kulwer Academic Publisher.
4. ChabaneDjeraba,"Multimedia mining A highway to intelligent multimedia documents", Kulwer Academic Publisher, ISBN 1-4020-7247-3.
5. Ricci, F, Rokach, L. Shapira, B.Kantor, "Recommender Systems Handbook", First Edition, 2011.
6. Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, Information Retrieval Implementing and Evaluating Search Engines, The MIT Press, Cambridge, Massachusetts London, England, 2010.

List of Practical Assignments

Faculty member should frame 7-8 assignments of sufficient complexity and maintain a record of continuous assessment and should be produced at the time of practical/oral examination

414463 D - ELECTIVE III : IT ENABLED SERVICES

Teaching Scheme:	**Examination Scheme:**	
Lectures: 3 Hours/Week	In-Semester Assessment	End-Semester Assessment
Practical: 2 Hours /Week	Phase I – 30 Marks	Phase II – 70 Marks

Prerequisites: Information Technology and Project Management, Web Engineering and Technology.

Course Objectives :

1. To understand importance of IT enabled services.
2. To encourage the use of Information Technology so as to enable students to improve their skills, knowledge and job prospects and enable them to obtain employment in sunrise industries.
3. To develop the ability to integrate various resources for optimization in the industry as well as for strategic utilization of IT enabled services and functions.

Course Outcomes :

1. Students will be able to understand the process of IT Industry
2. Students will be able to understand Indian laws of IT industry
3. Student will be able to study current trends and services in IT industry
4. Student will be able to understand programming concept of IT Web services.

UNIT - I BUSINESS STRATEGY: CHALLENGES AND OPPORTUNITIES FOR IT — 6 Hours

Business Strategy: Challenges and Opportunities in the Globalized, Interconnected, Convergent World, Establish Principles before Practice, IT Strategy, Application Strategy, Technology Strategy for IT, IT Management Strategy, Developing IT Strategy for Competitive Advantage, Stages of IT Strategy Development and Implementation, Challenges of IT and Business Strategy Alignment, Inhibitors of Business and IT Strategy Alignment, Three-D Framework for Business and IT Strategy Alignment.

Unit – II STRATEGIC IT PLANNING — 6 Hours

Business Implications for IT Strategic and Planning, Strategic IT Planning Motivations, SITP Process: Prevalent Planning Approaches, Difficulties in Developing and Executing SITP, Best Practices for Achieving Good SITP, SITP Approaches-Prevalent Researches.

UNIT - III ENTERPRISE IT ARCHITECTURE — 6 Hours

Defining EITA, Contents of a Typical Enterprise IT Architecture, Standard for Enterprise IT Architecture, Technology Management strategy Framework, Prevalent Technology Reference Architectures Framework and Standards, Program Management, Benefits of PMO, Desired Qualities of a Program Office Manager, Maturity of PMO, Implementation of PMO Strategy, Measuring PMO Performance, Success Factors for PMO, Project Scope Management, PMO Dashboard and Reporting.

UNIT - IV IT SERVICE MANAGEMENT STRATEGY — 6 Hours

Information Technology Infrastructure Library (ITIL), ITIL Overview, ITIL Service Support Processes, Incident Management, Problem Management, Service Delivery, Service Level Management, Financial Management, Capacity Management, IT Service Continuity Management (ITSCM), Availability Management, Imperatives for Outsourcing, IT Management Layers, Variants of Outsourcing, Business Process Outsourcing, In sourcing.

UNIT – V IT ENABLED WEB SERVICES **6 Hours**

Overview of basic features of PHP: arrays, functions and state management, working with PHP forms, More advanced PHP, OOP's concept in PHP, Portable database supported with different, exception handling, concepts of UDDI, WSDL, SOAP.

UNIT – VI CURRENT TRENDS IN ITES **6 Hours**

Current Employment in the IT and ITES industry: Newly emerging area and requirement of IT enabled service sector. Industry Oriented Human Resource Requirement: Outlook of the IT and ITES Industry. Barriers to Trade in ITES Role of International Bodies (WTO & UNCTAD) in facilitating Trade in ITEST/ITES, experiences and Case studies of ITES-call centers, ERP, google.

Text Books:

1. Sanjiva Shankar Dubey, " IT strategy and Management", PHI.
2. K.Venkatesh, " Marketing of Information Technology",TMH.
3. Steve Suehring, Timconverse, Joyoe Park , "PHP 6 and MySQL Bible", Willey.

Reference Books:

1. Shiro Uesugi, "IT Enabled Services", Springer; 2013 edition, 2013.
2. Sanjiva Shankar Dubey, "IT Services Business Management: Concepts, Processes and Practices", PHI, 2012.
3. Nikhil Treebhoohu, "Promoting IT Enabled Services", Addison-Wesley, 2013.

List of Practical Assignments

1. Create a Dynamic Calendar using PHP functions which allows the user to move the calendar forward or backward by a month at a time using simple XHTML form submit button.
2. Write a program to implement error handling in PHP.
3. Write a program to implement file handling in PHP including different file functions such as fwrite(), fgetss(), fpassthru(), file() etc.
4. Explore and implement WSDL document structure.
5. Write a program to implement WSDL in PHP using request and response operations and its types.
6. Write a program to implement a SOAP web service in PHP using request and response operations.
7. Write a program in Object Oriented PHP such that it will create the number of pages for a web site that will look and behave in same way and those pages should be able to modify to suit the different parts of the site.
8. Study a case study of Internet Banking web site or Indian Call Center for understanding the Architecture, Strategic IT Planning, Business Strategies – Challenges and Opportunities.
9. Study assignment on Information Technology Infrastructure Library (ITIL).

Note:

All the assignments should be conducted on Latest version of Open Source Operating Systems, tools and Multi-core CPU supporting Virtualization and Multi-Threading.

Subject teacher may frame new assignments which will have equivalent the difficulty level.

Text Books:

1. IT strategy and Management by Sanjiva Shankar Dubey, PHI
2. PHP 6 and MySQL Bible,Steve Suehring, Timconverse, Joyoe Park, Willey.
3. PHP and MySQL Web Development by Luke Welling and Laura Thomson, SAMs Publishing.

414463 E - ELECTIVE III : ADVANCED COMPUTER NETWORKS

Teaching Scheme:
Lectures: 3 Hours/Week
Practical: 2 Hours /Week

Examination Scheme:

In-Semester Assessment	End-Semester Assessment
Phase I – 30 Marks	Phase II – 70 Marks
	Term work – 25 Marks
	Oral – 25 Marks

Prerequisites: Fundamentals of Computer Network, Computer Network, Web Technologies.

Course Objectives :

1. To learn fundamental of computer network principles, services and architectures of various networks.
2. To introduce a set of advanced technologies in networking.
3. To learn advanced routing protocols and router architecture.
4. To gain knowledge of QoS and congestion control in end-to-end data transfer.
5. To introduce with a set of advanced Wireless Network standards and research in network.

Course Outcomes :

After successful completion of this course students will be able to:

1. Apply basic principles in designing modern computer networks.
2. Use functionality of high speed networks in development of advanced network applications.
3. Use advanced routing architecture and protocols in networking.
4. Apply performance measures for routing in computer networks.
5. Use advanced wireless standards in designing wireless networks.

UNIT - I FOUNDATION OF COMPUTER NETWORK 6 Hours

Application, Requirements, Network Architecture, ISO-OSI, TCP-IP, Implementing Network Software, Performance, Perspective on Connecting, Encoding, Framing, Error Detection, Reliable Transmission, Ethernet and Multiple Access Network, Wireless: 802.11a/b, 802.15.1 to 802.15.4, 802.16 (c-d), Cell Phone Technologies, Ad-hoc Networking: Model of operation, DoD Perspective, Internetworking: Switching and Bridging, Basic Internetworking, Routing, Implementation and Performance.

UNIT - II HIGH SPEED NETWORKS AND ADVANCED TECHNOLOGIES 6 Hours

Frame Relay, ATM: Features, Addressing, Signaling, and Routing, ATM Header Structure, ATM Adaptation Layer, Management and Control, Internetworking with ATM, ISDN: Overview, Interface and function, ISDN layers, ISDN services, BISDN: Need, Functional Architecture, Optical Network: links, WDM system, Optical LANs, Optical paths and networks.

UNIT - III ADVANCED INTERNETWORKING 6 Hours

Routing Areas, Inter-domain Routing (BGP Version 4), IPv6, Multicast Addresses and Routing Mechanism (DVMRP, PIM, MSDP), Integrated IS-IS, Interior Gateway Routing Protocol (IGRP), Enhanced Interior Gateway Routing Protocol (EIGRP), Routing Among Mobile Devices Mobile IP, Virtual Private Network, VoIP Basics, Router Architectures: Shared CPU Architectures, Shared Forwarding Engine Architectures, Shared Nothing Architectures, Clustered Architectures.

UNIT - IV CONGESTION CONTROL, RESOURCE ALLOCATION AND END-TO-END DATA 6 Hours

Issues in resource allocation, Queuing Disciplines: First-In, First-Out Queueing, Priority Queueing , Round-Robin and Fair Queueing, Weighted Round-Robin and Weighted Fair Queueing, Deficit Round-Robin Queueing, Modified Deficit Round-Robin Queueing, TCP Congestion Control: Additive

Increase/Multiplicative Increase, Slow Start, Fast Retransmit and Fast Recovery, Congestion Avoidance Mechanisms: DECbit, RED, Source Based Congestion Avoidance, Traffic Policing, Quality of Service: Application Requirements, RSVP, EE, AF. Data Presentation Formatting: Taxonomy, XDR, ASN, NDB, Markup Languages, and Multimedia Data: Lossless Compression Techniques, Images Representation and Compression, Video Compression, Transmitting MPEG over Network, Audio Compression.

UNIT - V QUALITY OF SERVICE ROUTING 6 Hours

QoS attributes, Routing Protocol for QoS Routing, Traffic Engineering, Traffic Engineering Extension to Routing Protocols, Multiprotocol Lable Switching (MPLS), Generalized MPLS, MPLS Virtual Private Networks, and Traffic Engineering of IP/MPLS Networks, VPN Traffic Engineering, and Routing/Traffic Engineering for Voice over MPLS.

UNIT - VI ADVANCED WIRELESS NETWORK STANDARDS 6 Hours

Advanced Wireless LAN Standards: 802.11g, 802.11n, 802.11ac-ax, Difference in between different 802.11 standards, WPAN: High Rate WPAN, Low Rate WPAN, IEEE 802.15.5, IEEE 802.15.6, IEEE 802.15.7, WiMAX: 802.16e to 802.16. 1a, Difference in between different 802.16 standards, Quality of Service in Wireless Networks, Research Trends in Wireless Networks.

Text Books

1. Larry L. Peterson, Bruce S. ,"Computer Networks: A Systems Approach", 4th edition, Davie Publisher: Elsevier/Morgan Kaufmann, ISBN: 13:978-0-12-370548-8; 10:0-12-370548-7.
2. Jean Walrand and Pravin Varniya,"High Performance Communication Networks" second edition Publisher: Morgan Kaufmann Publisher Elsevier ISBN: 1-5580- 574-6 Indian ISBN: 81-8147-652-2.
3. Deepankar Medhi, Karthikeyan Ramasamy, "Network Routing Algorithms, Protocols, and Architectures", Publisher: Morgan Kaufmann Publisher Elsevier ISBN 13: 978-0-12-088588-6.
4. William Stallings, "Wireless Communications & Networks", 3rd Edition, Prentice Hall, ISBN-10: 0131918354.

Reference Books

1. Douglas E. Comer,"Internetworking with TCP/IP Vol -I", 5thEdition Publisher: Prentice Hall.
2. Andrew S. Tanenbaum, "Computer Networks", PHI, Fifth Edition, ISBN: 978-0132-126953.
3. C. Siva Ram Murthy and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols" Prentice Hall, 2004

414464 A - ELECTIVE IV : BIO INFORMATICS

Teaching Scheme:
Lectures: 3 Hours/Week

Examination Scheme:

In-Semester Assessment	End-Semester Assessment
Phase I – 30 Marks	Phase II – 70 Marks

Prerequisites : Design and Analysis of Algorithms, Basic Concepts of Data Mining and Machine Learning.

Course Objectives :

1. To introduce students with Synthesis of DNA and RNA, major databases and applications in Bioinformatics along with classification schema.
2. Study of various data visualization and statistical techniques to discover new patterns in protein structure, through Clustering and Classification.
3. Study of various Data Mining and Pattern Matching techniques for knowledge discovery in Bioinformatics Databases through sequence alignment algorithms.
4. Analysis of various simulation tools in Bioinformatics for similarity search and study of prediction algorithms.
5. Study of Protein Structure Modeling and Simulation, drug discovery process.
6. To introduce students with the overview of Systems Biology and Human Disease.

Course Outcomes :

After successful completion of this course student will able to:

1. Understand basic DNA and RNA structure, features and classification schema for databases, applications in Bioinformatics.
2. Use various statistical concepts and visualization tools to discover new patterns in Protein Structures and analyze randomness in data.
3. Explore the various Bioinformatics Databases for knowledge discovery given by Data Mining and Pattern Matching techniques through study of various sequence alignment algorithms.
4. Offer appropriate solutions for similarity search through similarity search and prediction algorithms.
5. Understand modeling and simulation in bioinformatics with the help of simulation and statistical protocols, basic drug discovery process.
6. Gain awareness in field of Systems Biology and Human Disease.

UNIT - I INTRODUCTION **6 Hours**

Introduction, Historical overview, Information Theory and Central Dogma of Molecular Biology, Bioinformatics Applications, Features and Classification Schema of Biological Databases, Protein Structure Classification Databases

UNIT - II DATA VISUALIZATION AND STATISTICS **6 Hours**

Sequence Visualization, Structure visualization, Rendering Tools, Statistical Concepts, Micro arrays, Imperfect Data, Quantifying Randomness, Data Analysis, Tool selection for Statistical Analysis, Statistics of Alignment, Clustering and Classification

UNIT - III DATA MINING AND PATTERN MATCHING **6 Hours**

Methods & Technology Overview, Infrastructure, Pattern Recognition & Discovery, Text Mining & Tools, Sequence alignment-Concept of alignment, Scoring matrices, PAM, BLOSUM, Alignment of pairs of sequences, Alignment algorithms

UNITIV BIOINFORMATICS TOOLS AND ALGORITHMS 6 Hours

Introduction, Heuristic Methods for Sequence Alignment, Working with FASTA, Working with BLAST, FASTA & BLAST Algorithms & Comparison, Introduction to Phylogenetic, Prediction algorithms for Genes and Phylogenetic

UNIT - V PROTEIN STRUCTURE MODELING, SIMULATION AND DRUG DESIGN 6 Hours

Methods for Protein Modeling, Homology or Comparative modeling, Model refinement and Evaluation, Tools for Modeling and Simulation, Drug Discovery Process, Structural Bioinformatics in Drug Discovery, Simulation and Statistical Protocols of Markov Chain and Hidden Markov Model

UNIT - VI RECENT AND FUTURE TRENDS IN BIOINFORMATICS 6 Hours

Systems Biology in Human Health and Disease and Future of Medicine

Text Books

1. S.C.Rastogi, N.Mendiratta, P.Rastogi 'Bioinformatics-Methods & Application Genomics, Proteomics and Drug Discovery', Third Edition, Prentice Hall of India.
2. Bryan Bergeron, 'Bioinformatics Computing', Pearson Education.
3. Zhumur Ghosh, BibekanandMallick, 'Bioinformatics Principles and Applications', Oxford University Press 2008.

Reference Books

1. Orpita Bosu, Simminder Kaur Thukral 'Bioinformatics: Databases, Tools and Algorithms', Oxford press.
2. David W. Mount,'Bioinformatics: Sequence and Genome Analysis.
3. Matej, Oresic, 'A Systems Biology to Study Metabolic Syndrome', Chapter 2, Systems Biology in Human Health and Disease, Springer International Publishing, Switzerland, 2014.
4. http://www.ncbi.nlm.nih.gov/pubmed/21928407.
5. http://www.ias.ac.in/pubs/splpubs/pjubileebook/379.pdf.
3. https://www.systemsbiology.org/sites/default/files/Hood_P4.pdf.

414464 B - ELECTIVE IV : REAL TIME AND EMBEDDED SYSTEMS

Teaching Scheme:	**Examination Scheme:**	
Lectures: 3 Hours/Week	In-Semester Assessment Phase I – 30 Marks	End-Semester Assessment Phase II – 70 Marks

Prerequisites : Processor Architecture and Interfacing

Course Objectives :

1. Understanding embedded system, processor & distributed embedded systems architecture.
2. Understanding Real Time system, Real time task scheduling & Real time operating system.

Course Outcomes :

1. Students should be able to design distributed embedded system for specific example.
2. Students should be able to schedule real time tasks as per the specific requirement.

UNIT - I EMBEDDED ARCHITECTURE — 6 Hours

Embedded Computers, Characteristics of Embedded Computing Applications, Challenges in Embedded Computing system design, Categories of Embedded System, Embedded system design process-Requirements, Specification, Architectural Design, Designing Hardware and Software Components, System Integration, Formalism for System Design-Structural Description, Behavioural Description, Design Example: Model Train Controller

UNIT – II EMBEDDED PROCESSOR AND COMPUTING PLATFORM — 6 Hours

ARM processor-processor and memory organization, Data operations, Flow of Control, SHARC processor-Memory organization, Data operations, Flow of Control, parallelism with instructions, CPU Bus configuration, ARM Bus, SHARC Bus, Memory devices, Input/output devices, Component interfacing, designing with microprocessor development and debugging, Design Example : Alarm Clock.

UNIT - III NETWORKS — 6 Hours

Distributed Embedded Architecture-Hardware and Software Architectures, Networks for embedded systems-I2C, CAN Bus, SHARC link ports, Ethernet, Myrinet, Internet, Network-Based design-Communication Analysis, system performance Analysis, Hardware platform design, Allocation and scheduling, Design Example: Elevator Controller.

UNIT - IV INTRODUCTION TO REAL-TIME SYSTEMS — 6 Hours

Characteristics of Real – Time Systems, Classification of Real – Time Systems, Types of Real-Time tasks – Timing constraints –Real-Time Scheduling: Basic concepts and classification of Algorithms – Clock-Driven Scheduling – Event-Driven Scheduling – Hybrid schedulers – EDF Scheduling – RM Scheduling and its Issues.

UNIT – V RESOURCE SHARING AND DEPENDENCIES AMONG REAL-TIME TASKS — 6 Hours

Resource sharing in Real Time tasks, Priority Inversion, Priority Inheritance Protocol, Highest Locker Protocol, Priority Ceiling Protocol, Handling Task dependencies – Scheduling Real-Time Tasks in Multiprocessor and Distributed Systems – Resource Reclaiming in Multiprocessor RealTime Systems – Fault-Tolerant Task Scheduling in Multiprocessor Real-Time Systems.

UNIT - VI REAL-TIME OPERATING SYSTEM (RTOS) — 6 Hours

Features of RTOS, Commercial Real-Time Operating Systems, Real-Time Databases, Applications, Design issues, Characteristics of Temporal Data, Concurrency control, Commercial Real-Time

Databases.

Text Books

1. Frank Vahid, Tony Givargis Embedded system design: a unified hardware/ software introduction. Wiley publication.
2. C. Siva Ram Murthy and G. Manimaran, “Resource Management in Real-Time Systems and Networks”, Prentice-Hall of India, 2005.

Reference Books

1. Raj Kamal, Embedded systems: Architecture, Programming and design; Tata McGraw Hill
2. Wayne Wolf, Computers as Components: Principles of Embedded Computing System Design, Morgan Kaufman Publishers, 2001.
3. Jane.W.S. Liu Real-Time systems, Pearson Education Asia, 2000.
4. Rajib Mall, “Real-Time Systems Theory and Practice”, Pearson Education, India, 2007.
5. C.M. Krishna, Kang G. Shin, “Real-Time Systems”, ISBN-13: 978-0-07-070115-1, MC GrawHill Education

414464 C - ELECTIVE IV : GREEN IT – PRINCIPLES AND PRACTICES

Teaching Scheme:	Examination Scheme:	
Lectures: 3 Hours/Week	In-Semester Assessment Phase I – 30 Marks	End-Semester Assessment Phase II – 70 Marks

Prerequisites : The course assume no prior knowledge in this area

Course Objectives :

1. To understand what Green IT is and How it can help improve environmental Sustainability
2. To understand the principles and practices of Green IT.
3. To understand how Green IT is adopted or deployed in enterprises.

Course Outcomes :

1. Students will be able to create awareness among stakeholders and promote green agenda and green initiatives in their working environments leading to green movement.
2. This green movement will create new career opportunities for IT professionals, auditors and others with special skills such as energy efficiency, ethical IT assets disposal, carbon footprint estimation, reporting and development of green products, applications and services.

UNIT – I INTRODUCTION — 6 Hours

Environmental Impacts of IT, Holistic Approach to Greening IT, Green IT Standards and Eco-Labelling, Enterprise Green IT Strategy , Green IT: Burden or Opportunity?

Hardware: Life Cycle of a Device or Hardware, Reuse, Recycle and Dispose.

Software: Introduction, Energy-Saving Software Techniques, Evaluating and Measuring Software Impact to Platform Power.

UNIT - II SOFTWARE DEVELOPMENT AND DATA CENTERS — 6 Hours

Sustainable Software, Software Sustainability Attributes, Software Sustainability Metrics, Sustainable Software Methodology, Data Centres and Associated Energy Challenges, Data Centre IT Infrastructure, Data Centre Facility Infrastructure: Implications for Energy Efficiency, IT Infrastructure Management, Green Data Centre Metrics.

UNIT - III DATA STORAGE AND COMMUNICATION — 6 Hours

Storage Media Power Characteristics, Energy Management Techniques for Hard Disks, System-Level Energy Management, Objectives of Green Network Protocols, Green Network Protocols and Standards.

UNIT - IV INFORMATION SYSTEMS, GREEN IT STRATEGY AND METRICS — 6 Hours

Approaching Green IT Strategies, Business Drivers of Green IT Strategy, Business Dimensions for Green IT Transformation, Multilevel Sustainable Information, Sustainability Hierarchy Models, Product Level Information, Individual Level Information, Functional Level Information, Organizational Level Information, Regional/City Level Information, Measuring the Maturity of Sustainable ICT.

UNIT - V GREEN IT SERVICES AND ROLES — 6 Hours

Factors Driving the Development of Sustainable IT, Sustainable IT Services (SITS), SITS Strategic Framework, Sustainable IT Roadmap, Organizational and Enterprise Greening, Information Systems in Greening Enterprises, Greening the Enterprise: IT Usage and Hardware, Inter-organizational Enterprise Activities and Green Issues, Enablers and Making the Case for IT and the Green Enterprise.

UNIT – VI MANAGING AND REGULATING GREEN IT **6 Hours**

Strategizing Green Initiatives, Implementation of Green IT, Information Assurance, Communication and Social Media, The Regulatory Environment and IT Manufacturers, Nonregulatory Government Initiatives, Industry Associations and Standards Bodies, Green Building Standards, Green Data Centres, Social Movements and Greenpeace.

Text Book

1. San Murugesan, G. R. Gangadharan: Harnessing Green IT,WILEY 1st Edition-2013

414464 D - ELECTIVE IV : INTERNET OF THINGS

Teaching Scheme:
Lectures: 3 Hours/Week

Examination Scheme:

In-Semester Assessment	End-Semester Assessment
Phase I – 30 Marks	Phase II – 70 Marks

Prerequisites : Fundamentals of Computer Network, Computer Network

Course Objectives :

1. To understand what Internet of Things is.
2. To get basic knowledge of RFID Technology, Sensor Technology and Satellite Technology.
3. To make students aware of resource management and security issues in Internet of Things.

Course Outcomes :

At the end of this course, students will be able to:

1. Explain what Internet of Thins is.
2. Describe key technologies in Internet of Things.
3. Understand wireless sensor network architecture and its framework along with WSN applications.
4. Explain resource management in the Internet of Things.
5. Understand business models for the Internet of Things.

UNIT - I INTRODUCTION 6 Hours

What is the Internet of Things? : History of IoT, About IoT, Overview and Motivations, Examples of Applications, Internet of Things Definitions and Frameworks : IoT Definitions, IoT Architecture, General Observations, ITU-T Views, Working Definition, IoT Frameworks, Basic Nodal Capabilities

UNIT - II FUNDAMENTAL IoT MECHANISMS AND KEY TECHNOLOGIES 6 Hours

Identification of IoT Objects and Services, Structural Aspects of the IoT, Environment Characteristics, Traffic Characteristics, Scalability, Interoperability, Security and Privacy, Open Architecture, Key IoT Technologies, Device Intelligence, Communication Capabilities, Mobility Support, Device Power, Sensor Technology, RFID Technology, Satellite Technology,

UNIT - III RADIO FREQUENCY IDENTIFICATION TECHNOLOGY 6 Hours

RFID: Introduction, Principle of RFID, Components of an RFID system, Issues

EPCGlobal Architecture Framework: EPCIS & ONS, Design issues, Technological challenges, Security challenges, IP for IoT, Web of Things.

Wireless Sensor Networks: History and context, WSN Architecture, the node, Connecting nodes, Networking Nodes, Securing Communication

WSN specific IoT applications, challenges: Security, QoS, Configuration, Various integration approaches, Data link layer protocols, routing protocols and infrastructure establishment.

UNIT - IV RESOURCE MANAGEMENT IN THE INTERNET OF THINGS 6 Hours

Clustering, Software Agents, Clustering Principles in an Internet of ThingsArchitecture, Design Guidelines, and Software Agents for Object Representation, Data Synchronization.

Identity portrayal, Identity management, various identity management models: Local, Network, Federated and global web identity, user-centric identity management, device centric identity management and hybrid-identity management, Identity and trust.

UNIT - V INTERNET OF THINGS PRIVACY, SECURITY AND GOVERNANCE **6 Hours**

Vulnerabilities of IoT, Security requirements, Threat analysis, Use cases and misuse cases, IoT security tomography and layered attacker model, Identity establishment, Access control, Message integrity, Non-repudiation and availability, Security model for IoT.

UNIT - VI BUSINESS MODELS FOR THE INTERNET OF THINGS **6 Hours**

Business Models and Business Model Innovation, Value Creation in the Internet of Things, Business Model Scenarios for the Internet of Things.

Internet of Things Application : Smart Metering Advanced Metering Infrastructure, e-Health Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards,

Text Books

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. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer
3. Parikshit N. Mahalle& Poonam N. Railkar, "Identity Management for Internet of Things", River Publishers, ISBN: 978-87-93102-90-3 (Hard Copy), 978-87-93102-91-0 (ebook).

Reference Books

1. Hakima Chaouchi, " The Internet of Things Connecting Objects to the Web" ISBN : 978-1-84821-140-7, Willy Publications
2. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, ISBN: 978-1-119-99435-0, 2nd Edition, Willy Publications
3. Daniel Kellmereit, Daniel Obodovski, "The Silent Intelligence: The Internet of Things",. Publisher: Lightning Source Inc; 1 edition (15 April 2014). ISBN-10: 0989973700, ISBN-13: 978-0989973700.
4. Fang Zhaho, Leonidas Guibas, "Wireless Sensor Network: An information processing approach", Elsevier, ISBN: 978-81-8147-642-5.

414464 E - ELECTIVE IV : OPEN ELECTIVE

In this subject, a student can opt for a subject from other branch of engineering (preferably *Computer Engineering* and *Electronics & Telecommunication*). An institution may design the syllabus of a subject in consultation with a software company/industry. This syllabus will be approved by the University authorities and then students can opt for the same as an open elective.

414465 : SOFTWARE LABORATORY – V

Teaching Scheme:
Practical : 2 Hours/Week

Examination Scheme:
Term Work : 25 Marks
Practical : 25 Marks

Prerequisites: Operating System, Computer Networks and Web Engineering and Technology.

Course Objectives :

1. To understand the fundamentals of distributed environment in complex application.
2. To get comprehensive knowledge of the architecture of distributed systems.
3. To make students aware about security issues and protection mechanism for distributed environment.

Course Outcomes :

After completion of the subject, the students will be able to:

1. Understand the principles on which the internet and other distributed systems are based.
2. Understand and apply the basic theoretical concepts and algorithms of distributed systems in problem solving.

Contents

1. Design a distributed application using RMI for remote computation where client submits two strings to the server and server returns the concatenation of the given strings.
2. Design a distributed application using RPC for remote computation where client submits an integer value to the server and server calculates factorial and returns the result to the client program.
3. Design a distributed application using Message Passing Interface (MPI) for remote computation where client submits a string to the server and server returns the reverse of it to the client.
4. Design a distributed application which consist of a server and client using threads.
5. Design a distributed application which consists of an agent program that program travels in the network and performs a given task on the targeted machine. You may assign any task to the agent e.g. to carry out the existing file opening and reading number of vowels present in that file.
6. 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.
7. 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.
8. Design and develop a distributed Hotel booking application using Java RMI.

   A distributed hotel booking system consists of the hotel server and the client machines. The server manages hotel rooms booking information. A customer can invoke the following operations at his machine

   i) Book the room for the specific guest
   ii) Cancel the booking of a guest

1. Enquire the check in date for the specified customer/guest.

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”, 5th Edition, Publisher: Pearson, ISBN – 978-13-214301-1.
2. Randay Chow, Theodore Johnson, “Distributed Operating System and Algorithm Analysis”, Publisher: Pearson (LPE). ISBN – 978-81-317-2859-8.

414466 : SOFTWARE LABORATORY – VI

Teaching Scheme:
Practical : 4 Hours/Week

Examination Scheme:
Practical : 50 Marks
Oral : 50 Marks

Prerequisites : Database Management System

Course Objectives :

1. To learn and understand Database Modeling, Architectures.
2. To learn and understand Advanced Database Programming Frameworks.
3. To learn and understand web database language, XML, JDOQL.
4. To learn NoSQL Databases (Open source) such as Hive/ Hbase/ Cassendra/DynamoDB.

Course Outcomes :

1. Understanding of Advanced Database Programming Languages.
2. Master the basics of web and object oriented database languages and construct queries using XML and JDOQL.
3. Master the basic concepts of NoSQL Databases.
4. Understand how analytics and big data affect various functions now and in the future.
5. Appreciate the impact of analytics and big data on the information industry and the external ecosystem for analytical and data services.

Contents

1. Study and Configure Hadoop for Big Data
2. Study of NoSQL Databases such as Hive/Hbase/Cassendra/DynamoDB
3. Design Data Model using NoSQL Databases such as Hive/Hbase/Cassendra/DynamoDB
4. Implement any one Partitioning technique in Parallel Databases
5. Implement Two Phase commit protocol in Distributed Databases
6. Design Persistent Objects using JDO and implement min 10 queries on objects using JDOQL in ObjectDB NOSQL DATABASE
7. Create XML, XML schemas , DTD for any database application and implement min 10 queries using XQuery FLOWR expression and XPath
8. Design database schemas and implement min 10 queries using Hive/ Hbase/ Cassendra column based databases
9. Design database schemas and implement min 10 queries using DynamoDBkeyValue based databases
10. Implement Web Page ranking algorithm
11. Implement any one machine learning algorithm for classification / clustering task in BIG data Analytics
12. Design and Implement social web mining application using NoSQL databases, machine learning algorithm, Hadoop and Java/.Net

Instructor should maintain progress report of mini project throughout the semester from project group and assign marks as a part of the term work

Instructor should frame Practical Assignments based on above mentioned list of assignments. Submission of each Practical Assignment should be in the form of handwritten write-ups/ printout of

source code and output. Instructor should assign an assignment no. 12 to a group of 3 - 4 students Practical Examination will be based on the all topics covered and questions will be asked to judge understanding of practical performed at the time of practical examination
Group of students should submit the Report for assignment no. 12 which will be consist of Title of the Project, Abstract, Introduction, scope, Requirements, Data Modeling , Database design, Algorithms, Graphical User Interface, Source Code, Testing document, Conclusion.

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. http://nosql-database.org/
2. Hadoop, O'Reilly Publications.
3. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", 6thEdition, McGraw Hill Publishers, ISBN 0-07-120413-X.
4. http://www.objectdb.com/database/jdo
5. Data Mining: Concepts and Techniques by Jiawei Han, MichelineKamber, Jian Pei, Elsevier.

414467 : PROJECT WORK

Teaching Scheme:
Tutorial : 6 Hours/Week

Examination Scheme:
Term work : 50 Marks   Oral : 100 Marks

Prerequisites :BE-Project Phase I – Semester I, Project Based Seminar

Course Objectives :

1. To expose students to product development cycle using industrial experience, use of state of art technologies.
2. To encourage and expose students for participation in National/International paper presentation activities and funding agency for sponsored projects.
3. Exposure to Learning and knowledge access techniques using Conferences, Journal papers and anticipation in research activities.

Contents

Reviews3: Based on Implementation (50% implementation expected)

Reviews4: Complete Project and Testing

Project Exhibition: All TE students must see all the projects in the exhibition

The group will submit at the end of semester II.

a) The Workable project.
b) 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

Plagiarism Report of paper and project report from any open source tool

One paper should be published in reputed International conference/International journal

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]

CODE	TEACHING SCHEME	EXAMINATION SCHEME					CREDITS
	Lect. /Week	Paper		TW	Oral/ Presentation	Total	
		In Semester Assessment	End Semester Assessment				
502209	4	50	50	-	-	100	4

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]

CODE	TEACHING SCHEME	EXAMINATION SCHEME					CREDITS
	Lect. /Week	Paper		TW	Oral/ Presentation	Total	
		In Semester Assessment	End Semester Assessment				
502211	4	-	-	50	50	100	4

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

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
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 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	**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: 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	**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: 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	Examination Scheme
Lectures: 1 hours/week	In semester Exam. : 25 marks
Credits: 1	

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	Examination Scheme
Lectures: 1 hours/week	In semester Exam. : 25 marks
Credits: 1	

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
Lectures: 1 hours/week
Credits: 1

Examination Scheme
In semester Exam. : 25 marks

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	**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

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	**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

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	**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 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	**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: 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, $P - \Delta$ 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	**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

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	**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

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	**Examination Scheme**
Lectures: 1 hours/week	**In semester Exam. : 25 marks**
Credits: 1	

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	**Examination Scheme**
Lectures: 1 hours/week	**In semester Exam. : 25 marks**
Credits: 1	

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.

UNIVERSITY OF PUNE, PUNE

Structure and Syllabus

FOR

M. E. (Mechanical) (Design Engineering)
2013-Course

UNDER FACULTY OF ENGINEERING

EFFECTIVE FROM JULY 2013

M.E. Mechanical Engineering (Design Engineering) - 2013 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
502204	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 Programmes**

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. Structures of Metals and Ceramics
Atomic structure and inter-atomic bonding, structures of metals and ceramics, crystal structures, crystallographic directions and planes, crystalline and non-crystalline materials, polymer structure, Imperfections in solids, point defects, linear defects, interfacial defects, volume defects, diffusion mechanisms, diffusion in ionic and polymeric materials

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, torsion test, 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, shakedown 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, Inc.
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. Mechanical Behaviour of Materials, Dominique Francois, Andre Pineau, Andre Zaoui, Springer, 2012
6. Mechanical Behaviour of Materials, W. F. Hosford, Cambridge University Press, 2005

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 Plasticity
Different criterions for three dimensional stress analysis using plasticity, evaluation of stress concentration factors in different geometries using plasticity theorem, practical problems on stress analysis for plasticity-stress in the sharp groove of the shaft, stress in the L shaped bracket under cantilever load, strain rate effects on highly deformable materials and stress calculations.

3. Stress Analysis of Engineering Plastics and Composites
Types of engineering plastics (Nylon, ABS, PP) failure modes, failure phenomenon in two and three dimensional stress analysis, wear and tear of plastics, impact properties of plastics, types of composites (fiber reinforced plastics), evaluation of elastic properties of composites, stress analysis of composite circular tubes (internal and external pressure), flat plate fixed at the edges and concentrated load, uniformly distributed load

4. Plate bending
Bending of plate to cylindrical surface, bending of a long uniformly loaded rectangular plate, pure bending in two perpendicular directions, bending of circular plates loaded symmetrically w.r.t. center, bending of circular plates of variable thickness, circular plate with circular hole at center symmetrically loaded and load distributed along inner and outer edges

5. Contact stresses
Geometry of contact surfaces, method of computing contact stresses and deflection of bodies in point contact, stress for two bodies in line 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

6. Experimental stress analysis
Dimensional analysis, analysis techniques, strain gauges, types of strain gauges, materials, configuration, instrumentation, characteristics of strain gauge measurement, theory of photoelasticity, 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, McGraw Hill
3. Advanced Mechanics of Materials – Boresi, Schmidt, Sidebottom, Willey
4. Theory of Elasticity – Timoshenko and Goodier, Mc Graw Hill
5. Advanced Strength of Materials, Vol. 1, 2 – Timoshenko, CBS
6. Advanced Strength of Materials – Den Harteg
7. Experimental Stress Analysis – Dally & Riley
8. Theory of Plates and Shells – Timoshenko Mc Graw Hill
9. The Mathematical Theory of Plasticity - R. Hill, Oxford University Press, 1998

Semester – I
Research Methodology [502204]

CODE	TEACHING SCHEME	EXAMINATION SCHEME					CREDITS
	Lect. /Week	Paper		TW	Oral/ Presentation	Total	
		In Semester Assessment	End Semester Assessment				
502204	4	50	50	-	-	100	4

1. Research Problem
Meaning of research problem, Sources of research problem, Criteria / Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem

2. 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 is collected data contains noise.

3. Applied statistics
Regression analysis, 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

4. Modelling and prediction of performance
Setting up a computing model to predict performance of experimental system, 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 theory and applications.

5. Developing a Research Proposal
Format of research proposal, Individual research proposal, Institutional proposal, Proposal of a student – a presentation and assessment by a review committee consisting of Guide and external expert only, Other faculty members may attend and give suggestions relevant to topic of research.

<u>**In semester assessment is to be carried out by two internal tests and five assignments one on each unit.**</u>

Reference Books:
1. 'Research methodology: an introduction for science & engineering students', by Stuart Melville and Wayne Goddard
2. 'Research Methodology: An Introduction' by Wayne Goddard and Stuart Melville
3. 'Research Methodology: A Step by Step Guide for Beginners', by Ranjit Kumar, 2nd Edition
4. 'Research Methodology: Methods and Trends', by Dr. C. R. Kothari
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. Complex Mechanisms
Types of complex mechanisms, velocity-acceleration analysis of complex mechanisms by the normal acceleration and auxiliary point methods, Goodman's indirect acceleration analysis

2. Planar Mechanisms Dynamic Analysis
Inertia forces in linkages, principle of super position, analysis of elastic mechanisms, beam element, displacement fields for beam element, element mass and stiffness matrices, system matrices, elastic linkage model, equations of motion.

3. Curvature theory
Fixed and moving centrodes, inflection circle, Euler- Savy 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, three and four accuracy points using pole method, center point and circle point curves, Bermester points, synthesis for five accuracy 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, synthesis of four-bar for prescribed angular velocities and accelerations using complex numbers, 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, cognates

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. Mechanism Design - Analysis and Synthesis (Vol.1 and 2), A. G. Erdman and G. N. Sandor, Prentice Hall
4. Theory of Machines and Mechanisms, J. E. Shigley and J. J. Uicker, 2nd Ed. McGraw-Hill.
5. Design of Machinery: An Introduction to the Synthesis and Analysis of Mechanisms and Machines, Robert L. Norton, Tata McGraw-Hill, 3rd Edition.
6. Kinematics and Linkage Design, A. S. Hall, Prentice Hall of India.

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 undamped 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, impulse response and frequency response functions.

2. Continuous System

Vibrations of String, Bars, Shafts and beams, free and forced vibration of continuous systems

3. Transient vibrations

Response of a single degree of freedom system to step and any arbitrary excitation, convolution (Duhamel’s) integral, impulse response functions

4. Vibration Control

Balancing of rotating machine, in-situ balancing of rotors, control of natural frequency introduction of damping, vibration isolation and vibration absorbers

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, CBS Publishers, Delhi

2. Mechanical Vibrations, S. S. Rao, Addison-Wesley Publishing Co

3. Fundamentals of Vibration, Leonard Meirovitch, McGraw Hill International Edison

4. Principles of Vibration Control: Ashok Kumar Mallik, Affiliated East-West Press

5. Mechanical Vibrations, A H Church, John Wiley & Sons Inc

6. Mechanical Vibrations, J P Den Hartog, McGraw Hill

7. Mechanical Vibration Analysis, Srinivasan, McGraw Hill

8. Mechanical Vibrations, G K Groover

Semester - II
Finite Element Method [502209]

CODE	TEACHING SCHEME	EXAMINATION SCHEME					CREDITS
	Lect. /Week	Paper		TW	Oral/ Presentation	Total	
		In Semester Assessment	End Semester Assessment				
502209	4	50	50	-	-	100	4

1. Introduction – Finite element method, brief history, basic steps, advantages and disadvantages, weak formulation, variational methods of approximation – Rayleigh-Ritz methods, Methods of Weighted Residuals (Galerkin, Least-squares & Collocation methods), 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, postprocessing of the results.

2. Isoparametric Elements and Formulation of Plane Elasticity Problems
Introduction, 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, numerical integration – Trapezoidal rule, Simpson’s 1/3 rule, Newton-Cotes Formula, Gauss Quadrature formula, Gauss Quadrature in two and three dimensions

3. Plate Bending Problems – Plate and Shell Elements
Introduction, thin and thick plates – Kirchoff theory, Mindlin plate element, triangular and rectangular, conforming and nonconforming elements, degenerated shell elements, reduced and selective integration, shear locking and hour glass phenomenon

4. 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

5. 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

6. Special Topics
Linear buckling analysis, adaptive finite element technique, error estimation, h & p refinements, symmetry – mirror/plane, axial, cyclic & repetitive, submodelling and substructuing

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]

CODE	TEACHING SCHEME	EXAMINATION SCHEME					CREDITS
	Lect. /Week	Paper		TW	Oral/ Presentation	Total	
		In Semester Assessment	End Semester Assessment				
502211	4	-	-	50	50	100	4

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. Lele M. M.*, 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. Classical Optimization Techniques
Engineering applications of optimization, statement of optimization problem, classification of optimization problem, single variable optimization, multi variable optimization with no constraint, equality constraint, in-equality constraint

2. Linear Programming
Simplex algorithm, two phases of the simplex method, applications

3. Non-Linear Programming
One-dimensional minimization - exhaustive search, golden section method, quasi-newton method, random search methods, Powell’s method

4. Modern Methods of Optimization
Genetic algorithms, simulated annealing, fuzzy optimization, neural-network-based methods

5. Topology Optimization
Problem formulation and parameterization of design, solution methods, topology optimization as a design tool, combining topology and shape design, buckling problems, stress constraints

6. Evolutionary Structural Optimization (ESO) Methods
ESO Based on Stress Level, evolutionary methods, two-bar frame, Michell type structure, ESO for stiffness or displacement optimization, Bi-directional Evolutionary Structural Optimization (BESO) method, BESO Based on von Mises Stress, topology optimization for natural frequency

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

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. Instrument types and performance characteristics
Active and Passive instruments, Null type and deflection type instruments, Analogue and digital instruments, Indicating instruments and instruments with signal output, smart and non smart instruments. Static and Dynamic characteristics of instruments, Necessity of calibration

2. Measurement Uncertainty
Sources of Systematic Error, System Disturbance due to Measurement, Errors due to Environmental Inputs, Wear in Instrument Components, Accumulation of Accepted Error, Improper Functioning of Instruments, Dual Sensitivity Errors, Other Sources of Error, Minimizing Experimental Error, Statistical Analysis of Measurements subject to Random Errors, Aggregation of Measurement System Errors, Reduction of Systematic Errors, Quantification of Systematic Errors, Sources and Treatment of Random Errors, parameter estimation, regression analysis, correlations, analysis of data

3. Measurement of field quantities
Temperature, heat flux measurement, heat transfer coefficient, measurement of force, pressure, flow rate, velocity, humidity, noise, vibration

4. Measurement of derived quantities
Force, Acceleration, Torque, power, thermo physical properties, radiation and surface properties, Miscellaneous Measurements - Time, Frequency, and Phase-Angle Measurement, Liquid Level, Chemical Composition, Current and Power Measurement

5. Control in Time Domain
Introduction to open loop and closed loop control, Modelling of system using state space approach (only second order mechanical, electro-mechanical, thermal and hydraulic system), Poles and Zeros of System, Stability of system using Lyapunov's criterion, Controllability of system, Full state feedback control of system using pole placement technique, Pole placement using Ackerman's formula

6. Control in Frequency Domain
Modelling of system using transfer function (only second order mechanical, electro-mechanical, thermal and hydraulic system), Transient response of system based on location of poles, Transient response specifications for second order system, Stability of system based on Routh Hurwitz criterion, Analysis of second order system using Bode Plots, Closed loop control of system using Proportional Integral Derivative Control

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. Mechanical Measurements, S.P. Venkateshan, Ane Books Pvt. Ltd

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. Lele M.M.*, 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 *Mr. Lele M.M.*, 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

____
Head
Department and
Institute Name

External Examiner

Seal

____
Principal,
Institute Name

SYLLABUS

OF

M.E. CIVIL (STRUCTURES)
w.e.f. July,2013

University of Pune
M.E. (Civil) (Structures)
COURSE STRUCTURE (2013Course)
(w.e.f. June – 2013)
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					Credits
		Lect./ Pract.	Paper		T. W.	Oral / Presentation	Total	
			In Semester Assessment	End Semester Assessment				
501 001	Advanced Mechanics of Solids	4	50	50	--	--	100	4
501 002	Structural Dynamics	4	50	50	--	--	100	4
501 003	Advanced Design of Steel Structures	4	50	50	--	--	100	4
501 004	Research Methodology	4	50	50	--	--	100	4
501 005	Elective –I	5	50	50	--	--	100	5
501 006	Lab Practice- I	4			50	50	100	4
	Total	**25**	**250**	**250**	**50**	**50**	**600**	**25**

501 005-Elective I

Code	2 Credits Course	Code	1 Credit Course	Code	Audit Course (No Credit Course)
501 005A	Cyber Security/Information security	501 005 F	Economics & Finance For Engineers	501 005 K	Mass communication, Photography and Videography
501 005 B	Soil Structure Interaction	501 005 G	Foreign Language – I	501 005 L	Yoga and Meditation
501 005 C	Plastic Analysis and Design of Steel Structure	501 005 H	Engineering Ethics		
501 005	Optimization	501	Intellectual		

D	techniques	005 I	Property Rights		
501 005E	Mechanics of modern materials				

SEMESTER –II

Code	Subject	Teaching Scheme	Examination Scheme					Credits
		Lect. / Pract.	Paper		TW	Oral / Presentation	Total	
			In Semester Assessment	End Semester Assessment				
501 007	Finite Element Analysis	4	50	50	--	--	100	4
501 008	Theory of Plates & Shells	4	50	50	--	--	100	4
501 009	Advanced Design of Concrete Structures	4	50	50	--	--	100	4
501 010	Elective- II	5	50	50	--	--	100	5
501 011	Lab Practice- II	4	--	--	50	50	100	4
501 012	Seminar –I	4	--	--	50	50	100	4
	Total	25	200	200	100	100	600	25

501 010-Elective II

Code	2 Credits Course *L*	Code	1 Credit Course	Code	Audit Course (No Credit Course)
501010 A	Human Rights	501010 E	Foreign Language II	501010 I	Performing Arts – Music and Dance
501010 B	Design of precast components and Ferrocement	501010 F	Building Services and Maintenance	501010 J	Principle Centred Leadership
501010 C	Design of	501010 G	Green		

	Foundations		Building Design and Construction		
501010 D	Non linear Analysis of structure	**501010 H**	Forensic Civil Engineering		

SEMESTER –III

Code	**Subject**	**Teaching Scheme**	**Examination Scheme**					**Credits**
		Lect./ Pract.	**Paper**		**T. W.**	**Oral / Presentation**	**Total**	
			In Semester Assessment	**End Semester Assessment**				
601 013	Earthquake Engineering and Disaster management	4	50	50	--	--	100	4
601 014	Design of RCC&Prestressed CementConcrete Bridges	4	50	50	--	--	100	4
601 015	Elective- III	5	50	50			100	5
601 016	Seminar-II	4			50	50	100	4
601 017	Project stage I	8	--	--	50	50	100	8
	Total	25	150	150	100	100	500	25

601 015--Elective III

Code	**2 Credits Course** *L*	**Code**	**1 Credit Course**	**Code**	**Audit Course (No Credit Course)**
601 015A	Bio Mechanics and Bio Materials	**601015E**	Design of Composite Construction	**601015H**	Chess
601015B	Adv analysis of steel Frames	**601015F**	Foreign Language	**601015 I**	Abacus

601015C	Theory of Plasticity	**601015G**	Safety Practices in construction.		
601015D	Design of Concrete Shell Structures				

SEMESTER –IV

Code	Subject	Teaching Scheme	Examination Scheme					Credits
		Lect./ Pract.	Paper		TW	Oral/Presentation	Total	
			In Semester Assessment	End Semester Assessment				
601 018	Seminar III	5	--	--	50	50	100	5
601 019	Project Work Stage II	20	--	--	150	50	200	20
	Total	**25**	**--**	**--**	**200**	**100**	**300**	**25**

University of Pune
M.E. (Civil) (Structures)--2013Course
Semester I
1Credit =2 Modules=15 Hrs.
501 001 - Advanced Mechanics of Solids

Teaching Scheme	**Examination Scheme**
Lectures: 4 hours/week	**In semester Exam: 50 marks**
Credits 4	**End Sem. Exam. : 50 marks**
	Duration of End Sem.Exam:3Hrs

Module1:
Analysis of Stresses and Strains
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 and stress compatibility conditions, Relations between Elastic Constants, Problems on Navier Lame's Equilibrium Equations, Problems on Beltrami-Michell compatibility equations, Boundary value problems in Elasticity.
Module 2:
Stress-Strain Relationship
Generalized Hook's law for Isotropic, Orthotropic, plane stress, plane strain and axisymmetric problems, Problems in 2D and 3D Cartesian coordinate system, Airy's stress function, bending of beams.
Module 3:
Polar Coordinate System
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,
Module 4:
Stress concentration problems
Stress concentration problems such as stress concentration due to circular hole in stressed plate(Kirsch's Problem), stresses under concentrated load such as concentrated load acting on the vertex of a wedge (Michell's Problem) and Concentrated load acting on the free surface of a plate (Flamant's Problem), Axisymmetric Problems such as stresses in thick cylinders subjected to internal and external uniformly distributed pressures (Lame's Problem).
Module5:
Beams Curved in Plan
Analysis of Beams Curved in Plan such as cantilever circular arc, Semicircular beams fixed at two ends and subjected to central concentrated load, simply supported semicircular beam subjected to UDL supported on three equally spaced columns, Analysis of circular ring beam.
Module6:
Beams Curved in Elevation
Analysis of Beams Curved in Elevation, Application to curved circular and elliptical Rings and Crane hooks.
Module7:
Torsion
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, Torsion of thin-walled structures by membrane analogy, Torsion of rolled sections and shear flow

Module 8:

Beams on Elastic Foundation

Differential equation, Infinite beams with concentrated load, concentrated moment, and finite uniformly distributed load. Semi-Infinite beams with free & hinged ends subjected to finite uniformly distributed load, hinged end. Finite beams with free end and hinged end.

Reference Books

1. Swaroop Adarsh---Mechanics of Materials------- New Age International Publishers
2. S. Crandall, N. Dahl and T. Lardner - Mechanics of Solids, McGraw Hill Publications
3. S.S.Bhavikatti – Structural Analysis-II Vikas Publishing House, Pvt Ltd.
4. Enrico Volterra and J. H. Gaines – Advanced Strength of Materials, Prentice Hall
5. Nautiyal, B.D.--Introduction to Structural Analysis--- New Age International Publishers
6. S M A Kazimi – Solid Mechanics, Tata McGraw-Hill Publications
7. Irving Shames, Mechanics of deformable solids, Prentice Hall
8. Scholer, Elasticity in Engineering, McGraw-Hill Publications
9. Sadhu Singh – Theory of Elasticity, Khanna Publishers
10. L.S.Sreenath – Advanced Mechanics of Solids, Tata McGraw-Hill Publications
11. N. K. Bairagi- Advanced Solid Mechanics- Khanna Publishers, New Delhi.
12. Timoshenko and Goodier - Theory of Elasticity, McGraw-Hill Publications
13. Wang - Applied Elasticity, Dover Publications

University of Pune
M.E. (Civil) (Structures)--2013Course
Semester I
1Credit =2 Modules=15 Hrs.

501 002 : Structures Dynamics

Teaching Scheme	**Examination Scheme**
Lectures: 4 hours/week	**In semester Exam: 50 marks**
Credits 4	**End Sem. Exam. : 50 marks**
	Duration of End Sem.Exam:3Hrs

Module1:
Nature of exciting forces, degrees of freedom and mathematical modelling of dynamic systems. Single degree freedom system (SDOF): An undamped and damped free vibrations, Viscous and Coulomb's damping.

Module 2:
SDOF system: Undamped and damped Forced Vibrations to harmonic excitations, Fourier analysis of periodic forces. Response to unit impulse and arbitrary loading by Duhamel's integral.

Module 3:
SDOF system: Step and Ramp forces, Pulse loadings, Response to ground motion and transmissibility..

Module4:
Non-linear analysis by step-by-step method with linear acceleration

Module 5:
Multiple degrees of freedom (MDOF) system: Free vibrations of a shear building, fundamental frequencies and mode shapes,

Module6:
Orthogonality of mode shapes, Power and Stodola methods. Concept of Tuned Mass Dampers..

Module7:
MDOF System: Forced Vibrations of shear building, transformation of coordinates and mode superposition method, Response to ground motion. Non-linear analysis by Wilson-Theta method

Module8:
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.

Lab Practice assignment for the term work:
Report on the experimental work based on Horizontal and Vertical Shake Table

Reference Books
1. Dynamics of structures--Poultre, Wiley India
2. Mario Paz – Structural Dynamics Theory and Computation, CBS Publications
3.Anil K Chopra – Dynamics of Structures Theory and Applications to Earthquake Engineering,
Prentice-Hall Publications
4.R.W Clough and J Penzin – Dynamics of Structures, McGraw Hill Publications
5.R.C. Roy - Structural Dynamics an Introduction to Computer Methods, John Wiley & Sons Publications.

6.Madhujit Mukhopadhyay – Structural Dynamics Vibrations and Systems, Ane Books India Publishers

---

University of Pune
M.E. (Civil) (Structures)--2013Course
Semester I
1Credit =2 Modules=15 Hrs.

501 003 : Advanced Design of Steel Structures

Teaching Scheme	Examination Scheme
Lectures: 4 hours/week	In semester Exam: 50 marks
Credits 4	End Sem. Exam. : 50 marks
	Duration of End Sem.Exam:3Hrs

Module1: Hoarding Structures - Analysis and design of hoarding structures under dead, live and wind load conditions as per codal provisions by limit state method, introduction to fatigue failure.

Module 2: Castellated beams - Concept, fabrication of the castellated beam from rolled steel section, design of castellated beam for bending and shear as per codal provisions by limit state method.

Module 3: Microwave Towers - Introduction, structural configuration, function, analysis and design.

Module 4Transmission Towers - Introduction, structural configuration, bracing systems, analysis and design as per codal provisions. Use working stress method.

Module 5: Tubular Structures - Design of tubular Trusses and scaffoldings using circular hollow, rectangular hollow sections as per codal provisions, detailing of joints.

Module 6: Cold form light gauge section - 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 codal provisions.

Module 7: Design of chimneys – Introduction, type, joints, lining, ladder, forces acting on chimneys, design of thickness of steel plates for self supporting chimney,

Module8 -Design of base plate, anchor bolt and foundation, stability of steel chimneys. Use working stress method.

References Books and I. S. Codes

1. Ram Chandra, Design of steel Structures, Volume II, Standard Book House, Delhi.

2. Punmia and Jain, Comprehensive Design of steel structure, Laxmi Publication, 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. Sarwar Alam Raz—Structural Design in Steel---New Age International Publishers

7. IS: 800 - 2007, Code of Practice for General Construction in Steel, BIS, New Delhi.

8. IS: 800 - 1984, Code of Practice for General Construction in Steel, BIS, New Delhi.

9. IS: 801 - 1975, Code of Practice for use of cold formed light gauge steel structural members in general building construction, BIS, New Delhi.

University of Pune
M.E. (Civil) (Structures)--2013Course
Semester I
1Credit =2 Modules=15 Hrs.

501 004 : Research Methodology

Teaching Scheme	**Examination Scheme**
Lectures: 4 hours/week	**In semester Exam: 50 marks**
Credits 4	**End Sem. Exam. : 50 marks**
	Duration of End Sem.Exam:3Hrs

Module1:
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

Module 2:
Developing a Research Proposal Format of research proposal, Individual research proposal, Institutional research proposal,Significance,objectives,methodology,Funding for the proposal,Different funding agaencies.Framework for the planning

Module 3:
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.

Module 4:
Data collection ,Measuring,Sampling and Scaling—Classification of data, benefits and drawbacks of data, evaluation of data,qualititative 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.

Module 5:
Preliminary data analysis- Testing of hypothesis- concepts and testing , analysis of variance techniques, introduction to non parametric tests.Valedity and reliability,Approaches to qualitative and quantitative data analysis,

Module 6:

Advanced data analysis techniques-Correlation and regression analysis, Introduction to factor analysis, discriminant analysis, cluster analysis, multidimensional scaling,Descriptive statistics,Inferential statistics,Mutidimentional measurementnand factor analysis

Module 7:

Report writing—Need of effective documentation, importance of report writing, types of reports, report structure, report formulation,Plagirism.

Module 8:

Presentation of research---Research briefing, presentation styles, impact of presentation, elements of effective presentation, Writing of research paper, presenting and publishing paper, patent procedure,

Reference Books:

1. Research Methodology: concepts and cases—Deepak Chawla and Neena Sondhi,Vikas Publishing House Pvt.Ltd. (ISBN 978-81-259-5205-3)
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.-ISBN-978-0-415-58336-7
5. Research Methodology: An Introduction' by 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.

e-Resource---For class room ppts---www.wileyeurope.com/college/sekaran

---

University of Pune
M.E. (Civil) (Structures)--2013Course
Semester I
1Credit =2 Modules=15 Hrs.

501 005 : ELECTIVE –I

Teaching Scheme	**Examination Scheme**
Lectures: 5 hours/week	**In semester Exam: 50 marks**
Credits 5	**End Sem. Exam. : 50 marks**
	Duration of End Sem.Exam:3Hrs

Select any combination having total of 5 credits from following technical / interdisciplinary courses

----------------Elective I

Code	2 Credits Courses	Code	1 Credit Courses	Code	Audit Courses (No Credit Course)
501 005 A	Cyber Security/Information security	**501 005 F**	Economics and Finance for Engineers	**501 005 K**	Mass communication, Photography and Videography
501 005 B	Soil Structure Interaction	**501 005 G**	Foreign Language - I	**501 005 L**	Yoga and Meditation

501 005 C	Plastic Analysis and Design of Steel Structure	**501 005 H**	Engineering Ethics		
501 005 D	Optimization technique	**501 005 I**	Intellectual Property Rights		
501 005 E	Mechanics of modern materials				

501 005 –A-Elective I - Cyber Security / Information security (2Credits course)

Module1:

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

Module2:

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.

Module 3:

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.

Module 4:

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,

Reference Books:

1) Bakshi P M and Sri R K, Cyber and E-commerce Laws, Bharat Publishing House, 1st Edn, 2002
2) Syed Shakil Ahmed, Rajiv Raheja, A handbook on Information technology: Cyber law and E-Commerce, Capital Law House, 2004

3) Rodney D Ryder, Business Process Outsourcing, Date Protection and Information Security, Wadhwa & Co., 1st Edn, 2001
4) Vakul Sharma, Information Technology Law and Practice, Delhi Law House, 3rd Edn, 2011
5) Lipton, K., Cyberspace Law Cases and Materials, 2nd edition. Aspen Publishers. NY: New York, 2006
6) Michael E Whitman and Herbert J Mattord, Principles of Information Security, Vikas Publishing House, New Delhi, 2003
7) Micki Krause, Harold F. Tipton, Handbook of Information Security Management, Vol 1-3 CRC Press LLC, 2004.
8) Michael E Whitman and Herbert J Mattord, Principles of Information Security, Vikas Publishing House, New Delhi, 2003

501 005 –B-Elective–I Soil Structure Interaction (2Credits course)

Module 1

Introduction, Importance and Applications of Soil Structure Interaction **(**SSI)

a) Introduction to SSI, Importance of SSI, Applications and examples of SSI for structural engineer, Effects of structure roughness/smoothness on soil behaviour.

b)General soil-structure interaction problems – Shallow Foundations, Sheet piles, Mat/Raft foundations etc., Contact pressures and soil-structure interaction for shallow Foundations, Fixed/Flexible Base.

Module 2:

Soil Structure Interaction - Parameters

a) Concept of sub grade modulus, effects/parameters influencing sub grademodulus, Flexiable and Rigid Foundations – Rigidity calculations, Static and Dynamic Spring Constants – Winkler Model, Estimation of soil spring constants/stiffness for foundations design.

b)SSI Models - Elastic Continuum, Winkler Model, Multi-Parameter Models, Hybrid Model. Structure Contact Interface

Module 3:

Soil Behaviour

a)Arching in soils. Elastic and plastic analysis of stress distribution on yielding bases. Analysis of conduits/pipes in soils. Beams on elastic foundation concept, introduction to the solution of beam problems.

b)Seismic Soil-Structure Interaction - Dynamic response of soil, strain-compatibility, and damping characteristics of soil-structure. Shake-table tests.

Module 4:

A) SSI in Retaining Structures: Curved failure surfaces, their utility and analytical/graphical predictions from Mohr-Coulomb envelope and circle of stresses. Earth pressure computations by friction circle method. Earth pressure distribution on walls with limited/restrained deformations, Dubravo's analysis. Earth pressures on sheet piles, braced excavations. Design of supporting system for excavations.

B)Soil-Pile Behaviour: Introduction, axial and laterally loaded piles, load-displacement behaviour, Modified Ramberg Osgood Model, pile group, interaction effect in pile group, soil-pile modelling in FEM, Elastic continuum and elasto-plasticanalysis of piles and pile groups. Non-linear load-deflection response.

Reference Books:

1. Bowels J.E., "Analytical and Computer Methods in Foundation", McGraw Hill Book Co. New York.
2. Desai C.S. and Christian J.T., "Numerical Methods in Geotechnical Engineering" McGraw Hill Book Co. New York.
3. Soil Structure Interaction, the real behaviour of structures, Institution of Structural Engineers, 1989.
4. Elastic Analysis of Soil Foundation Interaction, Developments in Geotechnical Engg.vol-17, Elsevier Scientific Publishing Co.
5. Prakash, S., and Sharma, H. D., "Pile Foundations in Engineering Practice."John Wiley & Sons, New York, 1990.

General Reading Suggested:

Codes/Hand books:

1)"Foundation Engineering Handbook," H.-Y. Fang, Editor, Van Nostrand Reinhold, 2nd Ed., New York, USA.

e-Resources:

1)http://trb.metapress.com/home/main.mpx ... … (Free Online Research Reports)

---

501 005 –C-Elective-I Plastic Analysis& Design of Steel Structure (2Credits course)

Module 1:

Plastic collapse loads of gable portal frames, various mechanisms.
Analysis of Multi Bay- Multi Storey rectangular portal frame, Joint & Various mechanisms (Two bays - Three storeys)

Module 2:

Secondary design considerations: Effect of axial force, shear, residual stresses and brittle fracture on moment capacity. Design of beams with high shear, interaction of bending & axial force: section and member strength.

Module 3:

Design of rectangular and gable portal frames Design of corner connection with and without haunches. Review of semi-rigid connections .

Module 4:

Design of beam to column Moment resisting connections. End plate: Flush & extended, T-Stub connections. Combined tension & shear considerations in welded & bolted connection.

Reference Books:

1) "Limit state Design of Steel Structures", S K Duggal , McGraw Hill education, 2010
2) "Limit State Design of Steel Structures", Dr. M R Shiyekar, PHI Publication, 3rd Print
3) A.S. Arya and J.L. Ajmani – Design of Steel Structures, Nemchand& Bros., Roorkee
4) Ramchandra – Design of Steel Structures Vol – II, Standard Book House, Delhi
5) B.G. Neal – Plastic Method of Structural Analysis, Chapman & Hall
6) L.S. Beedle – Plastic Design of Steel Frames, John Willey & Sons
7) Structural design in steel by Salwar Alam Raz New Age International Publishers

8) Steel Designers Manual – ELBS

General Reading Suggested:

1)Codes: IS: 800 - 2007 Code of Practice for General Construction in SteelHand books

2) SP: 6 (6) – 1972 Handbook for Structural Engineers: Application of plastic Theory in Design of Steel Structures

3) Handbook for Structural Engineers SP 6 (8) 1972 (Reaffirmed 1993) – Bureau of Indian Standards.

4) NPTEL

5)e-Recourses:)Teaching Resource for Structural Steel Design – INSDAG Kolkatta

---

501 005 –D-Elective –I Optimization Techniques (2Credit Course)

Module 1:

Linear Programming I: Introduction to Optimization techniques, Linear programming basic concepts, graphical method, Simplex method

Module 2:

Linear Programming II: Big M Method, Two phase method, Duality, sensitivity analysis. Application of Linear Programming to Hydraulics & Water Resource

Module 3:

Non Linear Programming: Unconstrained one Dimensional search methods: Dichotomous search method, Fibonacci, Golden section, Multivariable unconstrained techniques: Steepest ascent and Descent methods, Newton's methods, Constrained technique: Lagrangian Multiplier

Module 4:

Dynamic Programming:Principle of optimality, recursive equations.

Reference Books

1. Engineering Optimazation Theory & Practice – S.S. Rao., Wiely. Wiely.
2.Engineering Optimization—Methods and Applications—Ravindran,Wiely
2. Operation Research – Taha Hamdey A.
3. Principles of Operation Research – Wagner, Prentice Hall.
4. Operation Research – Hira and Gupta, S.Chand
5. Operation Research—Ravindran-- Wiely.

---

501 005 –E-Elective –I Structural Mechanics of Modern Materials (2 Credits course)

Module 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.

Module 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

a) Three dimensional transformations. Stress-Strain: Force Equilibrium, Strain Compatibility, Constitutive Laws of materials. Introduction to Fracture Mechanics.

b)Design of Steel Fiber Concrete elements – flexure, shear, ductility etc., smeared concept, constitutive models for FRC, codal provisions for FRC (ACI, RILEM etc.), Hybrid Fiber composites, behaviour of macro-micro-nano fiber matrix.

Stiffness matrix for Functionally Graded Materials.Pultruded Rod,GFRComposite,flexural members,Self healing Materials,Nano Composites.

Module 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.

Module 4

Elastic behaviour of Composite Laminates: Basic assumptions, Laminate configurations, Straindisplacement 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, antisymmetric cross-ply and angle ply, orthotropic, quasi-isotropic laminates.

Experimental Methods of Testing of Composite Materials: Fiber volume ratio, void volume ratio. Determination of, tensile, compressive and shear properties of unidirectional laminates. Testing of interlaminar fracture toughness, Biaxial testing. Introduction to stress concentration in laminates.

Reference Books

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. Roman Solecki and R Jay Conant – Advanced Mechanics of Materials, Oxford University Press,New York, Special Edition for sale in India.

---

501 005 –F- Elective –I Economics and Finance for Engineers (1Credit Course)

Module1:

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.

Module2:

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 –G- Elective –I Foreign Language -I (French-I) (1Credit Course)

Module1:

Introduction: Glimpse of France, life of French people (Culture, food, etc.), French alphabets, accent, etc., Unit zero of the Text Book (Grammar, Vocabulary, and Lesson), Exercise of Unit zero of Text Book & workbook

Module2:

French Lessons: Brief revision, Unit-1 of the Text Book (Grammar, vocabulary), Unit-1, Lesson 1 of the Text Book, Exercise of Unit-1, Lesson 1 of the Text book & workbook

Reference

1. Jumelage-I Text Book by Manjiri Khandekar & Roopa Luktuke (Latest edition)
2. Jumelage-I workbook by Roopa Luktuke

---

501 005 –H- Elective –I Engineering Ethics (1Credit Course)

Module1:

Introduction : Meaning & scope of Ethics in general & for engineers in particular, Moral obligations 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

Module2:

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 Enginerring Practice and Research---Carolin Whitbeck—Cambridge University Press—ISBN—978-1-107-66847-8

---

501 005 –I- Elective –I Intellectual Property Rights (1Credit Course)

Module1

Introduction to Intellectual Property Rights

Nature of Intellectual Property: Patents, Designs, Trademarks and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development.

International Scenario

International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Module2

Patent Rights

Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Recent Developments in IPR

Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies,

Reference Books
1 Prabuddha Ganguly, " Intellectual Property Rights",Tata Mc-Graw Hill.
2 Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007
3 Robert P. Merges, Peter S. Menell, Mark A. Lemley "Intellectual Property in New",

---

501 005 –K-Elective –I Mass communication, Photography and Videography

(Audit Course—No Credits)

Module 1:
Mass Communication - Theories & methods
Concepts and Theories, Communication concepts, Process and Function, Interpersonal & Intra personal, Group behaviour, need for Mass Communication. Relevance of Communication Theories to Practice, Models of Communication, Impact and Effect of Communication Old and new media, Communication Techniques, - Feedback and Evaluation of Communication Effect, Interview and Questionnaires- Method of Data Analysis, use of Information Technology, various methods of mass communication like seminars, conferences, print and digital media, internet, CDs, DVD, movies, U-tube, video conferencing.

Module 2 :
Photography and Videography
Camera Basics, Still Photography, Lenses, Exposure, Composition, Colour. Shot Angle, Camera Movement, Light techniques and final printing.
Videography Basics – Video camera –types, mounting. Sound Basics, Film Sound appreciation, Sound Track analysis, Editing Basics, Fragmentation
Juxtaposition: Frame, Shot, Sequence, Scene Time, Pace, Rhythm. Learning basic editing software and primary editing on available/given materials.

Reference Books
1. Richard Dimbleby and Graeme Burton, 1995, More than words: An introduction to communication, London: Routledge.
2. Melvin L. DeFleur and Everette E. Dennis, 1991, Understanding mass communication, New Delhi: Goyal Saab.
3. Marshall McLuhan, 1964, Understanding Media, New York: McGraw –Hill
4. Wilbur Schramm, 1964, Mass media and national development, the role of information in developing countries, Stanford: Stanford University Press.
5. Holman, Tomlinson, Sound for film and television, Focal Press
6. McCormick, Tim and Rumsey, Francis, Sound and recording: An introduction, Focal Press
7. Talbot-Smith, Michael, Sound engineering explained, Focal Press
8. Talbot-Smith, Michael, Sound assistance, Focal Press
9. Altman, Rick, ed., Sound theory sound practice, Routledge Talbot-Smith, Michael, Sound engineer's pocket book, Focal Press
10. Truebitt, Rudy and David, Trubitt, Live sound for musicians,
11. Hal Leonard Nathan, Julian, Back to basic audio,
12. Newnes Yewdall, Lewis, David, Practical art of motion picture sound, Focal Press
13. Leider, N., Colby, Digital audio workstation, McGraw-Hill

---

501 005 –L-Elective I Yoga and Meditation (Audit course--Non Credit course)

Module 1

Yoga: Sukshma (subtle) yoga techniques, Difference between physical exercises and yogasans, Impact of yogasans on human body, benefits of yogasans, Patanjali yoga sutras, Technique of different yogasans like, Trikonasan, Ardhachandrasan, Padmasan, Akarnadhanurasan, Ardhamatsendrasan, Vajrasan, Pachhimottanasan, Bhujangasan, Shalbhasan, Dhanurasan, Naukasan, Makrasan, Pawanmuktasan, Halasan, Sarvangasan, Shavasan, Suryanamaskar(Sun Salutation), Yoga and Food.

Module 2

Meditation: Breathing Technique, Pranayam, Benefits of Pranayam, Precautions for Pranayam, Kumbhak, Bandh(Locks), Chakras, Mudra, Technique of Pranayam,Anulom-VilomPranayam, UjjayiPranayam, BhramariPranayam, BhastrikaPranayam, AgnisarPranayam, KapalbhatiPranayam, Meditation(Dhyan).

References Books:

Light on Yoga: by B.K.S. Iyengar, Harper Collins Publishers India

1. Light on Pranayama: by B.K.S. Iyengar, Harper Collins Publishers India
2. Yoga for Dummies by Georg Feuerstein and larry Payne, Wiley India publishing
3. Yoga, Pilates, Meditation & Stress Relief By Parragon Books Ltd
4. The Yoga Sutrasby Patanjali, Swami Satchidananda, Integral Yoga Publications
5. Meditation - Science and Practice by N. C. Panda, D. K. PrintworldPublisher
6. YogPravesh by Vishwas VMandlik,YogchaitanyaPrakashan
7. Asanand YogVigyan, BhartiyaYogSansthan, Delhi
8. PranayamVigyan, BhartiyaYogSansthan, Delhi

Reference Web Sites:

1. http://www.artofliving.org/in-en/yoga
2. http://www.artofliving.org/in-en/yoga/sri-sri-yoga/sukshma-yoga-relaxation
3. http://www.yogsansthan.org/
4. http://www.yogapoint.com/
5. http://www.divyayoga.com/
6. http://www.yogaville.org/about-us/swami-satchidananda/
7. http://www.yogaVision.net
8. http://www.swamij.com

University of Pune
M.E. (Civil) (Structures)--2013Course
Semester I
1Credit =15 Hrs.

501 006 : Lab.Practice–I

Teaching Scheme	**Examination Scheme**
Lectures: 4 hours/week	**Term work : 50marks**
Credits : 4	**Oral : 50 marks**

Lab Practice I

The lab. practice-I will be based on completion of assignments / practicals / reports of site visits, confined to the course in that semester.

The term work will consist of --

i)Visit reports of minimum three site visits, exploring the field aspects for various subjects

ii) Report on minimum 3 assignments / designs / laboratory work on each subject. Report on the experimental work based on Horizontal and Vertical Shake Table is mandatory.

iii)Report on minimum 2 software applications on any subject of the semester.

iv) Report on atleast one patent with its details studied in any subject of the semester.

v) Technical review and critique of a research article/paper on any topic from the refereed journal paper related to any subject learnt in the semester–

University of Pune
M.E. (Civil) (Structures)--2013Course
Semester II
1Credit =2 Modules=15 Hrs.

501 007-Finite Element Method

Teaching Scheme	**Examination Scheme**
Lectures: 4 hours/week	**In semester Exam: 50 marks**
Credits 4	**End Sem. Exam. : 50 marks**
	Duration of End Sem.Exam:3Hrs

Module 1:

a)Background on variational calculus. Galerkin methods, Collocation methods, Leastsquares methods. Variational methods of approximation- Rayleigh-Ritz method.

b)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.

Module 2:

a)Two dimensional elements in plane stress /plane strain problems. CST, LST & Rectangular elements, modelling considerations; aspect ratio, Use of polynomial displacement functions, Pascal triangle. Requirements for convergence, Geometric Invariance, Grid refinement

Module:3 Standard stiffness and load vector formulation procedure using variational principle.

Module 4:

a)Shape functions in cartesian & natural coordinate systems, shape functions for one dimensional element such as truss & beam. Shape function for two dimensional elements.

b)Three dimensional elements such as Tetrahydron, Hexahydron, shape functions, stress strain relations

Module 5:

a)Axisymmetric elements in axisymmetric problems, stress strain relations, triangular and Quadrilateral elements.

Module 6:

Concept of isoparametric elements and isoparametric mapping, Jacobian Matrix, Formulation procedure for 2 D quadrilateral isoparametric element in plane elasticity problem, 3-D isoparametric elements.

Module 7:

a)Thin Plate bending elements, various Triangular and Rectangular elements, ACM (Adini, Clough, Melosh) and BFS (Bogner, Fox, Schimdt) elements

Conforming & nonconforming elements, Concept of four noded & eight nodded isoparametric elements, Mindlin's hypothesis for plate bending element.

Module 8:

a)Flat & curved shell element, elements for cylindered shells, curved solid element

b)Ahmad's degenerated solid element, Pawsey's eight noded shell element.

Reference Books

1. S.S. Bhavikatti - Finite Element Analysis – New Age International Publishers, Delhi
2. Thompson---Introduction to the Finite Element,Method: Theory, Programming and Applications, Wiley,India
3. C.S. Krishnamoorthy – Finite Element Analysis – Theory & Programming – Tata McGraw Hill Publishing Co. Ltd
4. Zienkiewicz & Taylor - The Finite Element Method 4th Edition – Vol – I & II – McGraw Hill International Edition
5. Robert D. Cook, D.S. Malkus, M.E. Plesha – Concepts & Applications of Finite Element Analysis – Wiley ,India.
6. J.N. Reddy – An Introduction to the finite element method – Tata McGraw Hill Publishing Co. Ltd
7. S.S. Rao - The Finite Element Method in Engineering 4th Edition – Elsevier Publication
8. G.R. Buchanan – Finite Element Analysis Schaum's outlines - Tata McGraw Hill Publishing Co. Ltd
9. Segerlind L.J. – Applied Finite Element Analysis - John Wiley & Sons.

10 Energy & Finite Element Methods in Structural Mechanics by Iriving Shames & Clive Dym, New Age International Publishers,Delhi.

Lab Practice assignment for the term work:

1.Any three assignments based on FEM by using coding tools such as EXCEL, MATLAB etc. for

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. Finite Element Method – Software applications of any one of following cases using either SATDD-Pro / Anysis / Etabs / SAP .

a) Plane stress / plane strain problem

b) Axisymmetric problem

c) Three dimensional problem

d) Plate or shell structures

University of Pune

M.E. (Civil) (Structures)--2013Course

Semester II

1Credit =2 Modules=15 Hrs.

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 Sem.Exam:3Hrs

Module 1:
a)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

Module 2:
Analysis of Rectangular Plates: Navier solution for plates with all edges simply supported. Distributed loads, point loads and rectangular patch load.

Module 3:
a) Levy's Method: Distributed load and line load. Plates under distributed edge moments. Raleigh- Ritz approach for simple cases in rectangular plates.
b) Introduction to shear deformation theories. Reissener - Mindlin Theory, Moment curvature relationship for First order shear deformation theory.

Module 4:
a)Circular Plates: Analysis of circular plates under axi-symmetric loading. Moment Curvature relations.Governing differential equation in polar co-ordinates.
b)Simply supported and fixed edges. Distributed load, ring load, a plate with a central hole.

Module 5:
a) Introduction: Classification of shells on geometry, thin shell theory, equations to shell surfaces, stress resultants, stress- displacement relations, compatibility and equilibrium equations.
b)Shells of Revolution: Membrane theory, equilibrium equations, strain displacement relations, boundary conditions, cylindrical, conical and spherical shells.

Module 6:
a)Circular cylindrical shells: Membrane theory: Equilibrium equations, strain displacement relations, boundary conditions.

Module 7:
b)Bending Theory: Equilibrium equation, strain displacement relations, governing differential equation, solution for a simply supported cylindrical shell, various boundary conditions. Application to pipes and pressure vessels.

Module 8:
Beam theory of cylindrical shells: Principles of Lundgren's beam theory, beam analysis, arch analysis, application to cylindrical roof shells.

Reference Books
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

University of Pune
M.E. (Civil) (Structures)--2013Course
Semester II
1Credit =2 Modules=15 Hrs.

501 009-Advance Design of Concrete Structures

Teaching Scheme	**Examination Scheme**
Lectures: 4 hours/week	**In semester Exam. : 50 marks**
Credits 4	**End Semester Exam. : 50 marks**
	Duration of End Sem.Exam:3Hrs

Module 1:
Yield line theory for analysis of slabs, Various patterns of yield lines , Assumptions in yield line theory, Equilibrium and virtual work method of analysis ,

Module 2:
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 orthotropically reinforced slabs,

Module3 :
- Grid and coffered floors, general features , rigorous and approximate method of analysis design of grid floor by approximate method, Design of flat slab, column and middle strip, proportioning of flat slab element,

Module 4:
Design methods for flat slabs , Design by direct method only of intermediate and end panel , total design moment , distribution of moments , effect of pattern loading, Design for shear.

Module 5 :
Elevated service reservoir – Rectangular and Circular type only flat bottom, Design of staging for wind and earthquake forces, Effect of joint reactions and continuity

Module6:
Design of Bunkers, Silos, and chimney—Square and circular bunkers, silos shallow and deep

Module 7:
Design of raft foundations, Pile foundations, single pile, group of piles, Pile cap

Module 8:
Design of Shear wall, design of form work for slabs, girders, columns etc.

Reference Books-

1. Advance R.C.C.DesignBy 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, New Delhi
4. P.C. Varghese – Advanced Reinforced Concrete Design, Prentice Hall of India Pvt. Ltd., New Delhi

5- Reinforced Concrete design ---Dr.H.J.Shah—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:-2002 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

---

University of Pune
M.E. (Civil) (Structures)--2013Course
Semester II
1Credit =2 Modules=15 Hrs.

501 010 - Elective –II

Teaching Scheme | **Examination Scheme**
Lectures: 5 hours/week | **In semester Exam: 50 marks**
Credits 5 | **End Sem. Exam. : 50 marks**
Duration of End Sem.Exam:3Hrs

Select any combination having total of 5 credits from following technical / interdisciplinary courses

Code	2 Credits Course *L*	Code	1 Credit Course	Code	Audit Course (No Credit Course)
501 010 A	Human Rights	**501 010 E**	Foreign Language II	**501 010 I**	Performing Arts – Music and Dance
501 010 B	Design of precast components and Ferrocement	**501 010 F**	Building Services and Maintenance	**501 010 J**	Principle Centred Leadership
501 010 C	Design of Foundations	**501 010 G**	Green Building Design and Construction		
501 010 D	Non linear Analysis of structure	**501 010 H**	Forensic Civil Engineering		

501 010 –A-Elective II Human Rights (2 Credits course)

Module 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

Module 2:

Human Rights & State Mechanisms

- Police & Human Rights
- Judiciary & Human Rights
- Prisons & Human Rights
- National and State Human Rights Commissions

-**Module 3:**

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,

Module 4. :

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.(2 hrs)

- UN Documents
- International Mechanisms (UN & Regional)
- International Criminal Court

Reference Books:

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

.

---

501 010 –B-Elective II Design of Precast Components and Ferrocrete (2 Credits course)

Module 1

Introduction

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.

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.

Module 2

Prefabricated Components and Its Behaviour

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.

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.

Module 3

Joints and Connections

Joints and connections in precast construction; classification and their requirements.

Design of Concrete bracket and corbels; Cantilever beam-design method, Strut-and-tie method. Introduction to Hanger Connections. Design of bearing pads, column bases and moment connections. Typical connection designs for lateral load resisting systems.

Module 4

Design of Ferrocrete Structures

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

Reference Books--

1--.Ferrocement Construction Mannual-Dr. D.B.Divekar-1030,Shivaji Nagar,Model Colony, Pune

2.--.CBRI, Building materials and components, India, 1990

3--Gerostiza C.Z., Hendrikson C. and Rehat D.R., Knowledge based process planning for construction and manufacturing, Academic Press Inc., 1994

4---.PCI Design Handbook – Precast and Prestressed Concrete (6th Edition), ISBN – 0-937040-71-1.

5---Koncz T., Manual of precast concrete construction, Vols. I, II and III, Bauverlag, GMBH, 1971.

6---.Structural design manual, Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 1978.

7-- 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

8--- Ferrocement--- B R Paul and R P Pama. Published by International Ferrocement Information Centre. A.I.T.Bangkok, Thailand.

9---Ferrocement and laminated cementitious composites--- A E Naaman.: Techno-press, Ann Arbor, Michigan, U S A.

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 –C- Elective I - Design of Foundations (2 Credits course)

Module 1

Soil Structure Interaction

Foundation objectives and their importance, Classification of foundations, Soil classification. Geotechnical design parameters, bearing capacity, settlements and factors affecting settlement. Loads for design, depth of foundation and depth of soil exploration. Parameters for design of foundation on various types of soil, soil structure interaction.

Module 2

Design of Raft Foundations

Types of rafts, Design of Flat slab raft foundation .Design of beam and slab raft foundation.

Module 3

Pile Foundation –I

Function and Classification of piles, Concrete piles, Precast and cast-in-situ piles. Static point and skin resistance capacity of a Pile, Pile settlements.

Laterally loaded Piles. Various pile group patterns, Efficiency of Pile in group, Negative skin friction. Shell Foundations: Types and applications, Soil structure interaction, Membrane analysis for Hyper and Conical RC shells with and without edge beams, detailing of critical sections.

Module4

Pile Foundation-II

IS code recommendations for structural design for various piles. Design of RC cast-in-situ and precast pile by IS code method. Pile group analysis by rigid and flexible methods, Design of pile cap.

References Books

1.Kurain N.P, Modern Foundations: Introduction to Advance Techniques: TataMcGraw Hill,1982

2.Kurain N. P, Design of foundation systems Principles and Practice, Narosa Publishing house, New Delhi, 2005.

3.Dr. H.J.Shah, Reinforced Concrete, Vol II, Charotar Publishing House.

4.Winterkorn H.F. and Fang H.Y. Ed., Foundation Engineering Hand Book, Van-Nostrand Reynold, 1975

5.Bowles J.E., Foundation Analysis and Design (4th Ed.), Mc.Graw –Hill, NY, 1996

6.Poulose H.G. and Davis E.H., Pile foundation Analysis and Design, John-Wiley Sons, NY, 1980.

7.Leonards G. Ed., Foundation Engineering, Mc.Graw-Hill, NY, 1962

8.Shamsher Prakash, Soil Dynamics, McGraw Hill

9.Sreenivasalu & Varadarajan, Handbook of Machine Foundations, Tata McGraw Hill

10.O’Neil, M.W. and Reese, L.C. “Drilled Shafts: Construction Procedures and Design Methods”, FHWA Publication No. FHWA-IF-99-025, Federal HighwayAdministration, Washington, D.C., USA, 1999.

11.P. C. Varghese, “Design of Reinforced Concrete Foundations”, PHI Learning Pvt. Ltd., New Delhi, 2009.

12.IS 1904: 1986 Code of practice for design and construction of foundations in soils: general requirements (Third Revision)

13.IS 2911: Part 1 : Sec 1 to3 : 1979 Code of practice for design and construction of pile foundations: Part 1 Concrete piles

14.IS 2911: Part 1: Sec 4 : 1984 Code of practice for design and construction of pile foundations: Part 1 Concrete piles

15.IS 2911: Part 3: 1980 Code of practice for design and construction of pile foundations: Part 3 Under-reamed piles

16.IS 2950: Part 1: 1981 Code of Practice for design and construction of raft foundations: Part 1: Design

17.IS 2974: Part 1to 5: 1982 Code of practice for design and construction of machine foundations

General Reading Suggested :Codes:

1)Reese, L.C. and O'Neill, M.W., 1988. "Drilled Shafts: Construction and Design." FHWA, Publication No.HI-88-042, USA.

2)FHWA-NHI-10-016, “Drilled Shaft: Construction Procedures and LRFD Design Methods,”2010, U.S. Department of Transportation Federal Highway Administration, Washington, D.C., USA.
(http://www.fhwa.dot.gov/engineering/geotech/foundations/nhi10016/nhi10016.pdf)

Hand books:

1)“Foundation Engineering Handbook,” H.-Y. Fang, Editor, Van Nostrand Reinhold, Kulhawy, F.H. (1991). “Drilled Shaft Foundations.” Chapter 14, 2nd Ed., New York, pp. 537-552.

e-Resources:

1)http://www.fhwa.dot.gov/engineering/geotech/library_listing.cfm … … (Free Reports)

2)www.Wikipedia.com

Lab Practice assignment for the term work:

Technical review and critique of a research article/paper on any one of the topics –
(1)Drilled Shaft (2) Caisson - Construction, Analysis, Design, Problems, Case Study
A detailed review and critique of a research article/paper in writing (5-10 pages) is expected from the students.

---

501 010 –D- Elective I -Non Linear Structural Analysis(2 Credits course)

Module 1

Types of Nonlinearities - Geometric Nonlinearity, Material Nonlinearity, Nonlinear Governing Equation for Beams: Moment-curvature Nonlinearity, Geometric Nonlinearity Due to Strectching, Material Nonlinearity, Geometrically Nonlinear Beam Problems - Moment-Curvature Nonlinearity-Cantilever Beam, Centrally
Loaded beam with two supports, Cantilever Beam subjected to Tip Load

Module 2

Nonlinear Analysis of Columns- Post buckling of cantilever column, Large deflection of column with both ends hinged

Module 3

Nonlinear Analysis of Trusses and Nonlinear Elastic Analysis of Frames - Derivation of non linear stiffness matrix, Matrix displacement method for nonlinear analysis of structures, Nonlinear analysis of plane
frames.

Module 4

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.

Reference Books

1. M.Sathyamoorthy, ‘Nonlinear Analysis of Structures’, CRC Press, New York
2. K.I. Majid, ‘Non Linear Structures’, Butter worth Publishers, London.
3. N G R Iyengar, ‘Elastic Stability of Structural elements’, Macmillan India Ltd.

---

501 010 –E-Elective II Foreign Language –II French-II (1 Credit course)

Module 1
French Grammar and Vocabulary: Unit-1, Lesson 2 of the Text Book (Grammar & Vocabulary), Unit-1, Lesson 1 of the Text Book, Exercise of Unit-1, Lesson 2 of the Text Book & workbook
Module 2
Advance Vocabulary, Writing & Speaking: Unit-1, Lesson 3 of the Text Book (Grammar & Vocabulary), Unit-1, Lesson 3 of the Text Book, Exercise of Unit-1, Lesson 3 of the Text Book & workbook, Revision & speaking practice

Reference

1. Jumelage-I Text Book by Manjiri Khandekar & Roopa Luktuke (Latest edition)
2. Jumelage-I workbook by Roopa Luktuke

----

501 010 –F--Elective II Building Services and Maintenance
(1 Credit course)

Module 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.
Module 2
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.
Reference books

1. Buiding Services—S.M.Patil---(ISBN-978-81-7525-980-5), 1-C,102,Saamana Pariwar Society,Gen A.K.Vaidya Marg, Goregaon (E),Mumbai-65
2. Building Maintenance Management, 2ed,---Chanter, Wiley India

3. Miantenance of Buildings—A.C.Panchodhari—New Age International Publishers.

---

501 010 –G-Elective II Green Building Design and Construction
(1 Credit course)

Module 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
Module 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

Reference Books
1.C.J. Kibert (2008) "Sustainable Construction: Green Building Design and Delivery", 3rd Ed., John Wiley, Hoboken, New Jersey
2.G.T. Miller Jr. (2004) "Living in the Environment: Principles, Connections, and Solutions", 14th Ed., Brooks Cole, Pacific Grove, California
3. Energy Conservation Building Code (ECBC)

---

501 010 -H-Elective II Forensic Civil Engineering (1 Credit course)
Module 1
Introduction to forensic engineering, Forensic investigations-tools and techniques, Failures-types, causes and mechanisms ,Monitoring and instrumentation, Mitigation of failure
Module 2
Professional practice and ethics, Legal issues, Repairs and remediation, Risk and risk assessement, Assessement 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

---

501 010 –I-Elective II Performing Arts – Music and Dance
(Audit course--Non Credit course)

Module 1 :
Indian Music

Vocal, Instrumental, Sur, Laya, Tal. Ragas and their classification based on time and “Raasa-Nirmitee”. Seasons and Ragas. Various “Bandishes” and “Gharanas” or styles. Light Indian Music-different types.
Experiencing ethos and bliss by listening to performances of various reputed artists.
Experiencing oneness with nature and the super power by performing individually or in a group.

Module 2 : Indian Classical Dance

Types –Kathak, Bharatnatyam, Kuchipudi, Odissy etc. Importance of “Abhinaya” (acting) in dance. Role of “Taala” and “Laya” in dance. Various dance form. Various gharanas in traditional dance types Fusion with other dance styles. Experiencing the Indian cultural power through individual and group performances.

.

Books/Audio CD

1.Hindustani Sangeet Paddhati by Pt.Vishnu Narayan Bhatkhande publ. Swarganga Foundation.
2.Jivi Jivai (Golden Voice Golden Years) Pt.Jasraj, Publ. Bandishes with notations composed by the author.
3.Pranav Bharati, by Pt.Ompraksh Thakur, publ. Swarganga foundation.
4.Rasa Gunjan by Pt.Birju Maharaj, Publ. Swarganag foundation
5.Anup Rag Vilas by Pt.Kumar Gandharava, Bandishes composed and sung by author mostly available on cassettes Swarganga Foundation.
6.The dance Orissi – Mohan Khokar published by (2010) Abhinav Publications, New Delhi
7.Introduction to Bharata’s Natyashastra by Adya Rangacharya, Munshiram Manoharlal publication.
8. Art of Dancing classing and folk dance by priyabala Shah, Parimal publication
9.Tantra Mantra Yantra in Dance: An Exposition of Kathaka, by Ranjana Shrivastava, D.K.Prinword Pvt. Ltd.

---

501 010 –J-Elective II Principle Centered Leadership
(Audit course--Non Credit course)

Module 1 :
Motivation, Leadership and Competency

a) Motivation:--

Necessity, types, means of providing extrinsic motivation. Leadership. Qualities of a leader. Types of Leadership viz. Lassez Fairre, transactional, transformational. Principle centered leadership based on Stephen Covey habits.

b) Competency Mapping:-

Definition of competency. Generic, functional and Strategic Competencies. Importance of developing competencies. Identification of competency gaps at managerial cadre level through benchmarking requirements based on role, mapping and assessment. Training and Developmental programs for competency gap closure.

Module 2 :
Entrepreneurship and strategic Management

a) Entrepreneurship: - Qualities of an entrepreneur. Business ideas generation methods—creative imagination, brainstorming, newspaper exercise activity. Ideas evaluation based on John Mullion’s 7 point test concept of a B—plan.

b)Strategic Management: --

Necessity in the context of global challenges. Objectives of strategic management. Forecasting abilities and methods. Developing organizations for the achievement of strategic objectives. Dealing with uncertainties.

Reference Books

1. Seven habits of highly effective people—Stephen Covey—Franklin Covey Publications
2. Living the seven habits Stephen Covey—Franklin Covey Publications
3. 8th Habit – from effectiveness to greatness Stephen Covey—Franklin Covey Publications
4. Human Resource Development In The Building Industry, Vinita Shah, published by NICMAR
5. Human Resources Management & Human Relations , V P Michael , Himalaya
6. Human Resource Management Biswajeet Pattanayak published by Prentice Hall
7. Construction project Management, integrated approach—Feedings First Indian Reprint 2011—Yesdee publications
8. Cases in Strategic Management, Amita Mital , Tata Mcgraw Hill

---

University of Pune
M.E. (Civil) (Structures)--2013Course
Semester II
1Credit =15 Hrs.

501 011- Lab.Practice–II

Teaching Scheme	Examination Scheme
Lectures: 4 hours/week	Term work : 50 marks
Credits : 4	Oral : 50 marks

The lab. practice-II will be based on completion of assignments / practicals / reports of site visits, confined to the courses in that semester.

The term work will consist of --

i) Visit reports of minimum two site visits, exploring the field aspects for various subjects

ii) Report on minimum 3 assignments / designs / laboratory work on each subject.

iii) Finite Element Method – Software applications of any one of following cases using either SATDD-Pro / Anysis / Etabs / SAP .

a) Plane stress / plane strain problem

b) Axisymmetric problem

c) Three dimensional problem

d) Plate or shell structures

iv) Report on atleast one patent with its details studied in any subject of the semester.

v) Technical review and critique of a research article/paper on any one of the topics – (1)Drilled Shaft (2) Caisson - Construction, Analysis, Design, Problems, Case Study

vi) A detailed review and critique of a research article/paper in writing (5-10 pages) is expected from the students

vii)Any three assignments based on FEM by using coding tools such as EXCEL, MATLAB etc. for

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

University of Pune
M.E. (Civil) (Structures)--2013Course)
Semester II
1Credit =15 Hrs.
501 012 - Seminar – I

Teaching Scheme	Examination Scheme
Pract. 4 hrs./week	Oral : 50 Marks,
	TW :: 50 Marks
	Credits 4

The seminar I shall be on state of the art topic of own choice approved by the guide
Term work of the seminar should consist of spiral bound report ,preferably printed on both the sides of pages on any technical topic of interest associated with the post graduate course and should be submitted in a standard format having the following contents .

i. Introduction
ii. Literature Survey
iii. Theoretical contents
iv. Relevance to the present national and global scenario of construction industry
v. Strengths and weaknesses of the particular area of seminar
vi. R & D in the particular area
vii. Field Applications / case studies / Experimental work / software application / Benefit cost studies – feasibility studies
viii. Vendors associated
ix. Conclusions
x. 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.
It is desired that based on the seminar work, a paper be prepared and presented in a state / national conference.

At the end of first year, the students are required to undergo through a field training of minimum 2 weeks duration. The presentation and separate report of the vacational training will be submitted along with report of seminar II.

University of Pune
M.E. (Civil) (Structures)--2013Course)
Semester III
1Credit =2Modules=15 Hrs.

601 013-Earthquake Engineering and Disaster Management

Teaching Scheme | **Examination Scheme**
Lectures: 4 hours/week | **In semester Exam. : 50 marks**
Credits 4 | **End Semester Exam. : 50 marks**
Duration of End Sem.Exam:3Hrs

Module 1:

Introduction to Disaster and its Management

Definition of Disaster, Types of Disasters i.e. Natural and Man Made Disasters. Natural: Earthquake, Volcanoes and TsunamisMan Made: Fire, Blast etc.

Module 2:

Develop an understanding of why and how the modern disaster manager is involved with pre-disaster and post-disaster activities. Effect on structural elements.

Module 3:

Design of RCC Structures

Design of multi-story RC structure with foundation as per latest IS: 1893 by Equivalent static lateral load method and Response Spectrum Method.

Module 4:

Design of Steel Structures

Introduction to Time history method,Capacity based design of soft story RC building, design of Shear Walls. Ductile detailing as per latest IS:13920.

Module5 :

Blast Loading

Introduction to Blast Loading, Blast Wind, Clearance Time, Decay Parameter, Drag Force, Ductility Ratio, Dynamic Pressure, Equivalent Bare Charge, Ground Zero, Impulse, Mach Number, Overpressure, Reflected Overpressure,Shock Wave Front, Side-on Overpressure Transit Time,Yield.

Module 6:

General Characteristics of Blast and Effects on structures, Blast force, Blast load on above and below ground structures, Response of structural elements, Time period of structural members, Design Stresses for Steel and Reinforced Concrete, Load combinations, Design of structure for blast loading.

Module7 :

Fire Analysis of steel structure subjected to fire, Design consideration of structural steel members as per IS-800: 2007.

Module 8 :

Post Disaster Measures

Retrofitting of Structures, Sources of weakness in framed buildings, Classification of retrofitting techniques, Conventional and non-conventional methods, Comparative study of various methods and case studies. Introduction to Base Isolation systems. IS code provisions for retrofitting of masonry structures, failure modes of masonry structures and repairing techniques.

Reference Books:

i. P. Agarwal and M. Shrikhande – Earthquake Resistant Design of Structures, Prentice-Hall Publications.
ii. Earthquake resistant design of building strucures building----Hosure, Wiley India.
iii. Seismic Design of Reinforced Concrete and Masonry Buildings---Paulay, Wiley India
iv. IS:1893 – Indian Standard Criteria for Earthquake Resistant Design of Structures, Bureau of Indian Standards, New Delhi.
v. IS:13935 – Repair and Seismic Strengthening of Buildings – Guidelines, 1993
vi. IS: 4326 – Earthquake Resistant Design and Construction of Buildings – Code of Practice, 1993

vii. IS: 13828 – Improving Earthquake Resistance of Low Strength Masonry Buildings, 1993
viii. IS : 4991 – 1968 - Criteria For Blast Resistant Design of Structures for Explosions above ground.
ix. IS: 800 2007 - Code for general construction in steel structures
x. IS:13827 - Improving Earthquake Resistance of Earthen Buildings, 1993
xi. IS:13920 – Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Force, 1993
xii. IS: 3370- Indian Standard code of practice for concrete structures for storage of liquids, Bureau of Indian Standards, New Delhi.
xiii. Clough and Penzin – Dynamics of Structures, Mc-Graw Hills Publications.
xiv. Jai Krishna, A.R. Chandrashekharan and B Chandra – Elements of Earthquake Engineering, South Asian Publishers Pvt. Ltd.
xv. Joshi P S et al. - Design of Reinforced Concrete Structures for Earthquake Resistance Published by Indian Society of Structural Engineers, 2001

University of Pune
M.E. (Civil) (Structures)--2013Course)
Semester III
1Credit =15 Hrs.

601 014-Structural Design of Concrete and Prestressed Bridges

Teaching Scheme	**Examination Scheme**
Lectures: 4 hours/week	**In semester Exam. : 50 marks**
Credits 4	**End Semester Exam. : 50 marks**
	Duration of End Sem.Exam:3Hrs

Module 1:
Introduction to bridge engineering, classification and components of bridges, layout, planning.Structural forms of bridge decks, beam and slab decks, cellular decks.
Module 2:
Standard specification for bridges, IRC loadings for road bridges, loading standards for railway bridges.
Module 3:
Design of slab culvert, box culvert and skew bridge.
Module 4:
Introduction to Courbon’s method, Henry-Jaegar method and Guyon-Massonet method. Design of T-beam PC bridges using Courbon’s method.
Module 5:
Structural classification of Rigid Frame bridge, analysis and design of Rigid Frame bridge.
Module 6:
Classification and design of bearings. Expansion joints. Forces acting on abutments and piers,
Module 7:
Analysis and design, types and design of wing walls.
Module 8:
Bridge foundations, design of open well, pile and caisson foundation.

Reference Books

1. D. Johnson Victor - Essentials of Bridge Engineering Fifth Edition, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
2. T.R. Jagadeesh, M.A. Jayaram - Design of Bridge Structures, Prentice-Hall of India
3. N. Krishna Raju - Design of Bridges, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
4. David Lee – Bridge Bearings and Expansion Joints,E & FN Spon
5. V.K. Raina – Concrete Bridge Practice Analysis, design and Economics, Tata McGraw Hill
6. IRC Codes – IRC: 5, IRC: 6, IRC: 18, IRC: 27, IRC: 45, IRC: 78, IRC: 83
7. Joseph E. Bowles – Foundation Analysis and Design, McGraw-Hill International Edition
8. Nainan P. Kurian – Design of Foundation Systems, Narosa Publishing House

---

University of Pune
M.E. (Civil) (Structures)--2013Course)
Semester III
1Credit =15 Hrs.

601 015: Elective –III

Teaching Scheme
Lectures: 5 hours/week
Credits 5

Examination Scheme
In semester Exam: 50 Marks
End Sem. Exam. : 50 marks
Duration of End Sem.Exam:3Hrs

Select any combination having total of 5 credits from following technical / interdisciplinary courses ---

Code	**2 Credits Course** *L*	**Code**	**1 Credit Course**	**Code**	**Audit Course (No Credit Course)**
601 015A	Bio Mechanics and Bio Materials	**601 015E**	Design of Composite Construction	**601 015H**	Chess
601 015B	Adv analysis of steel Frames	**601 015F**	Foreign Language-III	**601 015I**	Abacus
601 015C	Theory of Plasticity	**601 015G**	Safety Practices in construction.		
601 015D	Design of Concrete Plate and Shell Structures				

601 015-A- Elective –III Bio Mechanics and Bio Materials
(2 Credit Course)

Module 1:
A)Structure of biomaterials, classification of bio materials, mechanical properties, isoelasticity, elasticity of non-Hookean materials..
B)Metallic Biomaterials and ceramic biomaterials ,Polymeric Biomaterials, Composite Biomaterials, Bio degradable Polymeric Biomaterials. stainless steel Co-Cr-alloys Ti & its alloys, medical applications, corrosion of metallic implants. Non-absorbable or relatively
Module 2:
Hard Tissue replacement, Preservation techniques for Biomaterials. Hip Joint Prosthesis fixation : Problems and possible solutions. Polymeric Biomaterials and composite biomaterials, medical applications, deterioration of polymers.
Module 3:
Introduction to Biomechanics of Human movement. Fundamentals of Biomechanics .Mechanical properties of cartilage. Structure and properties of articular cartilage, mechanical properties of
Bone tissue. Mechanics of musculoskeletal system, response of tissue to forces,stress,strain, stiffness, mechanical strength, viscoelasticity.
Module 4:
Biomecnics of Bone tissue Linear Kinetics and kinematics of joints elobow, Hip, Knee joint; Evaluation of joint forces and moments. Equilibrium of joint, fundamental concepts of Gait analysis.
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.

Reference books
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.

---

601 015-B-Elective –III Advanced Analysis of Steel Frames
(2 Credit Course)

Module 1:
Elastic stability & structural Instability, Review of critical loads of long columns for various boundary conditions; beam-columns, critical load of simple rectangular frames. Columns with initial imperfection.

Module 2:
First order elastic (FOE) & first order inelastic(FOIE) (Plastic) analysis of rectangular portal frames. Elastic & limit state of strength of frame.
Module 3:
Second order considerations in elastic analysis of frames P-δ & P-Δ effect. Critical load of single bay, single storey portal frame using P-δ & P-Δ effect; classical & semi geometrical approach.Direct second order elastic analysis (SOE), international codal provisions, application for simple frame.
Module 4:
Second order inelastic (SOIE) analysis of frames, elastic plastic hinge analysis, plastic zone method, use of finite element method Refined plastic hinge analysis, reduction in stiffness of member due to plasticity at hinge. Advantages of advanced analysis.
Design of frame using advanced analysis. Use of suitable software illustrating difference in analytical results among all methods such as FOE, FOIE, SOE, SOIE.

Reference Books :

1 "Stability Analysis & design of Structures" M.L. Gambhir, Springer, SIE
2 "Stability of structures" , Ashwini Kumar, Allied Publishers Ltd.
3."Advanced Analysis of steel frames, Theory Software and application", W F Chen, S. Toma, CRC press, Tokyo
4." Plastic Analysis and Design of Steel Structures", M Bill Wong, Elsevier
5." LRFD steel design using Advanced Analysis", W F Chen, S. Kim, CRC press.

General Reading Suggested:
Codes:
1.IS: 800 - 2007 Code of Practice for General Construction in Steel
2.AISC Steel Construction Manual

---

601 015-C- Elective –III Theory of Plasticity
(2 Credit Course)

-

Module 1:
Basic equations of theory of elasticity: Index notation, equations of equilibrium, constitutive relations for isotropic bodies, strain-displacement relations, compatibility, displacement and traction boundary conditions, admissibility of displacement and stress fields, plane stress and plane strain problems.
Module 2:
Plastic behaviour in simple tension, generalisation of results in simple tension, yield surfaces, uniqueness and stability postulates, convexity of yield surface and normality rule, limit surfaces.Initial Yield Surfaces for Polycrystalline Metals: Summary of general form of plastic constitutive equations, hydrostatic stress states and plastic volume change in metals, shear stress on a plane, thevon Mises initial yield condition, the Tresca initial yield condition, consequences of isotropy.
Module 3:
Plastic Behaviour under Plane Stress Conditions: Initial and subsequent yield surfaces in tension-torsion, the isotropic hardening model, the kinematic hardening model, yield surfaces made of two or more yield functions, piecewise linear yield surfaces, elastic perfectly plastic materials. Plastic Behaviour of Bar Structures - Behaviour of a three bar truss, behaviour of a

beam in pure bending, simply supported beam subjected to a central point load, fixed beams of an elastic perfectly plastic material, combined bending and axial force.

Module 4:

Theorems of Limit Analysis - Alternative statement of the limit theorems, the specific dissipation function, cold bending of bar beyond elastic limit, spring back, plastic bending with strain hardening material, plastic bending of wide plate.

Limit Analysis in Plane Stress and Plane Strain: Discontinuities in stress and velocity fields, the Tresca yield condition in plane stress and plane strain, symmetrical internal and external notches in a rectangular bar, the punch problem in plane strain, remarks on friction.

Reference Books

1. Martin, J.B., Plasticity, Fundamentals and General Results, MIT Press, London.
2. Kachanov, L.M., Fundamentals of the Theory of Plasticity, Mir Publishers, Moscow.
3. Chakrabarty, J, Theory of Plasticity, McGraw Hill, New York.
4. Hill, R., Mathematical Theory of Plasticity, Oxford University Press.
5. Chen, W.F., and Han, D.J., Plasticity for Structural Engineers, Springer Verlag.
6. Timoshenko, Theory of Plasticity, McGraw Hill

---

601 015-D- Elective –III Design of Concrete Plate and Shell structures
2 Credit Course

Module 1 :

Types of plates, scope and assumptions, Simpson and Iteration method of analysis and design, Ridge load resolution, edge shear, stress distribution, deflection and rotations, joint moment effect, design of north-light folded plate

Module 2 :

Design of flat and concave plate circular in shape resting on ring beam, Continuous folded plate design

Module 3 :

Membrane and bending theory of shells,Theories in Matrix form, Boundary conditions, Shell Parameter selection, Stress resultant calculation, Reinforcement parameters and details, composition of Ferro-cement shells

Module 4:

Design by Beam theory, Beam and arch analysis, modified beam method, Design of Multiple bay cylindrical shell, Design of North light cylindrical shell, continuous cylindrical shell, hyperbolic paraboloid shell, Design of Pre-stressed cylindrical shell and dome, selection of optimum pre-stressing force, effect of pre-stressing force on stress distribution in shell

Reference Books :

1.G. S. Ramaswamy, ‘Design and construction of concrete shell roofs’, CBS publication
2.Naaman `Ferrocement Construction `
3.S. Timoshenko and W. Krieger, Theory of Plates and Shells, McGraw Hill.
4.Ansel C. Ugural‘Stresses in Plates and Shells’, McGraw Hill
5.Chandrashekhara K., ‘Analysis of Concrete Shells’, New Age International Edition
6.Chandrashekhara K., ‘Analysis of Plates’, New Age International Edition
6.S. S. Bhavikatti, ‘Theory of plates and shells’, New Age International Publication

7.T.Y. Lin & Ned H. Burns – Design of Prestressed Concrete Structures, John Wiley Publication

8.N. Krishna Raju – Prestressed Concrete, Tata McGraw Hill Publication Co

Codes:

IS: 456: Indian Standard code of practice for plain and reinforced concrete, Bureau of Indian Standards, New Delhi.

IS: 1343: Indian Standard code of practice for Prestressed concrete, Bureau of Indian Standards, New Delhi.

IS: 1893: Indian Standard Code of practice for criteria for Earthquake resistant design of structures, Bureau of Indian Standards, New Delhi.

IS: 875 – 1964 Code of Practice for Structural Safety of Building: Loading Standards.

---

601 015-E-Elective III Design of Composite Construction (1 Credit course)

Module 1:

Introduction of Composite Constructions. Benefits of Composite Construction, Introduction to IS, BS and Euro codal provisions. Composite beams, elastic behaviour of composite beams, No and Full Interaction cases, Shear Connectors, Ultimate load behaviour, Serviceability limits,Effective breadth of flange, Interaction between shear and moment, Basic design consideration and design of composite beams.

Composite floors, Structural elements, Profiled sheet decking, Bending resistance, Serviceability criterion, Analysis for internal forces and moments

Module 2:

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.

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.

Reference Books

1). Johnson R. P. – Composite Structures of Steel and Concrete, Vol I, Beams, Columns and Frames in Buildings, Oxford Blackwell Scientific Publications.

2)Composite Structures of Steel and Concrete: Beams, Slabs Columns and Frames for Buildings, 3ed Johnson, -Wiley India.

3). INSDAG teaching resources for structural steel design Vol – 2, Institute for Steel Development and Growth Publishers, Calcutta

4). INSDAG Handbook on Composite Construction – Multi-Storey Buildings, Institute for Steel Development and Growth Publishers, Calcutta.

---

601 015-F-Elective III Foreign Language-- French-III (1 Credit course)

Module 1:

French Grammar and Vocabulary: Unit-1, Lesson 4 of the Text Book (Grammar & Vocabulary), Unit-1, Lesson 4 of the Text Book, Revision & speaking practice

Module 2:

Advance Vocabulary, Writing & Speaking, Exercise of Unit-1, Lesson 4 of the Text Book & workbook , Practicing Simple conversation in French, Revision & practice of conversation (Simple questions & answers)

Reference: Jumelage-I Text Book by Manjiri Khandekar & Roopa Luktuke
Jumelage-I workbook by Roopa Luktuke

---

601 015—G--Elective III Safety Practices in Construction
(1 Credit course)

Module 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-Retaining walls-Critical factors for failure-Regular Inspection and monitoring. Safety in Erection and closing operation - Construction materials –Specifications – suitability – Limitations – 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.
Module 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.

---

601 015—H--Elective III CHESS
(Audit course--Non Credit course)

Module 1
Introduction of chess game, What is chess board, the place of chess board , Chess pieces position & its moves, The concept of attacking, , The concept check with different pieces, Mate/Checkmate, Castling, Pawn Promotion, Notation, Stalemate, Pointing
Module 2
End game, attacking a piece, Opening principles, Piece exchange, Pin, Defining the draws in Chess
Reference: As specified by the instructor

---

601 015—I--Elective III ABACUS
(Audit course--Non Credit course)

Module 1

Introduction of Abacus, addition & subtraction with help of help of small friends, big friends & big family, Concept of visualization, Multiplication & Division

Module 2

Additional & Subtraction with decimal concept, Determine cube root & square root

Reference: As specified by the instructor

UNIVERSITY OF PUNE
M.E. (CIVIL) (Structures)
SEMESTER III
1Credit =15 Hrs.
601 016--Seminar – II

Teaching Scheme	Examination Scheme
Pract. 4 hrs./week	Oral : 50 Marks,
	TW :: 50 Marks
	Credits 4

Seminar II shall be on the topic relevant to latest trends in the field.
Term work should consist of ---

I) Spiral bound report preferably, printed on both the sides of paper on the topic of dissertation work and should be submitted in a standard format having the following contents.

i) A report on training undergone on a construction project site/organization/for a period of minimum 15 days, including the data collection necessary for the project work.

ii) A report on the topic of dissertation, containing the following:

a) Literature review and problem statement formulation.

b) Research Methodology and proposed schedule of completion of project work. 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.

II) Spiral bound report preferably, printed on both the sides of paper on vacational training of 2 weeks

UNIVERSITY OF PUNE
M.E. (CIVIL) (Structures)
SEMESTER III
1Credit =15 Hrs.

601 017- Project Stage I

Teaching Scheme	Examination Scheme
Pract. 8 hr./week	Oral: 50 marks,
	TW ; 50 marks
	Credits 8

The project work will start in semester III, and should preferably be a live problem in the industry or macro-issue of industry and should involve scientific research, design, collection, and analysis of data, determining solutions and must preferably bring out the individuals contribution.

The dissertation stage I report should be presented in a standard format, in a spiral bound hard copy, preferably printed on both the sides of paper, containing the following contents.

i. Introduction including objectives, limitations of study.
ii. Literature Survey, background to the research.
iii. Problem statement and methodology of work
iv. Theoretical contents associated with topic of research
v. Field Applications, case studies
vi. Data collection from field/organizations or details of experimental work/analytical work
vii. Part analysis / inferences
viii. Details of remaining work to be completed during the project work stage II
ix. References

Students should prepare a power point presentation to be delivered in 25 minutes and should be able to answer questions asked in remaining five minutes.(It is preferred that at least one paper on the research area be presented in a conference or published in a referred journal.)

UNIVERSITY OF PUNE
M.E. (CIVIL) (Structures)
SEMESTER IV
1Credit =15 Hrs.

601 018 -Seminar – III

Teaching Scheme	Examination Scheme
Pract. 5 hrs./week	TW : 50 marks
Credits : 5	Oral / Presentation-50 marks

Term work should consist of a spiral bound report on the topic of dissertation work,preferably typed on both the sides of pages and should be submitted in a standard format.
Seminar III will be assessed based on the requirements of completion of project work for the project stage II.
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.

UNIVERSITY OF PUNE
M.E. (CIVIL) (Structures)
SEMESTER - IV
1Credit =15 Hrs.

601 019 Project Work Stage II

Teaching Scheme	Examination Scheme
Pract. 20 hrs./week	Oral/Presentation : 50 Marks
Credits : - 20	TW : 150 Marks

The final dissertation should be submitted in black bound hard copy as well as a soft copy on CD.
(The due weightage will be given for the paper(s) on topic of project presented in a conferences or published in referred journals.)
The Term Work of Dissertation of semester IV should be assessed jointly by the pair of internal and external examiners, along with oral examination of the same.