# 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:**
Lectures: 4 Hours/Week

**Credits**
04

**Examination Scheme:**
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:** | **Credits** | **Examination Scheme:** |
|---|---|---|
| Lectures: 4 Hours/Week | 04 | In-Semester (Online):  50 Marks |
| | | End-Semester:  50 Marks |

**Prerequisites :** Fundamental knowledge of 'C' and basics of algorithms

**Course Objectives :**
1. To learn C language constructs and pointers in depth.
2. To learn algorithm development and analysis of algorithms.
3. To learn linear data structures and their applications
4. To learn different searching and sorting techniques

**Course Outcomes :**
After successful completion of this course, student will be able to
1. Apply appropriate constructs of C language, coding standards for application development.
2. Use dynamic memory allocation concepts and file handling in various application developments.
3. Perform basic analysis of algorithms with respect to time and space complexity
4. Select appropriate searching and/or sorting techniques in the application development
5. Select and use appropriate data structures for problem solving and programming
6. Use algorithmic foundations for solving problems and programming

### Course Contents

**UNIT – I    C BASICS                                                              6 Hours**
Control structures, arrays, functions and parameter passing Structure and Union, String manipulation, matrix operations.

**UNIT – II    POINTERS IN C AND FILE HANDLING                          9  Hours**
Introduction to Pointers, dynamic memory allocation, pointer to pointer, pointer to single and multidimensional arrays, array of pointers, string and structure manipulation using pointers, pointer to functions. Pointer to file structure and basic operations on file, file handling in C.

**UNIT – III    INTRIDUCTION TO DATA STRUCTURES AND ANALYSIS OF ALGORITHMS        5 Hours**
Introduction to Data Structures: Concept of data, Data object, Data structure, Abstract Data Types, realization of ADT in 'C'. Concept of Primitive and non-primitive, linear and Non-linear, static and dynamic, persistent and ephemeral data structures.
Analysis of algorithm: frequency count and its importance in analysis of an algorithm, Time complexity & Space complexity of an algorithm, Big 'O', 'Ω' and 'Θ' notations, Best, Worst and Average case analysis of an algorithm.

**UNIT – IV   SEARCHING AND SORTING TEHNIQUES                          7 Hours**
Need of searching and sorting, Concept of internal and external sorting, sort stability. Searching methods: Linear and binary search algorithms their comparison and complexity analysis

Sorting methods: Bubble, selection, insertion, merge, quick, bucket sort and their time and space complexity analysis

**UNIT – V     LINEAR DATA STRUCTURES USINF SEQUENTIAL ORGANIZATION          8 Hours**
Concept of sequential organization, Concept of Linear data structures, Concept of ordered list, Multidimensional arrays and their storage representation: row major and column major form and address calculation. Representation of sparse matrix using arrays, algorithms for sparse matrix addition, simple and fast transpose, polynomial representation using arrays. Analysis of these algorithms. Introduction to Stack and Queue, and their implementation using sequential organization, use of stack in recursion.

**UNIT - VI     LINEAR DATA STRUCTURES USING LINKED ORGANIZATION          8 Hours**
Concept of linked organization, singly linked list, doubly linked list, circular linked list. Linked list as an ADT. Representation and manipulations of polynomials using linked lists, comparison of a sequential and linked memory organization, concept of Generalized Linked List, representation polynomial using GLL.

**Text Books**

1. E. Horowitz, S. Sahani, S. Anderson-Freed "Fundamentals of Data Structures in C", Universities Press, 2008
2. R. Gilberg, B. Forouzan, "Data Structures: A pseudo code approach with C", Cenage Learning, ISBN 9788131503140.
3. YashwantKanetkar, "Let us C" and "Pointers in C" , BPB Publication

**Reference Books**

1. R S Bichkar, "Programming with C", University Press, ISBN 978-81-7371-771-0
2. Dennis Ritchie, Kernighan, "The C Programming Language", Prentice Hall
3. Treamblay, Sorenson, "An introduction to data structures with applications", Tata McGraw Hill, Second Edition
4. Seymour Lipschutz, "Data structures with C", Schaum's Publication
5. Aaron Tanenbaum, "Data Structures using C", Pearson Education
6. G. A.V, PAI , "Data structures and  Algorithms ", McGraw Hill, ISBN -13: 978-0-07-066726-6
7. Venkatesan, "Data Structures, w/cd", Wiley, ISBN-9788126553044
8. Langsam,Augenstein, Tenenbaum ,Data Structures Using C and C++, 2e, Pearson Pub.
9. Kamthane, Introduction to Data Structures in C, Pearson Publistion
10. Kruse ,Data Structures and Program Design in C, ISBN, 9788177584233, Pearson Publications,.

## 214445 : PROBLEM SOLVING AND OBJECT ORIENTED PROGRAMMING

| Teaching Scheme: | Credits | Examination Scheme: |
|---|---|---|
| Lectures: 4 Hours/Week | 04 | In-Semester (Online):  50 Marks |
| | | End-Semester:  50 Marks |

**Prerequisites :**Principles of Programming Languages, Fundamentals of Data Structures

**Course Objectives :**
1. Employ a problem-solving strategy to breakdown a complex problem into a series of simpler tasks.
2. Execute problem-solving actions appropriate to completing a variety of sub problems.
3. Apply analytical and logical thinking to extract facts from a problem description and determine how they relate to one another and to the problems to be solved.
4. Design and implement an object oriented solution to solve a real life problem.
5. Develop problem-solving and programming skills using OOP concept.

**Course Outcomes :**
After studying this subject student should be able to
1. Develop algorithms for solving problems by using modular programming concepts
2. Abstract data and entities from the problem domain, build object models and design software solutions using object-oriented principles and strategies
3. Discover, explore and apply tools and best practices in object-oriented programming.
4. Develop programs that appropriately utilize key object-oriented concepts

### Course Contents

**UNIT – I     Problem Solving Concepts                                                        6 Hours**
General Problem Solving Concepts-Types of problems, problems solving with computers, difficulties with problem solving, Problem Solving Aspects, Problem Solving Concepts for computer- constants and variables, data types, functions, operators, expressions and equations, Programming Concepts – communicating with computers, organizing the problem, using the tools, testing the solution, coding the program, Top down design

**UNIT – II     Problem Solving with Logic Structures                                        6  Hours**
Programming Structure - modules and their functions, cohesion & Coupling, Local and global variable, parameters, return values, variable names and data dictionaries, four logic structures. Problem solving with sequential logic structure - The sequential logic structure, solution development. Problem Solving with Decisions – decision logic structure, multiple if/then/else instructions, straight-through logic, positive logic, negative logic, logic conversion, decision tables. Problem solving with loops and case logic structures

**UNIT – III     Foundations of Object Oriented Programming                              6 Hours**
**Introduction**: Introduction to procedural, modular, object-oriented and generic programming techniques, Limitations of procedural programming, Need of object-oriented programming, fundamentals of object-oriented programming: objects, classes, data members, methods, messages, data encapsulation, data abstraction and information hiding, inheritance, polymorphism
**++ Extensions to C** : Variable declarations, global scope, 'const', reference variables, operators in C++(scope resolution, new , delete), dynamic memory allocation, function prototypes, default and constant arguments,  'cin', 'cout', inline functions

**Class**: Defining a class, data members and member functions, public, private and protected members, inline member functions, static data members, static member functions, constructors, destructors, array of objects, classes, objects and memory, class as ADTs and code reuse

### UNIT – IV    Overloading and Inheritance                                    8 Hours
Function overloading, friend function, friend class
**Operator Overloading** : Introduction, Need of operator overloading, rules for operator overloading, overloading the unary and binary operators using member function, operator overloading using friend function, overloading relational and logical operators, overloading new, delete and assignment operator, type conversions
**Inheritance** : Introduction, Need of inheritance, base and derived classes, member access control, types of inheritance,  derived class constructor, constructors in multiple inheritance, overriding member functions,  ambiguity in multiple inheritance, virtual base class

### UNIT – V    Virtual Functions and Templates                                7 Hours
**Virtual functions** : Pointers to objects, 'this' pointer, Pointers to derived class, virtual function, rules for virtual function, pure virtual function, abstract class, virtual destructors, early and late binding, container classes
**Templates** : Introduction, Function template and class template, overloading function template, member function templates and template arguments, Introduction to Standard Template Library (STL), containers, iterators and algorithms

### UNIT - VI    Exception Handling and File I/O                                7 Hours
**Namespaces**: Introduction, Rules of namespaces
**Exception Handling**: Introduction, Exception handling mechanism: try, catch and throw, Multiple Exceptions, Exceptions with arguments
**Managing Console I/O Operations**: Introduction, C++ streams, stream classes, unformatted I/O, formatted I/O and I/O manipulators
**File I/O**: Introduction, Classes for file stream operations, file operations (open, close, read, write, detect end of file), file modes, File pointers and their manipulations, error handling during file operations

**Text Books**

1. R G Dromey, "How to Solve it by Computer", Pearson Education, 2008, ISBN-13: 978-8131705629.
2. Maureen Spankle, "Problem Solving and Programming Concepts", Pearson, 2011, ISBN-13**:** 978-0132492645.
3. Robert Lafore, "Object-Oriented Programming in C++", SAMS Techmedia.

**Reference Books**

1. Joyce Farrell, "Programming Logic and Design", Cengage Learning, ISBN-13: 978-1285776712.
2. E. Balaguruswamy, "Object-oriented Programming with C++", Tata McGraw Hill, 5$^{th}$ 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<br>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<br>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, 5<sup>th</sup> 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            8 Hours
                       PROCESSOR**

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,            8 Hours
                       EXCEPTIONS**

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", 5$^{th}$ 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)", 3$^{rd}$ Edition, ISBN: 9780070667556
3. A S Tanenbaum, "Computer Networks", Pearson Education, 4$^{th}$ 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", 3$^{rd}$ 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:**
Practical : 4 Hours/Week    02

**Examination Scheme:**
Term Work : 25 Marks
Practical : 50 Marks

**Prerequisites:** Processor Architecture and Interfacing, Computer Organization and Architecture

**Course Objectives :**
1. To learn assembly language programming of 80386 microprocessors and 8051 microcontrollers.
2. To learn interfacing of real world input and output devices to 8051 microcontroller

**Course Outcomes :**
After successful completion of this course, student will be able to
1. Learn and apply concepts related to assembly language programming
2. Write and execute assembly language program to perform array addition, code conversion, block transfer, sorting and string operations
3. Learn and apply interfacing of real world input and output devices to 8051 microcontroller

### Guidelines for Instructor's Manual
The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant. The instructor's manual should include prologue, university syllabus, conduction & Assessment guidelines, topics under consideration-concept, objectives, outcomes, algorithm, sample test cases and references etc.

### Guidelines for Student's Lab Journal
1) The laboratory assignments are to be submitted by student in the form of journal. The Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory-Concept, circuit diagram, pin configuration, conclusion/analysis), printouts of the code written using coding standards, sample test cases etc.
2) Practical Examination will be based on the term work submitted by the student in the form of journal
3) Candidate is expected to know the theory involved in the experiment
4) The practical examination should be conducted if the journal of the candidate is completed in all respects and certified by concerned faculty and head of the department
5) All the assignment mentioned in the syllabus must be conducted

### Guidelines for Lab /TW Assessment
1) Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.
2) Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out
3) Necessary knowledge of usage of software and hardware such as assembler, linker, debugger,

8051 microcontrollers and its interfacing kits should be checked by the concerned faculty member

## Guidelines for Laboratory Conduction

1) The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications.

2) The guidelines published by BOS time to time regarding conduction of laboratory assignments and Practical/Oral examination is mandatory.

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## Guidelines for Practical Examination

Both internal and external examiners should jointly set problem statements for practical examination. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at the time of evaluation to judge the student's understanding of the fundamentals, effective and efficient implementation. The evaluation should be done by both external and internal examiners.

## Suggested List of Laboratory Assignments

**Group A: Microprocessor Programming**

1. Write Assembly Language Program (ALP) to add array of N numbers stored in the memory.

2. Write menu driven ALP to convert 4-digit Hex number into its equivalent BCD number and 5-digit BCD number into its equivalent HEX number. Make your program user friendly to accept the choice from user for

   i. HEX to BCD          ii. BCD to HEX    iii. EXIT.

   Display proper strings to prompt the user while accepting the input and displaying the result. Write near procedures to complete the task.

3. Write ALP to perform following operation on string:
   i.    Find and display length
   ii.   Display reverse
   iii.  Check whether string is palindrome or not.

   Display proper strings to prompt the user while accepting the input and displaying the result. Write near procedures to complete the task.

4. Write menu driven ALP to perform string manipulations. The strings to be accepted from the user is to be stored in code segment Module_1 and write FAR PROCEDURES in code segment Module_2 to perform any two of the following string operations:
   i.    Concatenation of two strings.
   ii.   Comparison of two strings.
   iii.  Finding Number of occurrences of a sub-string in the given string
   iv.   Finding number of alphabets, digits, special characters, lower & upper case alphabets, words and number of lines from the text.

   Note: Use PUBLIC and EXTERN directives. Create .OBJ files of both the modules and link them to create an .EXE file.

5. Assignment on file operations

Select any one of the following assignments

   a.   Write menu driven program in C using int86, int86x, intdos and intdosx functions for implementing following operations on file.

   i.   To delete a file

   ii.  To create a directory

   iii. To copy a file

   b.   Write 8086 ALP to read command line arguments using Program Segment Prefix (PSP) and simulate "DOS COPY Command". Use file handle function for handling the files. Handle all the errors and display appropriate message if user does not enter proper command line argument.

**Group B: Microcontroller Programming**

Assignment 6 and 7. Select any two of the following assignments:

   i.   Write 8051 ALP to add n, 8 bits numbers found in internal ram location 40H onwards and store results in R6 and R7.

   ii.  Write 8051 ALP to multiply 16 bit number by 8 bit number and store the result in internal memory location.

   iii. Write 8051 ALP for block transfer for internal / external memory.

   iv.  Write 8051 ALP for sorting byte array in ascending / descending order.

8. Select any one of the following assignments.

   i.   Timer programming: ISR based

        Write ALP to generate 2 KHz square wave using Timer interrupt on any port pin.

   ii.  Serial port programming: ISR based

        Connect two 8051 microcontrollers using serial ports. Send FFh and 00H alternatively to receiver. Output received byte to port1, see port1 pin waveform on CRO.

9 & 10. Select any two of the following assignments:

   Write ALP to interface 8051 with:

   i.   DAC to generate square, triangular and trapezoidal waveforms.

   ii.  ADC to read and display equivalent digital output.

   iii. Stepper motor to rotate motor with different step angles and speeds.

   iv.  Sensors (temperature, pressure) to read and display values of the physical parameters sensed.

   v.   LCD to display message.

**Note: This list of assignments is indicative. Concerned faculty member may frame different assignments if required maintaining similar difficulty level.**

**Reference Books**

1. Peter Abel, Niyaz Nizamuddin, "IBM PC Assembly Language and Programming", Pearson Education
2. Ray Duncan, "Advanced MS DOS Programming", 2nd edition, BPB Publications
3. Intel 8051 Microcontroller manual.

## 214455 : DATA STRUCTURE AND FILES LABORATORY

**Teaching Scheme:**          **Credits:**
Practical : 4 Hours/Week      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<br>**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)
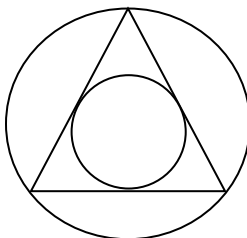
4.  Draw the following pattern using any Line drawing algorithms.
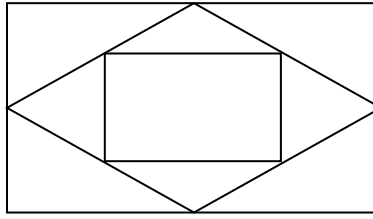


5.  Draw a 4X4 chessboard rotated 45˚ with the horizontal axis. Use Bresenham algorithm to draw all the lines. Use seed fill algorithm to fill black squares of the rotated chessboard

**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.

# 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:** | **Credits** | **Examination Scheme:** |
|---|---|---|
| Lectures: 4 Hours/Week | 04 | In-Semester   : 30 Marks |
| | | End-Semester: 70 Marks |

**Prerequisites:**
1. Discrete Structures.
2. Data structures and problem solving.

**Course Objectives :**
1. To understand problem classification and problem solving by machines.
2. To understand the basics of automata theory and its operations.
3. To study computing machines by describing, classifying and comparing different types of computational models.
4. Encourage students to study theory of computability and complexity.
5. To understand the P and NP class problems and its classification.
6. To understand the fundamentals of problem decidability and reducibility.

**Course Outcomes :**
1. To construct finite state machines to solve problems in computing.
2. To write mathematical expressions for the formal languages
3. To apply well defined rules for syntax verification.
4. To construct and analyze Push Down, Post and Turing Machine for formal languages.
5. To express the understanding of the decidability and decidability problems.
6. To express the understanding of computational complexity.

### UNIT – I      FINITE STATE MACHINES                                                        08 Hours
**Basic Concepts**: Symbols, Strings, Language, Formal Language, Natural Language. Basic Machine and Finite State Machine.
**FSM without output**: Definition and Construction-DFA, NFA, NFA with epsilon-Moves, Minimization Of FA, Equivalence of NFA and DFA, Conversion of NFA with epsilon moves to NFA, Conversion of NFA With epsilon moves to DFA.
**FSM with output:** Definition and Construction of Moore and Mealy Machines, Inter-conversion between Moore and Mealy Machines.

### UNIT – II      REGULAR EXPRESSIONS                                                        08 Hours
Definition and Identities of Regular Expressions, Construction of Regular Expression of the given L, Construction of Language from the RE, Construction of FA from the given RE using direct method, Conversion of FA to RE using Arden's Theorem, Pumping Lemma for RL, Closure properties of RLs, Applications of Regular Expressions.

### UNIT – III      CONTEXT FREE GRAMMAR AND LANGUAGES                                    08 Hours
Introduction, Formal Definition of Grammar, Notations, Derivation Process: Leftmost Derivation, Rightmost Derivation, derivation trees, Context Free Languages, Ambiguous CFG, Removal of ambiguity, Simplification of CFG, Normal Forms, Chomsky Hierarchy, Regular grammar, equivalence of RG(LRG and RLG) and FA.

### UNIT IV      PUSHDOWN AUTOMATA AND POST MACHINES                                    08 Hours
**Push Down Automata:** Introduction and Definition of PDA, Construction (Pictorial/ Transition diagram) of PDA, Instantaneous Description and ACCEPTANCE of CFL by empty stack and final state, Deterministic PDA Vs Nondeterministic PDA, Closure properties of CFLs, pumping lemma for CFL.
**Post Machine**- Definition and construction.

### UNIT – V    TURING MACHINES                                                              08 Hours

Formal definition of a Turing machine, Recursive Languages and Recursively Enumerable Languages, Design of Turing machines, Variants of Turing Machines: Multi-tape Turing machines, Universal Turing Machine, Nondeterministic Turing machines. Comparisons of all automata.

### UNIT – VI    COMPUTATIONAL COMPLEXITY                                                     08 Hours

**Decidability:** Decidable problems concerning regular languages, Decidable problems concerning context-free languages, Un-decidability, Halting Problem of TM, A Turing-unrecognizable language.

**Reducibility:** Un-decidable Problems from Language Theory, A Simple Un-decidable Problem PCP, Mapping Reducibility.

**Time Complexity:** Measuring Complexity, The Class P, Examples of problems in P, The Class NP, Examples of problems in NP, NP-completeness.

### Text Books

1. Michael Sipser, Introduction to the Theory of Computation, CENGAGE Learning, 3$^{rd}$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, 2$^{nd}$ Edition, ISBN: 9788131720479.
2. DanielI. 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, 2$^{nd}$ Edition.
4. John C. Martin, Introduction to Language and Theory of Computation, TMH, 3$^{rd}$ 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.
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. Kristina Chodorow, Michael Dirolf,  MongoDB: The Definitive Guide,  O'Reilly Publications,
2. Jiawei Han, Micheline Kamber, Jian Pei,  Data Mining: Concepts and Techniques,  Elsevier,
3. Bill Schmarzo,  Big Data: Understanding How Data Powers Big Business,  Wiley,  978-81-265-4545-2

## 314443: SOFTWARE ENGINEERING AND PROJECT MANAGEMENT

| | | |
|---|---|---|
| **Teaching Scheme:**<br>Lectures: 3 Hours/Week | **Credits**<br><br>03 | **Examination Scheme:**<br>In-Semester : 30 Marks<br>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:**
Lectures: 3 Hours/Week

**Credits :**

03

**Examination Scheme:**
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 Edition.
8. Rogers, Sharp, Preece, Interaction Design: Beyond Human Computer Interaction, Wiley India, ISBN: 9788126544912,3rd Edition.
9. Wilbert O.Galitz, The Essential Guide to user Interface Design, Wiley India, ISBN: 9788126502806.


**Web-links:**
1. http://hcibib.org/
2. Andriod Design Guidelines -  https://developer.android.com/guide/practices/ui_guidelines/index.html
3. iOS Human Interface Guidelines - https://developer.apple.com/ios/human-interface-guidelines/overview/design-principles/
4. MacOS Human Interface Guidelines - https://developer.apple.com/library/content/documentation/UserExperience/Conceptual/OSXHIGuidelines/

## 314446: SOFTWARE LABORATORY - I

**Teaching Scheme:**
Practical : 4 Hours/Week

**Credits**
02

**Examination Scheme:**
Term Work : 25 Marks
Practical    : 50 Marks
Oral         : 50 Marks

**Prerequisites:**
1. Data structures and files.
2. Discrete Structure.
3. Software engineering principles and practices.

**Course Objectives :**
1. Understand the fundamental concepts of database management. These concepts include aspects of database design, database languages, and database-system implementation.
2. To provide a strong formal foundation in database concepts, recent technologies and best industry practices.
3. To give systematic database design approaches covering conceptual design, logical design and an overview of physical design.
4. To learn the SQL and NoSQL database system.
5. To learn and understand various Database Architectures and its use for application development.
6. To programme PL/SQL including stored procedures, stored functions, cursors and packages.

**Course Outcomes :**
1. To install and configure database systems.
2. To analyze database models & entity relationship models.
3. To design and implement a database schema for a given problem-domain
4. To understand the relational and document type database systems.
5. To populate and query a database using SQL DML/DDL commands.
6. To populate and query a database using MongoDB commands.

### Guidelines for Instructor's Manual
1. The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.

### Guidelines for Student's Lab Journal
1. Student should submit term work in the form of handwritten journal based on specified list of assignments.
2. Practical Examination will be based on the term work.
3. Candidate is expected to know the theory involved in the experiment.
4. The practical examination should be conducted if and only if the journal of the candidate is complete in all respects.

### Guidelines for Lab /TW Assessment
1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.
2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.
3. Appropriate knowledge of usage of software and hardware related to respective laboratory should be

checked by the concerned faculty member.

As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers of the program in journal may be avoided. There must be hand-written write-ups for every assignment in the journal. The DVD/CD containing students programs should be attached to the journal by every student and same to be maintained by department/lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

## Suggested List of Laboratory Assignments

### Group A: Introduction to Databases (Study assignment – Any 2)

1. Study and design a database with suitable example using following database systems:
   - Relational: SQL / PostgreSQL / MySQL
   - Key-value: Riak / Redis
   - Columnar: Hbase
   - Document: MongoDB / CouchDB
   - Graph: Neo4J
   
   Compare the different database systems based on points like efficiency, scalability, characteristics and performance.

2. Install and configure client and server for MySQL and MongoDB (Show all commands and necessary steps for installation and configuration).

3. Study the SQLite database and its uses. Also elaborate on building and installing of SQLite.

### Group B: SQL and PL/SQL

1. Design any database with at least 3 entities and relationships between them. Apply DCL and DDL commands. Draw suitable ER/EER diagram for the system.

2. Design and implement a database and apply at least 10 different DML queries for the following task. For a given input string display only those records which match the given pattern or a phrase in the search string. Make use of wild characters and LIKE operator for the same. Make use of Boolean and arithmetic operators wherever necessary.

3. Execute the aggregate functions like count, sum, avg etc. on the suitable database. Make use of built in functions according to the need of the database chosen. Retrieve the data from the database based on time and date functions like now (), date (), day (), time () etc. Use group by and having clauses.

4. Implement nested sub queries. Perform a test for set membership (in, not in), set comparison (<some, >=some, <all etc.) and set cardinality (unique, not unique).

5. Write and execute suitable database triggers .Consider row level and statement level triggers.

6. Write and execute PL/SQL stored procedure and function to perform a suitable task on the database. Demonstrate its use.

7. Write a PL/SQL block to implement all types of cursor.

8. Execute DDL statements which demonstrate the use of views. Try to update the base table using its corresponding view. Also consider restrictions on updatable views and perform view creation from multiple tables.

## Group C: MongoDB

1. Create a database with suitable example using MongoDB and implement
   - Inserting and saving document (batch insert, insert validation)
   - Removing document
   - Updating document (document replacement, using modifiers, upserts, updating multiple documents, returning updated documents)

2. Execute at least 10 queries on any suitable MongoDB database that demonstrates following querying techniques:
   - find and findOne (specific values)
   - Query criteria (Query conditionals, OR queries, $not, Conditional semantics)
   - Type-specific queries (Null, Regular expression, Querying arrays)

3. Execute at least 10 queries on any suitable MongoDB database that demonstrates following:
   - $ where queries
   - Cursors (Limits, skips, sorts, advanced query options)
   - Database commands

4. Implement Map reduce example with suitable example.

5. Implement the aggregation and indexing with suitable example in MongoDB. Demonstrate the following:
   - Aggregation framework
   - Create and drop different types of indexes and explain () to show the advantage of the indexes.

## Group D: Mini Project / Database Application Development

Student group of size 3 to 4 students should decide the statement and scope of the project which will be refined and validated by the faculty considering number of students in the group.
Draw and normalize the design up to at ER Diagram least 3NF in case of back end as RDBMS.

Suggested Directions for development of the mini project.

- Build a suitable GUI by using forms and placing the controls on it for any application. (E.g Student registration for admission, railway reservation, online ticket booking etc.). Proper data entry validations are expected.

- Develop two tier architecture and use ODBC/JDBC connections to store and retrieve data from the database. Make a user friendly interface for system interaction. You may consider any applications like employee management system, library management system etc.

- Implement the basic CRUD operations and execute a transaction that ensures ACID properties. Make use of commands like commit, save point, and rollback. You may use examples like transfer of money

from one account to another, cancellation of e-tickets etc.

### References

1. Ramon A. Mata-Toledo, Pauline Cushman, Database management systems, TMGH, ISBN: IS978-0-07-063456-5, 5th Edition.
2. Kristina Chodorow, MongoDB The definitive guide, O'Reilly Publications, ISBN:978-93-5110-269-4, 2nd Edition.
3. Dr. P. S. Deshpande, SQL and PL/SQL for Oracle 10g Black Book, DreamTech.
4. Ivan Bayross, SQL, PL/SQL: The Programming Language of Oracle, BPB Publication.
5. Reese G., Yarger R., King T., Williums H, Managing and Using MySQL, Shroff Publishers and Distributors Pvt. Ltd., ISBN: 81 - 7366 - 465 – X, 2nd Edition.
6. Dalton Patrik, SQL Server – Black Book, DreamTech Press.
7. Eric Redmond, Jim Wilson, Seven databases in seven weeks, SPD, ISBN: 978-93-5023-918-6.
8. Jay Kreibich, Using SQLite, SPD, ISBN: 978-93-5110-934-1, 1st edition.

## 314447: SOFTWARE LABORATORY – II

**Teaching Scheme:**
Practical : 4 Hours/Week

**Credits**
02

**Examination Scheme:**
Term Work : 25 Marks
Practical   :  50 Marks

### Prerequisites:
1. C programming.
2. Fundamental of Data Structures.

### Course Objectives :
1. To introduce and learn Linux commands required for administration.
2. To learn shell programming concepts and applications.
3. To demonstrate the functioning of OS basic building blocks like processes, threads under the LINUX.
4. To demonstrate the functioning of OS concepts in user space like concurrency control (process synchronization, mutual exclusion & deadlock) and file handling in LINUX.
5. To aware Linux kernel source code details.
6. To demonstrate the functioning of OS concepts in kernel space like embedding the system call in any LINUX kernel.

### Course Outcomes :
1. To understand the basics of Linux commands and program the shell of Linux.
2. To develop various system programs for the functioning of operating system.
3. To implement basic building blocks like processes, threads under the Linux.
4. To develop various system programs for the functioning of OS concepts in user space like concurrency control and file handling in Linux.
5. To design and implement Linux Kernel Source Code.
6. To develop the system program for the functioning of OS concepts in kernel space like embedding the system call in any Linux kernel.

### Guidelines for Instructor's Manual
1. The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.

### Guidelines for Student's Lab Journal
1. Student should submit term work in the form of handwritten journal based on specified list of assignments.
2. Practical Examination will be based on the term work.
3. Candidate is expected to know the theory involved in the experiment.
4. The practical examination should be conducted if and only if the journal of the candidate is complete in all respects.

### Guidelines for Lab /TW Assessment
1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.
2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.
3. Appropriate knowledge of usage of software and hardware related to respective laboratory should be

checked by the concerned faculty member.

As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers of the program in journal may be avoided. There must be hand-written write-ups for every assignment in the journal. The DVD/CD containing students programs should be attached to the journal by every student and same to be maintained by department/lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

## Suggested List of Laboratory Assignments

Assignment No. 1: Shell programming
Write a program to implement an address book with options given below:
a) Create address book. b) View address book. c) Insert a record. d) Delete a record.
e) Modify a record. f) Exit.

Assignment No. 2: Process control system calls: The demonstration of *FORK*, *EXECVE* and *WAIT* system calls along with zombie and orphan states.

 a.  Implement the C program in which main program accepts the integers to be sorted. Main program uses the *FORK* system call to create a new process called a child process. Parent process sorts the integers using sorting algorithm and waits for child process using *WAIT* system call to sort the integers using any sorting algorithm. Also demonstrate zombie and orphan states.

 b.  Implement the C program in which main program accepts an integer array. Main program uses the *FORK* system call to create a new process called a child process. Parent process sorts an integer array and passes the sorted array to child process through the command line arguments of *EXECVE* system call. The child process uses *EXECVE* system call to load new program that uses this sorted array for performing the binary search to search the particular item in the array.

Assignment No. 3: Implement multithreading for Matrix Multiplication using pthreads.

Assignment No. 4: Thread synchronization using counting semaphores. Application to demonstrate: producer-consumer problem with counting semaphores and mutex.

Assignment No. 5: Thread synchronization and mutual exclusion using mutex. Application to demonstrate: Reader-Writer problem with reader priority.

Assignment No. 6: Deadlock Avoidance Using Semaphores: Implement the deadlock-free solution to Dining Philosophers problem to illustrate the problem of deadlock and/or starvation that can occur when many synchronized threads are competing for limited resources.

Assignment No. 7: Inter process communication in Linux using following.
 a.  Pipes: Full duplex communication between parent and child processes. Parent process writes a pathname of a file (the contents of the file are desired) on one pipe to be read by child process and child process writes the contents of the file on second pipe to be read by parent process and displays on standard output.
 b.  FIFOs: Full duplex communication between two independent processes. First process accepts sentences and writes on one pipe to be read by second process and second process counts number of characters, number of words and number of lines in accepted sentences, writes this output in a text file and writes the contents of the file on second pipe to be read by first process

and displays on standard output.

**Assignment No. 8:** Inter-process Communication using Shared Memory using System V. Application to demonstrate: Client and Server Programs in which server process creates a shared memory segment and writes the message to the shared memory segment. Client process reads the message from the shared memory segment and displays it to the screen.

**Assignment No. 9:** Implement an assignment using File Handling System Calls (Low level system calls like open, read, write, etc).

**Assignment No. 10:** Implement a new system call in the kernel space, add this new system call in the Linux kernel by the compilation of this kernel (any kernel source, any architecture and any Linux kernel distribution) and demonstrate the use of this embedded system call using C program in user space.

## References

1. Das, Sumitabha, UNIX Concepts and Applications, TMH, ISBN-10: 0070635463, ISBN-13: 978-0070635463, 4th Edition.
2. Kay Robbins and Steve Robbins, UNIX Systems Programming, Prentice Hall, ISBN-13: 978-0134424071, ISBN-10: 0134424077, 2nd Edition.
3. Mendel Cooper, Advanced Shell Scripting Guide, Linux Documentation Project, Public domain.

## 314448: SOFTWARE LABORATORY – III

**Teaching Scheme:**
Practical : 2 Hours/Week

**Credits**
01

**Examination Scheme:**
Term Work : 50 Marks

### Preamble:

A major component of the course is a Graphical User Interface development. The objective is to develop a GUI by using concepts learned from Software Engineering and Project management. At the beginning of the course, Course Teacher will form project teams with maximum 3 members. During the semester, the project team will work together through all the phases of development cycle up to design, from an initial feasibility study to designing, after designing phase students will deploy the designed system and will make a series of presentations and reports of the work.

### Prerequisites:

1. Programming fundamentals.
2. Problem solving skills.

### Course Objectives :

1. To understand the nature of software complexity in various application domains, disciplined way of software development and software life cycle process models.
2. To introduce principles of agile software development, the SCRUM process and agile practices.
3. To know methods of capturing, specifying, visualizing and analyzing software requirements.
4. To understand concepts and principles of software design and architecture.
5. To understand user-centric design approach.
6. To apply principles of designing for effective user interfaces.

### Course Outcomes :

1. To identify the needs of users through requirement gathering.
2. To apply the concepts of Software Engineering process models for project development.
3. To apply the concepts of HCI for user-friendly project development.
4. To deploy website on live webserver and access through URL.
5. To understand, explore and apply various web technologies.
6. To develop team building for efficient project development.

#### Guidelines for Instructor's Manual

1. The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.

#### Guidelines for Student's Lab Journal

1. Student should submit term work in the form of handwritten journal based on specified list of assignments.
2. Practical Examination will be based on the term work.
3. Candidate is expected to know the theory involved in the experiment.
4. The practical examination should be conducted if and only if the journal of the candidate is complete in all respects.

#### Guidelines for Lab /TW Assessment

1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical

assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.

2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.

3. Appropriate knowledge of usage of software and hardware related to respective laboratory should be checked by the concerned faculty member.

As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers of the program in journal may be avoided. There must be hand-written write-ups for every assignment in the journal. The DVD/CD containing students programs should be attached to the journal by every student and same to be maintained by department/lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

## Suggested List of Laboratory Assignments

### Group A :Website Design (HTML5, CSS, Bootstrap)

Assignment No. 1:  Using HTML5 layout tags develop informative page with sections which include various images, links to other pages for navigation, make use of all possible formatting (for example font, color etc.).

Assignment No. 2:  Apply CSS properties Border, margins, Padding, Navigation, dropdown list to page created in first assignment.

### Group B : Website GUI Validation (JavaScript, PHP)

Assignment No. 3:  Create form in HTML with all form elements apply form validations (e.g. Email, mobile, Pin code, Password).

Assignment No. 4:  Validate URL, Email, Required using functions empty, preg_match, filter_var in PHP.

### Group C : Website Working (Java Servlet)

Assignment No. 5:  Understand servlet life cycle, create login page and apply proper validations with appropriate messages using doGet()/ doPost() methods.

### Group D : Website Development (Mini-Project)

Assignment No. 6:  Develop website using any CMS tool which falls into one of the categories blog, social networking, News updates, Wikipedia, E-commerce store. Website must include home page, and at least 3 forms (with Validation), use at list HTML5, PHP, CSS/Bootstrap, JavaScript web technologies. No database support is needed. Deploy website on live webserver and access through URL.

Write a complete report of web development stages for the chosen topic and attach printout of the same with screen shots of web pages. Proper use of every technique used for web designing should be followed like for designing wireframe is used. Human computer interaction and user experience concepts learned from HCI should be applied while web development process.

### Guidelines for Mini project
1. Project group of maximum 3 students should be formed.
2. Every group member should participate in every stage of the web development.

3. Proper compilation of the report should be attached in the file in printed format.

4. Use of CMS should be done for only Assignment no 6 (Mini Project).

5. At the end of the semester, group should give a presentation of the Mini Project.

**References:**

1. HTML, XHTML and CSS, Fourth Edition by Steven M. Schafer, Wiley India Edition. ISBN: 978- 81-265-1635-3.

2. Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP, 4$^{th}$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 compliances involved 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: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, 2$^{nd}$ 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, 1$^{st}$Edition.
2. Email Marketing: An Hour a Day, Wiley, Jeanniey Mullen, David Daniels, David Gilmour-ISBN: 978-0-470-38673-6, 1$^{st}$Edition.
3. The New Rules of Marketing and PR, David Scott, Wiley India, ISBN: 978-1-119-07048-1, 1$^{st}$Edition.

# SEMESTER-II

## 314450: COMPUTER NETWORK TECHNOLOGY

**Teaching Scheme:**
Lectures: 3 Hours/Week

**Credits**

03

**Examination Scheme:**
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, 5$^{th}$ 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

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## 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

<span style="color:green">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.</span>

## 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

## 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:** | **Credits** | **Examination Scheme:** |
| --- | --- | --- |
| Tutorial : 1 Hour/Week | 01 | 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 21$^{st}$ 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.

**FACULTY OF ENGINEERING**

**Syllabus**

**B.E. (Information Technology) 2015 Course**

**(With effect from Academic Year 2018-2019)**

**SAVITRIBAI PHULE PUNE UNIVERSITY**
**The syllabus is prepared by**
**B.O.S. in Information Technology, Savitribai Phule Pune University**

# I N D E X

**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) 2015 Course to be implemented from Academic Year 2018-19**

SEMESTER –I

| Subject Code | Subject | Teaching Scheme | | | Examination Scheme | | | | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Lecture | Practical | Tutorial | In-Sem | TW | PR | OR | End-Sem | | |
| 414453 | Information and Cyber Security | 3 | -- | -- | 30 | -- | -- | -- | 70 | 100 | 3 |
| 414454 | Machine Learning and Applications | 4 | -- | -- | 30 | -- | -- | -- | 70 | 100 | 4 |
| 414455 | Software Design and Modeling | 3 | -- | -- | 30 | -- | -- | -- | 70 | 100 | 3 |
| 414456 | Elective-I | 3 | -- | -- | 30 | -- | -- | -- | 70 | 100 | 3 |
| 414457 | Elective -II | 3 | -- | -- | 30 | -- | -- | -- | 70 | 100 | 3 |
| 414458 | Computer Laboratory-VII | -- | 4 | -- | -- | 50 | 50 | -- | -- | 100 | 2 |
| 414459 | Computer Laboratory-VIII | -- | 4 | -- | -- | 50 | -- | 50 | -- | 100 | 2 |
| 414460 | Project Phase-I | -- | -- | 2 | -- | 50 | -- | -- | -- | 50 | 2 |
| 414461 | Audit Course-V | -- | -- | -- | -- | -- | -- | -- | -- | Grade | |
| **Total** | | **16** | **8** | **2** | **150** | **150** | **50** | **50** | **350** | **750** | **22** |
| **Total of Part-I** | | **26** | | | **750** | | | | | | |

**Abbreviations: TW:** Term Work **TH:** Theory **OR:** Oral **PR**: Practical **Sem**: Semester
Computer Laboratory-VII (Information and Cyber Security+ Machine Learning and Application)
Computer Laboratory-VIII (Software Design and Modeling)

| Elective I | | Elective II | |
|---|---|---|---|
| 414456 A | 1. Wireless Communications | 414457A | 1. Software Defined Networks |
| 414456B | 2. Natural Language Processing | 414457B | 2. Soft Computing |
| 414456C | 3. Usability Engineering | 414457C | 3. Software Testing and Quality Assurance |
| 414456D | 4. Multicore and Concurrent Systems | 414457D | 4. Compiler Construction |
| 414456E | 5. Business Analytics and Intelligence | 414457E | 5. Gamification |

| Audit Course-V | |
|---|---|
| 414461A | 1. Emotional Intelligence |
| 414461B | 2. Green Computing |
| 414461C | 3. Critical Thinking |
| 414461D | 4. Statistical Learning model using R. |

## SEMESTER –II

| Subject Code | Subject | Teaching Scheme | | | Examination Scheme | | | | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Lecture | Practical | Tutorial | In-Sem | TW | PR | OR | End-Sem | | |
| 414462 | Distributed Computing System | 3 | -- | -- | 30 | -- | -- | -- | 70 | 100 | 3 |
| 414463 | Ubiquitous Computing | 3 | -- | -- | 30 | -- | -- | -- | 70 | 100 | 3 |
| 414464 | Elective-III | 3 | 2 | -- | 30 | 25 | -- | 25 | 70 | 150 | 4 |
| 414465 | Elective-IV | 3 | -- | -- | 30 | -- | -- | -- | 70 | 100 | 3 |
| 414466 | Computer Laboratory-IX | -- | 4 | -- | -- | 50 | 50 | -- | -- | 100 | 2 |
| 414467 | Computer Laboratory-X | -- | 2 | -- | -- | 25 | -- | 25 | -- | 50 | 1 |
| 414468 | Project Work | -- | -- | 6 | -- | 50 | -- | 100 | -- | 150 | 6 |
| 414469 | Audit Course-VI | -- | -- | -- | -- | -- | -- | -- | -- | Grade | |
| **Total** | | 12 | 8 | 6 | 120 | 150 | 50 | 150 | 280 | 750 | 22 |
| **Total of Part-II** | | 26 | | | 750 | | | | | | |

**Abbreviations: TW:** Term Work **TH:** Theory **OR:** Oral **PR**: Practical **Sem**: Semester
Computer Laboratory-IX (Distributed Computing System)
Computer Laboratory-X (Ubiquitous Computing)

| Elective III | | Elective IV | |
|---|---|---|---|
| 414464A | 1. Internet of Things (IoT) | 414465A | 1. Rural Technologies and Community Development |
| 414464B | 2. Information storage and retrieval | 414465B | 2. Parallel Computing |
| 414464C | 3. Multimedia Techniques | 414465C | 3. Computer Vision |
| 414464D | 4. Internet and Web Programming | 414464D | 4. Social Media Analytics |
| 414464E | 5. Computational Optimization | 414465E | 5. Open Elective |

| Audit Course-VI | |
|---|---|
| 414469A | 1. IoT – Application in Engineering field |
| 414469B | 2. Entrepreneurship |
| 414469C | 3. Cognitive Computing |
| 414469D | 4. AI and Robotics |

# SEMESTER-I

| Savitribai Phule Pune University<br>Fourth Year of Information Technology Engineering (2015 Course)<br>414453: Information and Cyber Security | | |
| --- | --- | --- |
| **Teaching Scheme:**<br>TH:03 Hours/Week | **Credits: 03** | **Examination Scheme:**<br>In-Sem (Paper): 30 Marks<br>End-Sem (paper): 70 Marks |

**Prerequisites:**

Data Communication  and Computer Network

**Course Objectives:**

1. Understand computer, network and information security.
2. To study operating system security and malwares
3. To study security issues in internet protocols.
4. To study network defence tools.
5. To learn forensics and investigation techniques

**Course Outcomes:**

By the end of the course, students should be able to

1. Be able to use basic cryptographic techniques in software and system design.
2. Apply methods for authentication, access control, intrusion detection and prevention.
3. Able to apply the scientific method to digital forensics and perform forensic investigations.
4. To develop computer forensics awareness.
5. Ability to use computer forensics tools.

| Unit I | **SECURITY BASICS** | **7 Hrs** |
| --- | --- | --- |

Information Security Concepts, Security Threats and Vulnerabilities, Security Architectures and Operational Models, Types of Security attacks, Goals of Security, Malicious code, Intrusion detection system (IDS): Need, Types, Limitations and Challenges, security and privacy.

| Unit II | **SYMMETRIC AND ASYMMETRIC KEY CRYPTOGRAPHY** | **7Hrs** |
| --- | --- | --- |

Introduction, Classical Encryption Techniques, Block Ciphers and Data Encryption standards, Advanced Encryption standard, Public Key Cryptography and RSA, Diffie-Hellman, Elgamal Curve Arithmetic, Elliptic Curve arithmetic, Elliptic Curve cryptography.

| Unit III | **DATA INTEGRITY ALGORITHMS AND SECURITY REQUIREMENTS** | **7 Hrs** |
| --- | --- | --- |

Cryptographic Hash Functions, requirements and security, SHA, SHA-3, Digital Signatures, X.509 Certificate, Kerberos, IP Security: Architecture Protocols IPv4, IPv6, AH, EPS, ISAKMP, Web Security: SSL, HTTPS, Mail Security: PGP, S/MIME

| Unit IV | LEGAL, ETHICAL, AND PROFESSIONAL ISSUES IN INFORMATION SECURITY, RISK MANAGEMENT | 7 Hrs |
|---------|-----------------------------------------------------------------------------------|-------|

Overview, Risk identification, Risk Assessment, Risk Control Strategies, Quantitative vs. Qualitative Risk Control Practices. Risk Management. Laws and Ethics in Information Security, Codes of Ethics, Protecting programs and data.

| Unit V | INTRODUCTION TO CYBER SECURITY | 7 Hrs |
|--------|--------------------------------|-------|

Introduction, Definition and origin, Cybercrime and Information security, Classification of Cybercrimes, The legal perspectives- Indian perspective, Global perspective, Categories of Cybercrime, Types of Attacks, a Social Engineering, Cyber stalking, Cloud Computing and Cybercrime.

| Unit VI | TOOLS AND METHODS USED IN CYBERCRIME | 7 Hrs |
|---------|--------------------------------------|-------|

Introduction, Proxy servers and Anonymizers, Phishing, Password Cracking, Key-loggers and Spywares, Types of Virus, Worms, Dos and DDoS, SQL injection, Cybercrime and Legal perspectives, Cyber laws- Indian context, The Indian IT Act-Challenges, Amendments, Challenges to Indian Law and cybercrime Scenario in India, Indian IT Act and Digital Signatures. study of any two network security scanners: Nmap, Metasploit, OpenVAS, Aircrack, Snort, Wireshark,  Nikito, Samurai, Safe 3 etc.

## Text Books

1. William Stallings,  Computer Security : Principles and Practices, Pearson  6<sup>th</sup> Ed, ISBN: 978-0-13-335469-0
2. Nina Godbole, Sunit Belapure , Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiely India Pvt.Ltd, ISBN- 978-81-265-2179-1
3. Bernard Menezes, Network Security and Cryptography,  Cengage Learning , ISBN-978-81-315-1349-1
4. Dr. V.K. Pachghare, Cryptography and Information security, PHI, Second edition, ISBN- 978-81-203-5082-3

## Reference Books

1. Bruice Schneier , Applied Cryptography- Protocols, Algorithms and Source code in C, Algorithms, Wiely India Pvt Ltd, 2nd Edition, ISBN 978-81-265-1368-0
2. Nina Godbole , Information Systems Security , Wiley India Pvt. Ltd, ISBN -978-81-265-1692-6
3. CK Shyamala et el., Cryptography and Security , Wiley India Pvt. Ltd, ISBN-978-81-265-2285-9
4. Berouz Forouzan, Cryptography and Network Security, TMH, 2 edition, ISBN -978-00-707-0208-0
5. Mark Merkow, Information Security-Principles and Practices, Pearson Ed. , ISBN- 978-81-317-1288-7

| Savitribai Phule Pune University |
|---|
| Fourth Year of Information Technology Engineering (2015 Course) |
| 414454: Machine Learning and Applications |

| Teaching Scheme: TH:04 Hours/Week | Credits: 04 | Examination Scheme: |
|---|---|---|
| | | In-Sem (Paper): 30 Marks |
| | | End-Sem (paper): 70 Marks |

**Prerequisites:**

Linear Algebra and Calculus, Probability Basics

**Course Objectives:**

1. Understanding Human learning aspects.
2. Understanding primitives and methods in learning process by computer.
3. Understanding nature of problems solved with Machine Learning

**Course Outcomes:**

By the end of the course, students should be able to

1. model the learning primitives.
2. build the learning model.
3. tackle real world problems in the domain of Data Mining and Big Data Analytics, Information Retrieval, Computer vision, Linguistics and Bioinformatics.

| Unit I | INTRODUCTION TO MACHINE LEARNING | 8 Hrs |
|---|---|---|

Introduction: What is Machine Learning, Examples of Machine Learning applications, Training versus Testing, Positive and Negative Class, Cross-validation

Types of Learning: Supervised, Unsupervised and Semi-Supervised Learning

Dimensionality Reduction: Introduction to Dimensionality Reduction, Subset Selection, Introduction to Principal Component Analysis

| Unit II | CLASSIFICATION | 8 Hrs |
|---|---|---|

Binary and Multiclass Classification: Assessing Classification Performance, Handling more than two classes, Multiclass Classification-One vs One, One vs Rest

Linear Models: Perceptron, Support Vector Machines (SVM), Soft Margin SVM, Kernel methods for non-linearity

| Unit III | REGRESSION AND GENERALIZATION | 8 Hrs |
|---|---|---|

Regression: Assessing performance of Regression – Error measures, Overfitting and Underfitting, Catalysts for Overfitting, VC Dimensions

Linear Models: Least Square method, Univariate Regression, Multivariate Linear Regression, Regularized Regression - Ridge Regression and Lasso

Theory of Generalization:  Bias and Variance Dilemma, Training and Testing Curves
Case Study of Polynomial Curve Fitting

| Unit IV | LOGIC BASED AND ALGEBRAIC MODELS | 8 Hrs |
|---|---|---|

Distance Based Models: Neighbors and Examples, Nearest Neighbor Classification, Distance based clustering algorithms - K-means and K-medoids, Hierarchical clustering
Rule Based Models: Rule learning for subgroup discovery, Association rules mining – Apriori Algorithm, Confidence and Support parameters
Tree Based Models: Decision Trees, Minority Class,  Impurity Measures – Gini Index and Entropy, Best Split

| Unit V | PROBABILISTIC MODELS | 8 Hrs |
|---|---|---|

Conditional Probability, Joint Probability, Probability Density Function, Normal Distribution and its Geometric Interpretation, Naïve Bayes Classifier, Discriminative Learning with Maximum Likelihood. Probabilistic Models with Hidden variables: Expectation-Maximization methods, Gaussian Mixtures

| Unit VI | TRENDS IN MACHINE LEARNING | 8 Hrs |
|---|---|---|

Ensemble Learning: Combining Multiple Models, Bagging, Randomization, Boosting, Stacking
Reinforcement Learning: Exploration, Exploitation, Rewards, Penalties
Deep Learning: The Neuron, Expressing Linear Perceptrons as Neurons, Feed Forward Neural Networks, Linear Neurons and their Limitations, Sigmoid, Tanh and ReLU Neurons

## Text Books

1. Ethem Alpaydin: Introduction to Machine Learning, PHI 2nd Edition-2013.
2. Peter Flach:  Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.

## Reference Books

1. C. M. Bishop: Pattern Recognition and Machine Learning, Springer 1st Edition-2013.
2. Ian H Witten, Eibe Frank, Mark A Hall: Data Mining, Practical Machine Learning Tools and Techniques, Elsevier, 3rd Edition.
3. Parag Kulkarni: Reinforcement Learning and Systemic Machine Learning for Decision Making, IEEE Press, Reprint 2015.
4. Nikhil Buduma: Fundamentals of Deep Learning, O'Reilly Media, June 2017.
5. Hastie, Tibshirani, Friedman: Introduction to Statistical Machine Learning with Applications in R, Springer, 2nd Edition 2012.
6. Kevin P Murphy: Machine Learning – A Probabilistic Perspective, MIT Press, August 2012.

## Savitribai Phule Pune University
## Fourth Year of Information Technology Engineering (2015 Course)
## 414455: Software Design and Modeling

| Teaching Scheme: TH:03 Hours/Week | Credits: 03 | Examination Scheme: |
|---|---|---|
| | | In-Sem (Paper): 30 Marks |
| | | End-Sem (paper): 70 Marks |

**Prerequisites:**
1. Problem Solving & Object-Oriented Programming
2. Software Engineering and Project Management
3. Database Management System

**Course Objectives:**
1. To teach the student the fundamental aspects of different object oriented methodologies and unified approach along with Unified Modeling Language (UML), in terms of "how to use" it for the purpose of specifying and developing software.
2. Explore and analyze use case modeling, domain/ class modeling.
3. To teach the student Interaction and Behavior Modeling,
4. Aware students with design process in software development
5. Orient students with the software design principles and patterns
6. Enable students to learn the architectural design guidelines in various type of application development

**Course Outcomes:**
By the end of the course, students should be able to
1. Understand object oriented methodologies, basics of Unified Modeling Language (UML).
2. Understand analysis process, use case modeling, domain/class modeling
3. Understand interaction and behavior modeling.
4. Understand design process and business, access and view layer class design
5. Get started on study of GRASP principles and GoF design patterns.
6. Get started on study of architectural design principles and guidelines in the various type of application development.

| Unit I | OBJECT ORIENTED METHODOLOGIES, UML | 7 Hrs |
|---|---|---|

Views of Software Developments: Traditional System Development Methodology   and Object Oriented Analysis and Design, Importance Object –Orientation
Some of the object Oriented Methodology:- Object Oriented Design –Booch, Object Modeling Techniques – Rumbaugh, Object – Oriented Analysis - Cood Yourdon, Object – Oriented Software Engineering – Ivar Jacobson
Unified Approach: Object Oriented Analysis, Object Oriented Design, Iterative Development & Continuous Testing, Modeling Based on UML, Layered Approach,

Unified Modeling Language: Introduction to Modeling & UML, MDA, UML Structure, UML Building Blocks, UML Common Mechanisms, Introduction to all UML Diagram Notational Techniques, 4+1 View.

| Unit II | OBJECT ORIENTED ANALYSIS | 7 Hrs |
|---------|--------------------------|-------|

Object Oriented Analysis Process,
Use Case Modeling: Actor Identification, Actor Classification, Actor Generalization, Use Cases Identification, Communication, Uses/Include and Extend Associations, Writing a Formal Use Cases, Use Case realizations
Domain / Class Modeling: Approaches For Identifying Classes (Noun-Phase Approach, Common Class Pattern Approach, Class Responsibilities Collaboration Approach, Naming Classes,
Class Associations and Identification of Associations, Generalization/Specialization Relationship, Aggregation and Composition Relationships, Attributes and Methods Identification.

| Unit III | INTERACTION AND BEHAVIOR MODELING | 7 Hrs |
|----------|-----------------------------------|-------|

Activity Diagram : Activity and Actions, Initial and Final Activity, Activity Edge, Decision and Merge Points, Fork and Join, Input and Output Pins, Activity Group, Activity Partitions, Constraints on Action, Swim Lanes
Sequence Diagram: Context, Objects and Roles, Links, Object Life Line, Message or stimulus, Activation/Focus of Control, Modeling Interactions,
Collaboration Diagram :Objects and Links, Messages and stimuli, Active Objects, Communication Diagram, Iteration Expression, Parallel Execution, Guard Expression, Timing Diagram
State Diagram : State Machine, Triggers and Ports, Transitions, Initial and Final State, Composite States, Submachine States

| Unit IV | OBJECT ORIENTED DESIGN | 7 Hrs |
|---------|------------------------|-------|

Object Oriented Design Process
Designing Business Layer : Object Oriented Constraints Language (OCL), Designing Business Classes : The Process, Designing Well Defined Class Visibility, Attribute Refinement, Method Design Using UML Activity Diagram, Packaging and Managing Classes.
Designing Access Layer: Object Relational Systems, Object Relation Mapping, Table Class Mapping, Table – Inherited Classes Mapping, Designing the Access Layer Classes: The Process,
Designing View Layer : View Layer Classes Design, Identifying View Classes by Analyzing Use Cases, Macro-Level Design Process, Prototyping the User Interface
Component and Deployment Design using Component and Deployment Diagram.

| Unit V | DESIGN PRINCIPLES AND PATTERNS | 7 Hrs |
|--------|--------------------------------|-------|

Introduction to Patterns
General Responsibility Assignment Software Patterns (GRASP) : Introduction,  Creator , Information Expert, Low coupling, Controller, High Cohesion, Polymorphism , Pure fabrication, Indirection, Protected Variations
Gang of Four (GoF): Introduction, Categories of Patterns (Creational, Structural and Behavioral Patterns), Singleton, Adapter, State, and Strategy.

| Unit VI | ARCHITECTURAL DESIGN | 7 Hrs |
|---------|----------------------|-------|

Overview of software Architecture, Designing Client / Server Software Architectures, Designing Service Oriented Software Architectures, Designing Component Based Software Architectures, Designing Concurrent and Real-Time Software Architectures, Designing Product Line Architectures, Related Case Studies.

## Text Books

1. Ali Bahrami, Object Oriented System Development: Using Unified Modeling Language, McGraw-Hill, International Editions 1999,ISBN:0-07-116090-6
2. Craig Larman, Applying UML and Patterns, Pearson Education, Second Edition,ISBN:978-0130925695
3. Erich Gamma et al, Design Patterns: Elements of Reusable Object, Pearson, First Edition,ISBN:9789332555402, 9332555400

## Reference Books

1. Martin Fowler, UML Distilled, Pearson, Third Edition, ISBN:978-81-317-1565-9
2. Dan Pilone, Neil Pitman, UML in Nutshell, O'reilly Pub.,ISBN:8184040024, 9788184040029
3. Roger S. Pressman, Software Engineering: A Practitioner's Approach, McGraw Hill, Seventh Edition ,ISBN:9339212088, 9789339212087
4. Hassan Gomaa, Software Modeling And Design UML, Use Cases, Pattern, & Software Architectures, Cambridge University Press, ISBN:978-0-521-76414-8
5. JIM Arlow, Ila Neustadt, UML 2 and the Unified Process, Pearson, Second Edition, ISBN:9788131700549 Tom Pender, UML 2 Bible, Wiley India, ISBN:9788126504527

## Savitribai Phule Pune University
## Fourth Year of Information Technology Engineering (2015 Course)
## 414456A: Elective-I
## Wireless Communications

| Teaching Scheme:<br>TH:03 Hours/Week | Credits: 03 | Examination Scheme:<br>In-Sem (Paper): 30 Marks<br>End-Sem (paper): 70 Marks |
|---|---|---|

**Prerequisites:**
1. Foundations of Communication and Computer network
2. Computer Network  Technology

**Course Objectives:**
1. To provide fundamental knowledge that forms the basis for wireless communication systems and Networks.
2. For creating foundation of cellular concepts which will be useful for understanding the fundamentals of cellular mobile communication systems design.
3. To provide knowledge about the Mobile Radio Propagation models and various wireless channel effects.
4. To Study various Multiple Access techniques.
5. Give Students the exposure to recent emerging trends in wireless communication like Software Defined Radio as well.
6. To Provide overview of recent trends like wireless communication like Wi-Fi, Wi-MAX, bee, UWB Radio and Wireless Adhoc Networks.

**Course Outcomes:**
By the end of the course, students should be able to
1. Understand the basics of propagation of radio signals
2. Understand the basic concepts of basic Cellular System and the design requirements
3. Have an understanding of the basic principles behind radio resource management techniques such as power control, channel allocation and handoffs.
4. Gain insights into various mobile radio propagation models and how the diversity can be exploited to improve performance
5. Gain knowledge and awareness of the technologies for how to effectively share spectrum through multiple access techniques i.e. TDMA, CDMA, FDMA etc.
6. Have in-depth understanding of the design consideration and architecture for different Wireless Systems like GSM, CDMA, GPRS etc
7. Understanding of the emerging trends in Wireless communication like WiFi, WiMAX, Software Defined Radio (SDR) and related issues and challenges.

| Unit I | INTRODUCTION TO WIRELESS COMMUNICATION SYSTEM | 7 Hrs |
|---|---|---|

Evolution of mobile communications, Mobile Radio System around the world, Types of Wireless Communication System, Comparison of Common wireless system, Trend in Cellular radio and personal communication. Second generation Cellular Networks, Third Generation (3G) Wireless Networks, Wireless Local Loop(WLL),Wireless Local Area network(WLAN), Bluetooth and Personal Area Networks

| Unit II | THE CELLULAR CONCEPT- SYSTEM DESIGN FUNDAMENTALS | 7 Hrs |
|---|---|---|

Cellular system, Hexagonal geometry cell and concept of frequency reuse, Channel Assignment Strategies Distance to frequency reuse ratio, Channel & co-channel interference reduction factor, S/I ratio consideration and calculation for Minimum Co-channel and adjacent interference, Handoff Strategies, Umbrella Cell Concept, Trunking and Grade of Service, Improving Coverage & Capacity in Cellular System-cell splitting, Cell sectorization, Repeaters, Micro cell zone concept, Channel antenna system design considerations.

| Unit III | MOBILE RADIO PROPAGATION MODEL, SMALL SCALE FADING AND DIVERSITY | 7 Hrs |
|---|---|---|

Large scale path loss: Free Space Propagation loss equation, Path-loss of NLOS and LOS systems, Reflection, Ray ground reflection model, Diffraction, Scattering, Link budget design, Max. Distance Coverage formula, Empirical formula for path loss, Indoor and outdoor propagation models, Small scale multipath propagation, Impulse model for multipath channel, Delay spread, Feher's delay spread, upper bound Small scale, Multipath Measurement parameters of multipath channels, Types of small scale Fading, Rayleigh and rician distribution, Statistical for models multipath fading channels and diversity techniques.

| Unit IV | MULTIPLE ACCESS TECHNIQUES | 7 Hrs |
|---|---|---|

Access Methods: TDMA (TDD and FDMA); Spread-Spectrum Frequency-Hopping; Direct-Sequence CDMA and CSMA. Comparison of Linearly Amplified BPSK, DQPS and DQPSK and Nonlinearly Amplified (NLA) GMSK, GFSK, 4-FM, and FQPSK Radio Equipment (Coherent and Noncoherent). Radio Link Design of Digital Wireless Cellular Systems. Spectrum Utilization in Digital Wireless Mobile Systems. Capacity and Throughput (Message Delay) Study and Comparison of GMSK, GFSK, and FQPSK Modulated Wireless Systems. Time Division Multiple Access Wireless Cellular Systems. Code Division Multiple Access Spread-Spectrum Digital Cellular IS-95 System.

| Unit V | WIRELESS SYSTEMS | 7 Hrs |
|---|---|---|

GSM system architecture, Radio interface, Protocols, Localization and calling, Handover, Authentication and security in GSM, GSM speech coding, Concept of spread spectrum, Architecture of IS-95 CDMA system, Air interface, CDMA forward channels, CDMA reverse channels, Soft handoff, CDMA features, Power control in CDMA, Performance of CDMA System, RAKE Receiver, CDMA2000 cellular technology, GPRS system architecture.

| Unit VI | RECENT TRENDS | 7 Hrs |
|---|---|---|

Introduction to Wi-Fi, WiMAX, ZigBee Networks, Software Defined Radio, UWB Radio, Wireless Adhoc Network and Mobile Portability, Security issues and challenges in a Wireless network.

| Text Books |
|---|

1. Rappaport, T.S., "Wireless communications", Second Edition, Pearson Education, 2010.
2. Wireless Communications and Networking, Vijay Garg, Elsevier.
3. Wireless digital communication, KamiloFeher, PHI.
4. Andreas.F. Molisch, "Wireless Communications", John Wiley – India, 20063

**Reference Books**

1. David Tse and PramodViswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 2005.
2. UpenaDalal, " Wireless Communication", Oxford University Press, 2009.
3. Van Nee, R. and Ramji Prasad, "OFDM for wireless multimedia communications", Artech House, 2000.
4. Mobile Communications Engineering, William C. Y. Lee, McGraw Hill Publications
5. Mobile and personal Communication system and services by Rajpandya, IEEE press (PHI).
6. Wireless Communications-T.L.Singh-TMH
7. Adhoc Mobile Wireless network, C.K.Toh Pearson

## Savitribai Phule Pune University
## Fourth Year of Information Technology Engineering (2015 Course)
## 414456B: Elective-I
## Natural Language Processing

| Teaching Scheme:<br>TH:03 Hours/Week | Credits: 03 | Examination Scheme:<br>In-Sem (Paper): 30 Marks<br>End-Sem (paper): 70 Marks |
|---|---|---|

**Prerequisites:**
1. Basic understanding of probability theory
2. Basic knowledge of finite automata

**Course Objectives:**
1. To understand the core concepts of Natural language processing and levels of language analysis.
2. To understand the computational properties of natural languages and the commonly used algorithms for processing linguistic information

**Course Outcomes:**

By the end of the course, students should be able to

1. Understand automatic processing of human languages using computers.
2. Understand various applications of natural language processing

| Unit I | INTRODUCTION | 7 Hrs |
|---|---|---|

Applications of Natural Language Understanding, Evaluating Language Understanding Systems, The Elements of Simple Noun Phrases, Verb Phrases and Simple Sentences, Noun Phrases, Adjective Phrases, Adverbial Phrases.

| Unit II | GRAMMARS | 7 Hrs |
|---|---|---|

Grammars and Sentence Structure, Top-Down Parser, Bottom-Up Chart Parser, Top-Down Chart Parsing, Finite State Models and Morphological Processing, Feature Systems and Augmented Grammars, Morphological Analysis and the Lexicon, Parsing with Features.

| Unit III | EFFICIENT PARSING | 7 Hrs |
|---|---|---|

Auxiliary Verbs and Verb Phrases, Noun Phrases and Relative Clauses, Human Preferences in Parsing, Encoding Uncertainty: Shift-Reduce Parsers, A Deterministic Parser, Techniques for Efficient Encoding of Ambiguity, Partial Parsing.

| Unit IV | AMBIGUITY RESOLUTION | 7 Hrs |
|---|---|---|

Part-of-Speech Tagging, Obtaining Lexical Probabilities, Probabilistic Context-Free Grammars, Best-First Parsing, Semantics and Logical Form, Word Senses and Ambiguity, Encoding Ambiguity in Logical Form, Verbs and States in Logical Form.

| Unit V | LINKING SYNTAX AND SEMANTICS | 7 Hrs |
|---|---|---|

Semantic Interpretation and Compositionality, Prepositional Phrases and Verb Phrases, Lexicalized Semantic Interpretation and Semantic Roles, Handling Simple Questions, Semantic Interpretation Using Feature Unification, Semantic Filtering Using Selectional Restrictions, Semantic Networks, Statistical Word Sense Disambiguation

| Unit VI | KNOWLEDGE REPRESENTATION | 7 Hrs |
|---|---|---|

Handling Natural Language Quantification, Time and Aspectual Classes of Verbs, Automating Deduction in Logic-Based Representations, Procedural Semantics and Question Answering, Hybrid Knowledge Representations, Using World Knowledge, Establishing Coherence, Matching Against Expectations, Reference and Matching Expectations, Using Knowledge About Action and Casualty.

### Text Books

1. Allen James, Natural Language Understanding, Pearson India,2$^{nd}$ Edition, ISBN:9788131708958, 8131708950
2. James H. Martin, Daniel Jurafsky,Speech and Language Processing,Pearson,1$^{st}$ Edition,ISBN: 9789332518414, 8131716724

### Reference Books

1. M. Christopher, H. Schutze ,Foundations of Statistical Natural Language Processing, MIT Press,1$^{st}$ Edition, ISBN:9780262133609
2. C. Eugene,Statistical Language Learning, MIT Press,1$^{st}$ Edition, ISBN:9780262032162
3. S. Bird, E. Klein &E. Loper,Natural Language Processing with Python, O' Reilly(Shroff Publishers), 1$^{st}$ Edition,ISBN:9788184047486

**Savitribai Phule Pune University**
**Fourth Year of Information Technology Engineering (2015 Course)**
**414456C: Elective-I**
**Usability Engineering**

| Teaching Scheme: TH:03 Hours/Week | Credits: 03 | Examination Scheme: In-Sem (Paper): 30 Marks End-Sem (paper): 70 Marks |
|---|---|---|

**Prerequisites:**

Human Computer Interaction

**Course Objectives:**

1. To explain usability engineering lifecycle for designing a user-friendly software.
2. Discuss usability design guidelines, their foundations, assumptions, advantages, and weaknesses.
3. To develop usability evaluation skills for software testing.
4. To explain industry standards for designing and evaluating use-interfaces.
5. To make aware of the current trends in usability engineering.

**Course Outcomes:**

By the end of the course, students should be able to

1. justify the theory and practice of usability evaluation approaches, methods and techniques.
2. compare and evaluate strengths and weaknesses of various approaches, methods and techniques for evaluating usability.
3. design and implement a usability test plan, based on modelling or requirements specification.
4. choose appropriate approaches, methods and techniques to evaluate the usability of a specified interactive system..

| Unit I | INTRODUCTION | 7 Hrs |
|---|---|---|

What is Usability: Usability and Other Considerations, Definition of Usability, Example: Measuring the Usability of Icons, Usability Trade-Offs, Categories of Users and Individual User Differences.
Generations of User Interfaces: Batch Systems, Line-Oriented Interfaces, Full-Screen Interfaces, Graphical User Interfaces, Next-Generation Interfaces, Long-Term Trends in Usability.

| Unit II | THE USABILITY ENGINEERING LIFECYCLE | 7 Hrs |
|---|---|---|

The Usability Engineering Lifecycle: Know the User, Competitive Analysis, Goal Setting, Parallel Design, Participatory Design, Coordinating the Total Interface, Guidelines and Heuristic Evaluation, Prototyping, Interface Evaluation, Iterative Design, Follow-Up Studies of Installed Systems, Meta-Methods, Prioritizing Usability Activities, Be Prepared.

| Unit III | USABILITY HEURISTICS | 7 Hrs |
|---|---|---|

Usability Heuristics: Simple and Natural Dialogue, Speak the Users' Language, Minimize User Memory Load, Consistency, Feedback, Clearly Marked Exits, Shortcuts, Good Error Messages, Prevent Errors, Help and Documentation, Heuristic Evaluation

| Unit IV | USABILITY TESTING | 7 Hrs |
|---|---|---|

Usability Testing: Test Goals and Test Plans, Getting Test Users, Choosing Experimenters, Ethical Aspects of Tests with Human, Subjects, Test Tasks, Stages of a Test, Performance Measurement, Thinking Aloud, Usability Laboratories.

Usability Assessment Methods beyond Testing: Observation, Questionnaires and Interviews, Focus Groups, Logging Actual Use, User Feedback, Choosing Usability Methods

| Unit V | INTERFACE STANDARDS | 7 Hrs |
|---|---|---|

Interface Standards: National, International and Vendor Standards, Producing Usable In-House Standards. International User Interfaces: International Graphical Interfaces, International Usability Engineering Guidelines for Internationalization Resource Separation, Multi-locale Interfaces.

| Unit VI | FUTURE DEVELOPMENTS | 7 Hrs |
|---|---|---|

Future Developments: Theoretical Solutions, Technological Solutions, CAUSE Tools: Computer-Aided Usability Engineering, Technology Transfer, Ubiquitous Computing, Intelligent User-interfaces, Simulation and Virtual Reality,

Case Study: Usability Issues in Organizations, Organizational Roles and Structures, Ethics of Usability, Web Analytics

## Text Books

1. Jakob Nielsen, "Usability Engineering", Morgan Kaufmann, An Imprint of Academic Press, Harcourt Science and Technology Company

## Reference Books

1. Rosson, M. B., & Carroll, J. M. (2001), "Usability Engineering: Scenario-Based development of human-computer interaction", Elsevier.
2. Mayhew, D. (1999), "The Usability Engineering Lifecycle: A Practitioner's Handbook for user interface design", Morgan Kaufmann

## Savitribai Phule Pune University
## Fourth Year of Information Technology Engineering (2015 Course)
## 414456D: Elective-I
## Multicore and Concurrent Systems

| Teaching Scheme: TH:03 Hours/Week | Credits: 03 | Examination Scheme: In-Sem (Paper): 30 Marks End-Sem (paper): 70 Marks |
|---|---|---|

**Prerequisites:**

1. Computer Architecture and Organization
2. Processor Architecture and Interfacing
3. Operating System
4. Programming Language and Problem Solving

**Course Objectives:**

1. To understand the multicore and concurrent systems.
2. To understand the multicore and concurrent programming aspects.
3. To understand concept of distributed and shared memory programming.
4. To recognize differences in between different concurrent processing approaches and identifying correct one according to architectural and application needs.
5. To know the applications of multicore and concurrent systems and use its programming concepts for new application development.
6. To explore recent trends in multicore and concurrent system programming

**Course Outcomes:**

By the end of the course, students should be able to

1. Know types of parallel machine and to know multicore and concurrent systems in detail.
2. Know the ways to measure the performance of multicore systems.
3. Understand need of multicore and concurrent system programming.
4. Know the different approaches for multicore and concurrent programming.
5. Use and apply the approaches learned, for application development.
6. Understand and explore recent trends in multicore and concurrent system programming.

| Unit I | INTRODUCTION | 7 Hrs |
|---|---|---|

Information Security Concepts, Security Threats and Vulnerabilities, Security Architectures and Operational Models, Types of Security attacks, Goals of Security, Malicious code, Intrusion detection system (IDS): Need, Types, Limitations and Challenges, security and privacy.

| Unit II | MULTICORE AND CONCURRENT PROGRAM DESIGN | 7 Hrs |
|---|---|---|

The PCAM methodology, Decomposition patterns: Task parallelism, Divide-and-conquer decomposition
Geometric decomposition, Recursive data decomposition, Pipeline decomposition, Event-based

coordination decomposition, Program structure patterns: Single-program, multiple-data, Multiple-program, multiple-data, Master-worker, Map-reduce, Fork/join, Loop parallelism, Matching decomposition patterns with program structure patterns.

| Unit III | SHARED-MEMORY PROGRAMMING: THREADS | 7 Hrs |
|---|---|---|

Threads, Design concerns, Semaphores, Applying semaphores in classical problems, Monitors, Applying monitors in classical problems, Dynamic vs. static thread management, Debugging multithreaded applications, Higher-level constructs: multithreaded programming without threads: Concurrent Map, Map-Reduce, Concurrent filter, Filter-reduce

| Unit IV | SHARED-MEMORY PROGRAMMING: OPENMP | 7 Hrs |
|---|---|---|

Introduction, OpenMP integration V.0: manual partitioning, OpenMP integration V.1: manual partitioning without a race condition, OpenMP integration V.2: implicit partitioning with locking, OpenMP integration V.3: implicit partitioning with reduction, Loop-level parallelism, Task parallelism, Synchronization constructs, Correctness and optimization issues.

| Unit V | DISTRIBUTED MEMORY PROGRAMMING | 7 Hrs |
|---|---|---|

Communicating processes, MPI, Core Concepts, Program architecture, Point-to-Point communication, Buffered communications, Non-blocking communications, Error reporting and handling, Collective communications, Communicating objects, Node management: communicators and groups, One-sided communications, I/O considerations, Combining MPI processes with threads, Timing and performance measurements, Debugging and proiling MPI programs, The Boost.MPI library

| Unit VI | GPU PROGRAMMING | 7 Hrs |
|---|---|---|

CUDA's programming model: threads, blocks, and grids, CUDA's execution model: streaming multiprocessors and warps, CUDA compilation process, Memory hierarchy, Optimization techniques, Dynamic parallelism, Debugging CUDA programs, Proiling CUDA programs, CUDA and MPI

## Text Books

1. Gerassimos Barlas, "Multicore and GPU Programming An Integrated Approach", Morgan Kaufmann, 2015.
2. Max Domeika, "Software Development for Embedded Multi-core Systems: A Practical Guide Using Embedded Intel® Architecture",  Elsevier Inc., 2008.
3. Jean Bacon, Janet Van Der Linden, "Concurrent Systems: An Integrated Approach to Operating Systems, Distributed Systems and Database", Addison-Wesley, Edition 2000

## Reference Books

1. John L. Hennessey and David A. Patterson, " Computer Architecture – A quantitative approach", Morgan Kaufmann / Elsevier, 4th. Edition.
2. David E. Culler, Jaswinder Pal Singh, "Parallel Computing Architecture : A hardware/ software approach", Morgan Kaufmann / Elsevier. 3. Darryl Gove, "Multicore Application Programming for Windows, Linux, and Oracle Solaris", Pearson, 2011.
3. William Stallings, "Computer Organization and Architecture – Designing for Performance", Pearson Education, Seventh Edition.
4. Dezso Sima, Terence Fountain, Peter Kacsuk "Advanced Computer Architectures" A Design space approach, Pearson Education.
5. Advanced Computer Architecture Parallelism, Scalability – Kai Hwang, Programmability, Tata McGrawhill.

6.  4. Michael J Quinn, "Parallel programming in C with MPI and OpenMP", Tata McGraw Hill, 2003.
7.  Shameem Akhter and Jason Roberts, "Multi-core Programming", Intel Press, 2006.
8.  Roscoe A.W., "Understanding Concurrent Systems", Springer-Verlag, 2010.

## Savitribai Phule Pune University
## Fourth Year of Information Technology Engineering (2015 Course)
## 414456E: Elective-I
## Business Analytics and Intelligence

| Teaching Scheme: TH:03 Hours/Week | Credits: 03 | Examination Scheme: In-Sem (Paper): 30 Marks End-Sem (paper): 70 Marks |
|---|---|---|

**Prerequisites:**

**Course Objectives:**
1. Apply conceptual knowledge on how business intelligence is used within organizations.
2. Evaluate organization's abilities to create and mobilize corporate knowledge.
3. Select software tools for knowledge management systems in business organizations
4. Suggest design systems to provide business intelligence

**Course Outcomes:**

By the end of the course, students should be able to

1. Comprehend the Information Systems and development approaches of Intelligent Systems
2. Evaluate and rethink business processes using information systems
3. Propose the Framework for business intelligence
4. Get acquainted with the Theories, techniques, and considerations for capturing organizational intelligence
5. Align business intelligence with business strategy
6. Apply the techniques for implementing business intelligence systems

| Unit I | Decision Making and Decision Support Systems | 7 Hrs |
|---|---|---|

The role of computerized support for decision making and its importance. Types of decisions managers face, and the process through which they make decisions. Decision making styles, the four stages of Simon's decision making process, and common strategies and approaches of decision makers. The role of Decision Support Systems (DSS), its main components, the various DSS types and classification, and how DSS have changed over time. How DSS supports each phase of decision making and summarize the evolution of DSS applications, and on how they have changed over time.

| Unit II | Business Intelligence Concepts and Platform Capabilities | 7 Hrs |
|---|---|---|

Definition of business intelligence (BI), BI architecture, and its components, and relation with DSS. The main components of BI platforms, their capabilities, and the competitive landscape of BI platforms. The building blocks of business reports, the types of business reports, and the components and structure of business reporting systems. Role of Mathematical model in BI,

Factors Responsible for successful BI Project, Obstacle to Business Intelligence in an Organization Different types of OLAP and their applications, and the differences between OLAP and OLTP.

| Unit III | Data Visualization and Dashboard Design | 7 Hrs |
|---|---|---|

The top job responsibilities of BI analysts by focusing on creating data visualizations and dashboards. The importance of data visualization and different types of data that can be visually represented. The types of basic and composite charts. This will help you to determine which visualization is most effective to display data for a given data set, and to identify best practices for designing data visualizations. Common characteristics of dashboard, the types of dashboards, and the list attributes of metrics usually included in dashboards. The guidelines for designing dashboard and the common pitfalls of dashboard design.

| Unit IV | Business Performance Management Systems | 7 Hrs |
|---|---|---|

This module focuses on how BI is used for Business Performance Management (BPM). The main components of BPM as well as the four phases of BPM cycle and how organizations typically deploy BPM. The purpose of Performance Measurement System and how organizations need to define the key performance indicators (KPIs) for their performance management system. Four balanced scorecards perspectives and the differences between dashboards and scorecards. The benefits of using balanced scorecard versus using Six Sigma in a performance measurement system.

| Unit V | Role of Business Intelligence and Analytics in Business | 7 Hrs |
|---|---|---|

The role of visual and business analytics (BA) in BI and how various forms of BA are supported in practice. ERP and Business Intelligence, BI Applications in CRM, BI Applications in Marketing, BI Applications in Logistics and Production, Role of BI in Finance, BI Applications in Banking, BI Applications in Telecommunications, BI Applications in Fraud Detection, BI Applications in Retail Industry

| Unit VI | BI Maturity, Strategy and Modern Trends in BI | 7 Hrs |
|---|---|---|

BI maturity and strategy. Different levels of BI maturity, the factors that impact BI maturity within an organization, and the main challenges and the potential solutions for a pervasive BI maturity within an organization. The critical success factors for implementing a BI strategy, BI framework, and BI implementation targets. Open Source BI. Big Data systems. Social BI systems, Geographic BI systems. Customer Experience based BI.

## Text Books

1. Sabherwal, R. and Becerra-Fernandez, I.(2011). Business Intelligence: Practices, Technologies and Management. John Wiley.
2. Turban,E. and Volonino, L.(2011). Information Technology for Managment: Improving Strategic and Operational Performance. 8th edn.Wiley.

## Reference Books

1. Avison, D. and Fitzgerald, G. (2006). Information Systems development: Methodologies, techniques and tools. 4th ed. McGraw-Hill.
2. Anderson-Lehman, R., Watson, H.J., Wixom, B.H., & Hoffer, J.A., 2004, Continental Airlines Flies High with Real-Time Business Intelligence, MIS Quarterly Executive, 3, 4, pp 163-176
3. Gangadharan, G.R., & Swami, N., 2004, Business Intelligence Systems: Design and Implementation Strategies, Proceedings of the 2nd International conference on Technology Interfaces, June 7-10, Cavtat, Croatia, pp 139-144

**Savitribai Phule Pune University**
**Fourth Year of Information Technology Engineering (2015 Course)**
**414457A: Elective-II**
**Software Defined Networks**

| Teaching Scheme: | Credits: 03 | Examination Scheme: |
|---|---|---|
| TH:03 Hours/Week | | In-Sem (Paper): 30 Marks |
| | | End-Sem (paper): 70 Marks |

**Prerequisites:**

The course assumes prior knowledge of fundamentals of computer network

**Course Objectives:**

1. To understand the limitations of the current technology and need and evolution of SDN.
2. To comprehend role of data, control, and management planes and their separation.
3. To recognize how SDN is coupled with the Open Flow protocol and how green ICT can help improve environmental Sustainability
4. To understand network virtualization and network function virtualization.
5. To know in detail data and control plane in SDN.
6. To study use-cases of SDN

**Course Outcomes:**

By the end of the course, students should be able to

1. Acquire fundamental knowledge of SDN exploring the need, characteristics, and architecture of SDN.
2. Recognize OpenFlow protocols and its forwarding, pipeline model.
3. Understand different methodologies for sustainable SDN.
4. Comprehend IT Infrastructure for SDN.
5. Acquiring knowledge of OpenFlow protocols, visualization.

| Unit I | INTRODUCTION TO SDN: AN OVERVIEW | 7 Hrs |
|---|---|---|

Introduction: The Modern Data Center, Roles and Separation of data, control and management Planes, Advantages and Disadvantages. Need of SDN, Genesis of SDN.
Working of SDN: Fundamental characteristics, SDN Devices, SDN controllers, Applications.

| Unit II | OPEN FLOW PROTOCOLS | 7 Hrs |
|---|---|---|

Introduction: Definition, OpenFlow architecture, Flow & Group Tables, types,Hybrid Approaches, The OpenFlow forwarding and pipeline model. OpenFlow Advantages and Limitations, OpenFlow Protocol.
Use Case:FloodLight, Mininet,

| Unit III | NETWORK VIRTUALIZATION (NV) | 7 Hrs |
|---|---|---|

Definition, Concepts, Benefits of Network Virtualization, Components of a Virtual Network, Applications, Existing Network Virtualization Framework (VMWare and others), Network as a Service (NaaS).

| Unit IV | CONTROL PLANE | 7 Hrs |
|---------|---------------|-------|

Control Plane: Overview, Existing SDN Controllers including Floodlight and Open Daylight projects. Customization of Control Plane: Switching and Firewall Implementation using SDN Concepts.

| Unit V | DATA PLANE | 7 Hrs |
|--------|-----------|-------|

Data Plane: Software-based and Hardware-based; Programmable Network, Hardware.
Programming SDNs: Northbound Application Programming Interface,
Current Languages and Tools, Composition of SDNs.

| Unit VI | NETWORK FUNCTIONS VIRTUALIZATION (NFV) | 7 Hrs |
|---------|----------------------------------------|-------|

Introduction: Concepts, Comparison of NFV and NV, Implementation and Applications.
Data Center Networks: Packet, Optical and Wireless Architectures, Network Topologies.

## Text Books

1. Thomas D. Nadeau, Ken Gray, SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies, O'Reilly Media,ISBN:10:1-4493-4230-2, 978-1-4493-4230-2
2. Paul Goransson and Chuck Black, Software Defined Networks: A Comprehensive Approach, Morgan Kaufmann, ISBN:9780124166752, 9780124166844

## Reference Books

1. Vivek Tiwari, SDN and OpenFlow for Beginners ,Digital Services,10: 1-940686-00-8 13: 978-1-940686-00-4
2. Fei Hu, Network Innovation through OpenFlow and SDN: Principles and Design,CRC Press,ISBN:10: 1466572094
3. Open Networking Foundation (ONF)Documents, https://www.opennetworking.org
4. OpenFlow standards, http://www.openflow.or
5. Online Reading, http://www.nec-labs.com/~lume/sdn-reading-list.html,

| Savitribai Phule Pune University <br> **Fourth Year of Information Technology Engineering (2015 Course)** <br> **414457B: Elective-II** <br> **Soft Computing** | | |
|---|---|---|

| **Teaching Scheme:** <br> **TH:03 Hours/Week** | **Credits: 03** | **Examination Scheme:** <br> **In-Sem (Paper): 30 Marks** <br> **End-Sem (paper): 70 Marks** |
|---|---|---|

**Prerequisites:**
1. Linear Algebra and Calculus
2. Probability Theory

**Course Objectives:**
1. Identifying Soft computing techniques and their roles in problem solving.
2. Generate an ability to build neural networks for solving real life problems.
3. Conceptualize fuzzy logic and its implementation for various real world applications.
4. Apply evolutionary algorithms and Fuzzy logic to solve the problems
5. Design soft computing systems by hybridizing various other techniques

**Course Outcomes:**

By the end of the course, students should be able to
1. Tackle problems of interdisciplinary nature.
2. Find an alternate solution , which may offer more adaptability, resilience and optimization
3. Gain knowledge of soft computing domain which opens up a whole new career option
4. Tackle real world research problems

| **Unit I** | **INTRODUCTION** | **7 Hrs** |
|---|---|---|

Basic concepts of Soft Computing, Historical Developments and Definitions, Soft Computing Characteristics and Problem Solving– Strengths and Weaknesses, Constitutes of Soft Computing : Neural Computing, Fuzzy Logic and Computing, Evolutionary Computing and Genetic Algorithms, Probabilistic Reasoning.

| **Unit II** | **NEURAL NETWORKS – I** | **7 Hrs** |
|---|---|---|

Fundamentals: Biological Neurons and Model of Artificial Neuron. Neural Network Architectures: Single Layer Network, Multi-Layer Feed Forward Neural Networks, and Feedback Networks. Perceptron Model and Learning in Perceptron, Limitation of Learning in Perceptron, Error Back Propagation learning in Multilayer FFNN. Performance Issues of EBP algorithm for MLFFNN.

| **Unit III** | **NEURAL NETWORKS – II** | **7 Hrs** |
|---|---|---|

Complex Architectures Learning: Competitive Learning-Self Organizing Maps, Hebbian Learning-Hopfield Networks, Boltzmann Machines, Adaptive Resonance Theory (ART) Networks, Bayesian

Neural Networks, Deep Learning Architecture of Neural Networks, Applications of Neural Networks.

| Unit IV | FUZZY LOGIC AND FUZZY SYSTEMS | 7 Hrs |
|---|---|---|

Fuzzy Logic, Fuzzy Sets and Operations, Fuzzy Relations, Fuzzy Arithmetic and Fuzzy Measures. Fuzzy to Crisp Conversions: Lambda Cuts for fuzzy sets, Fuzzy Relations, Defuzzification Methods. Fuzzy Rules and Reasoning, Fuzzy Inference Systems, Mamdani Fuzzy Models – Sugeno Fuzzy Models, Applications of Fuzzy Modeling for Decision Making.

| Unit V | GENETIC ALGORITHMS | 7 Hrs |
|---|---|---|

Introduction, Encoding, Operators of Genetic Algorithm, Basic Genetic Algorithm, Simple GA, Crossover and Mutation, Multi-objective Genetic Algorithm (MOGA). Genetic algorithms in search and optimization, Ant colony optimization (ACO), Particle Swarm Optimization (PSO). Applications of GA for Clustering.

| Unit VI | ADVANCES IN SOFT COMPUTING | 7 Hrs |
|---|---|---|

Soft Computing Paradigms and Hybrid Approaches. Neuro-Fuzzy modeling, Genetic Algorithm Based Backpropagation Network, Fuzzy logic based Backpropagation, Fuzzy Logic Controlled Genetic Algorithms, Simplified Fuzzy ARTMAP.

**Text Books**

1. S. N. Sivanandam, S. N. Deepa,Principles of Soft Computing,Wiley publications,2nd Edition, ISBN: 9788126527410
2. J. S. R. Jang, C. T. Sun, E. Mizutani, Neuro-Fuzzy and Soft Computing- A computational approach to Learning and Machine Intelligence, PHI,1st Edition, ISBN:978-8131792469

**Reference Books**

1. David E. Goldberg ,Genetic Algorithms , PearsonEducation, 2nd Edition, ISBN: 9788120322431, ISBN:9780201157673
2. Satish Kumar, Neural Networks - A Classroom Approach, Tata McGraw Hill,2nd Edition, ISBN:1259006166
3. Timothy J. Ross,Fuzzy Logic with Engineering Applications, Wiley India, 3rd Edition, ISBN: 9788126531264
4. Samir Roy, Udit Chakroborthy,Introduction to soft computing - neuro-fuzzy and genetic algorithm ,Person Education, 1st Edition

## Savitribai Phule Pune University
## Fourth Year of Information Technology Engineering (2015 Course)
## 414457C: Elective-II
## Software Testing and Quality Assurance

| Teaching Scheme:<br>TH:03 Hours/Week | Credits: 03 | Examination Scheme:<br>In-Sem (Paper): 30 Marks<br>End-Sem (paper): 70 Marks |
|---|---|---|

**Prerequisites:**

Software Engineering

**Course Objectives:**

1. Learn to apply the testing strategies and methodologies in projects.
2. To understand test management strategies and tools for testing.
3. A keen awareness on the open problems in software testing and maintenance.
4. To explain quality assurance and various tools used in quality management.
5. To learn in detail about various quality assurance models.
6. To understand the audit and assessment procedures to achieve quality.

**Course Outcomes:**

By the end of the course, students should be able to

1. Test the software by applying testing techniques to deliver a product free from bugs.
2. Investigate the scenario and to select the proper testing technique.
3. Explore the test automation concepts and tools and estimation of cost, schedule based on standard metrics.
4. Understand how to detect, classify, prevent and remove defects.
5. Choose appropriate quality assurance models and develop quality.
6. Ability to conduct formal inspections, record and evaluate results of inspections.

| Unit I | SOFTWARE TESTING BASICS | 7 Hrs |
|---|---|---|

Testing as an engineering activity, Role of process in software quality, Testing as a process, Basic definitions, Software testing principles, The tester's role in a software development organization, Origins of defects, Defect classes, The defect repository and test design, Defect examples, Developer / Tester support for developing a defect repository.

| Unit II | TESTING TECHNIQUES AND LEVELS OF TESTING | 7 Hrs |
|---|---|---|

Using White Box Approach to Test design - Static Testing Vs. Structural Testing, Code Functional Testing, Coverage and Control Flow Graphs, Using Black Box Approaches to Test Case Design, Random Testing, Requirements based testing, Decision tables, State-based testing, Cause-effect graphing, Error guessing, Compatibility testing, Levels of Testing -Unit Testing, Integration Testing, Defect Bash Elimination. System Testing - Usability and Accessibility Testing, Configuration Testing, Compatibility Testing.

| Unit III | SOFTWARE TEST AUTOMATION AND QUALITY METRICS | 7 Hrs |
|---|---|---|

Software Test Automation, Skills needed for Automation, Scope of Automation, Design and Architecture for Automation, Requirements for a Test Tool, Challenges in Automation Tracking the Bug, Debugging. Testing Software System Security - Six-Sigma, TQM - Complexity Metrics and Models, Quality Management Metrics, Availability Metrics, Defect Removal Effectiveness, FMEA, Quality Function Deployment, Taguchi Quality Loss Function, Cost of Quality

| Unit IV | FUNDAMENTALS OF SOFTWARE QUALITY ASSURANCE | 7 Hrs |
|---|---|---|

SQA basics, Components of the Software Quality Assurance System, software quality in business context, planning for software quality assurance, product quality and process quality, software process models, 7 QC Tools and Modern Tools.

| Unit V | QUALITY ASSURANCE MODELS | 7 Hrs |
|---|---|---|

Models for Quality Assurance, ISO-9000 series, CMM, CMMI, Test Maturity Models, SPICE, Malcolm Baldrige Model- P-CMM

| Unit VI | SOFTWARE QUALITY ASSURANCE TRENDS | 7 Hrs |
|---|---|---|

Software Process- PSP and TSP, OO Methodology, Clean-room software engineering, Defect Injection and prevention, Internal Auditing and Assessments, Inspections & Walkthroughs, Case Tools and their Affect on Software Quality.

### Text Books

1. Srinivasan Desikan, Gopalaswamy Ramesh,Software Testing: Principles and Practices,Pearson
2. Daniel Galin, Software Quality Assurance: From Theory to Implementation, Pearson Addison Wesley

### Reference Books

1. Aditya P. Mathur, Foundations of Software Testing, Pearson
2. Paul Ammann, Jeff Offutt, Introduction to Software Testing, Cambridge University Press
3. Paul C. Jorgensen, Software Testing: A Craftsman's Approach, Auerbach Publications
4. William Perry, Effective Methods of Software Testing, Wiley Publishing, Third Edition
5. Renu Rajani, Pradeep Oak, Software Testing – Effective Methods, Tools and Techniques, Tata McGraw Hill
6. Stephen Kan, Metrics and Models in Software Quality, Addison – Wesley, Second Edition
7. S.A.Kelkar, Software quality and Testing, PHI Learing, Pvt, Ltd.
8. Watts S Humphrey, Managing the Software Process ,Pearson Education Inc.

| Savitribai Phule Pune University |
|---|
| **Fourth Year of Information Technology Engineering (2015 Course)** |
| **414457D: Elective-II** |
| **Compiler Construction** |

| Teaching Scheme: | Credits: 03 | Examination Scheme: |
|---|---|---|
| **TH:03 Hours/Week** | | **In-Sem (Paper): 30 Marks** |
| | | **End-Sem (paper): 70 Marks** |

**Prerequisites:**
1. Complete study of System Programming subject of TE (Code No: 314451)
2. Computer Organization and architecture.
3. Processor Architecture and Interfacing.
4. Fundamentals of Data Structures, Data Structures and Files.
5. Theory of Computation: DFA, NFA, Regular expressions, Grammars

**Course Objectives:**
1. The aim of this module is to show how to apply the theory of language translation introduced in the prerequisite courses to build compilers and interpreters.
2. It covers the building of translators both from scratch and using compiler generators. In the process, the module also identifies and explores the main and advanced issues of the design of translators.
3. The construction of a compiler/interpreter for a small language is a necessary component of this module, so students can obtain the necessary skills

**Course Outcomes:**

By the end of the course, students should be able to

1. Understand the structure of compilers
2. Understand the basic and advanced techniques used in compiler construction
3. Understand the basic data structures used in compiler construction such as abstract syntax
4. trees, symbol tables, three-address code, and stack machines
5. Cognitive skills (thinking and analysis)- Design and implement a compiler using a software engineering approach
6. Communication skills (personal and academic).
7. Practical and subject specific skills (Transferable Skills) - Use generators (e.g. Lex and Yacc).

| Unit I | **FUNDAMENTALS OF COMPILATION** | 7 Hrs |
|---|---|---|

Lexical Analysis: Input buffering, Regular Expression, Automata; Parsing: [Limited to] Context free grammar, Predictive parser, LR parsing, Parser generator, error recovery; Syntax and semantics analysis: [Limited to] S and L attributes, dependency graph, DAG and Activation records.

| Unit II | **MEMORY UTILIZATION** | 7 Hrs |
|---|---|---|

Intermediate representations, translation into trees, canonical trees, taming conditional branches, algorithms for instruction selection; Register allocation: coloring by simplification, coalescing, precolored nodes, graph coloring implementation, register allocation for trees; Garbage collection: Mark-and-sweep collection, copying, generational collection, incremental collection, Baker's algorithm, Interface to the compiler.

| Unit III | OBJECT ORIENTED AND FUNCTIONAL PROGRAMMING LANGUAGE | 7 Hrs |
|----------|-----------------------------------------------------|-------|

Classes, single inheritance of data field, multiple inheritance, testing class membership, private fields and methods, classless languages, optimizing object oriented programs; Functional Language: closure, Immutable variables, Inline expansion, closure conversion, efficient tail recursion, lazy evaluation.

| Unit IV | POLYMORPHIC TYPES AND DATA FLOW ANALYSIS | 7 Hrs |
|---------|------------------------------------------|-------|

Representation of polymorphic variables, parametric polymorphism, type inference, resolution of static overloading, Data flow analysis: Intermediate representation for flow analysis, various data flow analysis, transformations using data flow analysis, methods/mechanisms for speeding up data flow analysis, alias analysis.

| Unit V | STATIC SINGLE ASSIGNMENT FORM | 7 Hrs |
|--------|-------------------------------|-------|

Loop Optimization: Dominators, loop invariant computations, induction variables, array-bounds check, loop unrolling; SSA: Definition of SSA, Informal Semantics of SSA, Comparison with Classical Data-flow Analysis, SSA in Context, Benefits of SSA, Fallacies about SSA, Properties: Preliminaries, Def-Use and Use-Def Chains, Minimality, Optimization algorithms using SSA, converting to and back from SSA form, control dependency

| Unit VI | PIPELINING AND SCHEDULING | 7 Hrs |
|---------|---------------------------|-------|

Loop scheduling without resource bound, resource bounded loop pipelining, branch prediction, cache organization and block alignment, loop interchange, blocking and garbage collection. Modern Compiler in ML: ML-Lex, ML-YACC,Tiger Compiler.

## Text Books

1. Andrew W Appel, Modern compiler implementation in C, Cambridge University, Press,4TH, ISBN:0 521 58390 X

## Reference Books

2. J. Singer,Static Single Assignment Book, Springer,1st Edition
3. Russell Jesse , Static Single Assignment Form, Springer, ISBN: 10: 5508387455
4. B. Alpern, M. N. Wegman, and F. K. Zadeck, Detecting Equality of Variables in Programs. Proceedings of the Fifteenth Annual ACM Symposium on Principles of Programming Languages, ACM
5. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, Compilers Principles, Techniques and Tools, Addison Wesley, Low Price Edition, ISBN: 981–235–885 - 4

## Savitribai Phule Pune University
## Fourth Year of Information Technology Engineering (2015 Course)
## 414457E: Elective-II
## Gamification

| Teaching Scheme: TH:03 Hours/Week | Credits: 03 | Examination Scheme: In-Sem (Paper): 30 Marks End-Sem (paper): 70 Marks |
|---|---|---|

**Prerequisites:**

Discrete Structures

**Course Objectives:**

1. To develop problem solving abilities using gamification
2. Students will understand gamification paradigm

**Course Outcomes:**

By the end of the course, students should be able to

1. Write programs to solve problems using gamification and open source tools.
2. To apply gamifications for Mobile and Web Applications
3. Solve problems for multi-core or distributed, concurrent/Parallel environments

| Unit I | Gaming Foundations | 7 Hrs |
|---|---|---|

Introduction: Definition of Gamification, Why Gamify, Examples and Categories, Gamification in Context, Resetting Behavior, Replaying History, Gaming foundations: Fun Quotient, Evolution by loyalty, status at the wheel, the House always wins.

| Unit II | Developing Thinking | 7 Hrs |
|---|---|---|

Re-framing Context: Communicology, Apparatus, and Post-history, Concepts Applied to Video games and Gamification, Rethinking 'playing the game' with Jacques Henriot, To Play Against: Describing Competition in Gamification, Player Motivation: Powerful Human Motivators, Why People Play, Player types, Social Games, Intrinsic verses Extrinsic Motivation, Progression to Mastery. Case studies for Thinking: Tower of Hanoi.

| Unit III | Opponent Moves in Gamification | 7 Hrs |
|---|---|---|

Reclaiming Opposition: Counter gamification, Gamed Agencies: Affectively Modulating Our Screen- and App-Based Digital Futures, Remodeling design, Game Mechanics, Designing for Engagement, Case study of Maze Problem.

| Unit IV | Game Design | 7 Hrs |
|---|---|---|

Game Mechanics and Dynamics: Feedback and Re-enforcement, Designing for engagement Game Mechanics in depth, Putting it together, Case study of 8 queen's problem.

| Unit V | Advanced tools, techniques | 7 Hrs |
|---|---|---|

Gamification case Studies, Coding basic game Mechanics

| Unit VI | Applications | 7 Hrs |
|---|---|---|

Instant Gamification Platforms, Mambo.io (Ref:http://mambi.io), Installation and use of BigDoor (OpenSourcehttp://bigdoor.com),ngageoint/gamification-server(ref:https://github.com/ ngageoint/ gamification-server).

## Text Books

1. Mathias Fuchs, Sonia Fizek, Paolo Ruffino, Niklas Schrape, Rethinking Gamification
2. http://meson.press/books/rethinking-gamification, Meson Press, First Edition,ISBN:978-3-95796-001-6
3. Gabe Zechermann, Christopher Cunningham Gamification by Design, Oreilly media, First, ISBN:978-1-449-39767-8

## Reference Books

1. Susan Jacobs, Getting Gamification Right, The eLearning Guild, First

## Savitribai Phule Pune University
## Fourth Year of Information Technology Engineering (2015 Course)
## 414458: Computer Laboratory VII

| Teaching Scheme:<br>Practical:04 Hours/Week | Credits:02 | Examination Scheme: |
|---|---|---|
| | | TW:50 Marks<br>PR: 50 Marks |

**Prerequisites:**

Knowledge of Programming Languages
1. Java
2. R
3. Python
4. C++

**Course Objectives:**

1. To Understand the Security issues in networks and Applications software.
2. To understand the machine learning principles and analytics of learning algorithms.

**Course Outcomes:**

By the end of the course, students should be able to
1. The students will be able to implement and port controlled and secured access to software systems and networks.
2. The students will be able to build learning software in various domains.

**Suggested List of Laboratory Assignments**
**PART –A (ICS)**

**Assignment 1**

Write a program in C++ or Java to implement RSA algorithm for key generation and cipher verification.

**Assignment 2**

Develop and program in C++ or Java based on number theory such as Chinese remainder.

**Assignment 3**

Write a program in C++ or java to implement SHA1 algorithm using libraries (API)

**Assignment 4**

Configure and demonstrate use of vulnerability assessment tool such as Snort tool for intrusion or SSL Web security.

**PART –B (MLA)**

**Assignment 1**

Study of platform for Implementation of Assignments

Download the open source software of your interest. Document the distinct features and functionality of the software platform. You may choose WEKA and R and Python

**Assignment 2**

Supervised Learning - Regression  (Using R)

Generate a proper 2-D data set of N points. Split the data set into Training Data set              and Test Data set.   i) Perform linear regression analysis with Least Squares Method. ii) Plot the graphs for Training MSE and Test MSE and comment on Curve Fitting and Generalization Error.   iii) Verify the Effect of Data Set Size and Bias-Variance Tradeoff.  iv) Apply Cross Validation and plot the graphs for errors.  v) Apply Subset Selection Method and plot the graphs for errors. vi) Describe your findings in each case

**Assignment 3**

Create Association Rules for the Market Basket Analysis for the given Threshold. (Using R)

**Assignment 4**

Implement K-Means algorithm for clustering to create a Cluster on the given data.(Using Python)

**Assignment 5**

Implement SVM for performing classification and find its accuracy on the given data. (Using Python)

**Assignment 6**

Creating & Visualizing Neural Network for the given data. (Using Python)

**Assignment 7**

On the given data perform the performance measurements such as Accuracy, Error rate, precision, Recall, TPR,FPR,TNR,FPR etc. (Using Weka)

**Assignment 8**

Principal Component Analysis-Finding Principal Components, Variance and Standard Deviation calculations of principal components.(Using R)

**Reference Books**

1. Open source software-WEKA and  R and Python .
2. JAVA 6.1 or more ( for RJava Package).
3. Dr. Mark Gardener, Beginning R The Statistical Programming Language, ISBN: 978-81-2654120-1, Wiley India Pvt. Ltd.
4. Jason Bell, "Machine Learning for Big Data Hands-On for Developers and Technical Professionals", ISBN: 978-81-265-5337-2-1, Wiley India Pvt. Ltd

| Savitribai Phule Pune University<br>Fourth Year of Information Technology Engineering (2015 Course)<br>414459: Computer Laboratory VIII | | |
|---|---|---|
| **Teaching Scheme:**<br>**Practical:04 Hours/Week** | **Credits:02** | **Examination Scheme:** |
| | | **TW:50 Marks**<br>**OR: 50 Marks** |

**Prerequisites:**

1. Problem Solving & Object-Oriented Programming
2. Software Engineering and Project Management

**Course Objectives:**

1. To teach the student Unified Modeling Language (UML 2.0), in terms of "how to use" it for the purpose of specifying and developing software.
2. To teach the student how to identify different software artifacts at analysis and design phase.
3. To explore and analyze use case modeling.
4. To explore and analyze domain/ class modeling.
5. To teach the student Interaction and Behavior Modeling.
6. To Orient students with the software design principles and patterns.

**Course Outcomes:**

By the end of the course, students should be able to

1. Draw, discuss different UML 2.0 diagrams, their concepts, notation, advanced notation, forward and reverse engineering aspects.
2. Identify different software artifacts used to develop analysis and design model from requirements.
3. Develop use case model
4. Develop, implement analysis model and design model
5. Develop, implement Interaction and behaviour Model
6. Implement an appropriate design pattern to solve a design problem.

**Suggested List of Laboratory Assignments**

**Assignment 1: Write Problem Statement for System / Project**

Identify Project of enough complexity, which has at least 4-5 major functionalities.
Identify stakeholders, actors and write detail problem statement for your system.

**Assignment 2: Prepare Use Case Model**

Identify Major Use Cases, Identify actors.
Write Use Case specification for all major Use Cases.
Draw detail Use Case Diagram using UML2.0 notations.

**Assignment 3: Prepare Activity Model**

Identify Activity states and Action states.
Draw Activity diagram with Swim lanes using UML2.0 Notations for major Use Cases

| **Assignment 4: Prepare Analysis Model-Class Model** |
|---|
| Identify Analysis Classes and assign responsibilities.<br>Prepare Data Dictionary.<br>Draw Analysis class Model using UML2.0 Notations.<br>Implement Analysis class Model-class diagram with a suitable object oriented language |
| **Assignment 5: Prepare a Design Model from Analysis Model** |
| Study in detail working of system/Project.<br>Identify Design classes/ Evolve Analysis Model. Use advanced relationships.<br>Draw Design class Model using OCL and UML2.0 Notations.<br>Implement the design model with a suitable object-oriented language. |
| **Assignment 6: Prepare Sequence Model.** |
| Identify at least 5 major scenarios (sequence flow) for your system.<br>Draw Sequence Diagram for every scenario by using advanced notations using UML2.0<br>Implement these scenarios by taking reference of design model implementation using suitable object-oriented language. |
| **Assignment 7: Prepare a State Model** |
| Identify States and events for your system.<br>Study state transitions and identify Guard conditions.<br>Draw State chart diagram with advanced UML 2 notations.<br>Implement the state model with a suitable object-oriented language |
| **Assignment 8: Identification and Implementation of GRASP pattern** |
| Apply any two GRASP pattern to refine the Design Model for a given problem description Using effective UML 2 diagrams and implement them with a suitable object oriented language |
| **Assignment 9: Identification and Implementation of GOF pattern** |
| Apply any two GOF pattern to refine Design Model for a given problem description Using effective UML 2 diagrams and implement them with a suitable object oriented language |
| **Reference Books** |
| 1. UML2 Bible by Tom Pender, Wiley India Pvt. Limited 2011<br>2. Applying UML and Patterns Second Edition by Craig Larman, Pearson Education<br>3. UML 2 and the Unified Process, Second Edition, JIM Arlow, Ila Neustadt, Pearson<br>4. Design Patterns: Elements of Reusable Object Oriented Software, Erich Gamma, Pearson<br>5. Design Patterns in Java Second Edition by Steven John Metsker, Pearson<br><br>All the assignments should be conducted on Latest version of Open Source Operating Systems, tools and Multi-core CPU supporting Virtualization and Multi-Threading |

**Savitribai Phule Pune University**
**Fourth Year of Information Technology Engineering (2015 Course)**
**414460: Project Phase-I**

| Teaching Scheme:<br>TUT:02 Hours/Week | Credits:02 | Examination Scheme:<br>TW:50 Marks |
|---|---|---|

**Prerequisites:**

   Project Based Seminar

**Course Objectives:**

1. Student should be able implement their ideas/real time industrial problem/ current applications from their engineering domain.
2. 2. Students should be able to develop plans with help of team members to achieve the project's goals.
3. Student should be able to break work down into tasks and determine appropriate procedures.
4. Student should be able to estimate and cost the human and physical resources required, and make plans to obtain the necessary resources.
5. 5. Student should be able allocate roles with clear lines of responsibility and accountability and learn team work ethics.
6. Student should be able to apply communication skills to effectively promote ideas, goals or products.

**Course Outcomes:**

By the end of the course, students should be able to

1. To show preparedness to study independently in chosen domain of Information Technology and programming languages and apply their acquired knowledge to variety of real time problem scenarios.
2. To function effectively as a team to accomplish a desired goal.
3. An understanding of professional, ethical, legal, security and social issues and responsibilities related to Information Technology Project.

**Contents**

Project Based Seminar (PBS) helped students to gather, organize, summarize and interpret technical literature with the purpose of formulating a project proposal in third year. Students had also submitted a technical report summarizing state-of-the-art on an identified domain and topic in third year. B.E. Projects can be application oriented and/or will be based on some innovative/ theoretical work. In Project Phase-I the student will undertake project over the academic year, which will involve the analysis, design of a system or sub system in the area identified earlier in the field of Information Technology and Computer Science and Engineering. In some cases; if earlier identified project is not feasible; a new topic must be formulated in consultation with the guide and project coordinator. The project will be undertaken preferably by a group of 3-4 students who will jointly work and Implement

the project. The group will select a project which is based on seminar delivered in relevant domain in Project based Seminar activity with approval from a committee formed by the department of senior faculty to check the feasibility and approve the topic.

## Guidelines for Students and Faculty

- The Head of the department/Project coordinator shall constitute a review committee for project group; project guide would be one member of that committee by default.
- There shall be two reviews in Project phase –I in semester-I by the review committee.
- The Project Review committee will be responsible for evaluating the timely progress of the projects.
- As far as possible Students should finalize the same project title taken for Project Based Seminar (PBS).
- Student should Identify Project of enough complexity, which has at least 4-5 major functionalities
- Student should identify stakeholders, actors and write detail problem statement for system
- Review committee should revisit "Feasibility Review" conducted by Examiners during Oral examination in Third year in first week after commencement of the term.
- Review committee should finalize the scope of the project.
- If change in project topic is unavoidable then the students should complete the process of
- project approval by submitting synopsis along with the review of important papers. This new
- project topic should be approved by review committee.
- The students or project group shall make presentation on the progress made by them before the committee.
- The record of the remarks/suggestions of the review committee should be properly maintained and should be made available at the time of examination.
- Each student/group is required to give presentation as part of review for 10 to 15 minutes followed by a detailed discussion.
- Students should Revisit and Reassess the problem statement mentioned in the project-based seminar activity.

### Review 1:  Synopsis –
Deliverables:
1. The precise problem statement/title based on literature survey and feasibility study.
2. Purpose, objectives and scope of the project.
3. List of required hardware, software or other equipment for executing the
   project, test environment/tools, cost and human efforts in hours.
4. System overview- proposed system and proposed outcomes.
5. Architecture and initial phase of design (DFD) .
6. Project plan 1.0.

### Review 2:  SRS –
Deliverables:

1. SRS and High level design
2. Detail architecture/System design/algorithms/techniques
3. At least 30-40% coding documentation with at least 3 to 4 working modules
4. Test Results
5. Project plan 2.0

One paper should be published in reputed International conference/International journal based on

project work done.


**Project report contains the details as Follows**:

Contents

List of Abbreviations

List of Figures

List of Graphs

List of Tables

1. Introduction and aims/motivation and objectives
2. Literature Survey
3. Problem Statement/definition
4. Project Requirement specification
5. Systems Proposed Architecture
6. High level design of the project(DFD/UML)
7. System implementation-code documentation-algorithm, methodologies, protocols used.
8. GUI/Working modules/Experimental Results
9. Project Plan
10. Conclusions
11. Bibliography in IEEE format

Appendices

A. Plagiarism Report of Paper and Project report from any open source tool
B. Base Paper(s)
C. Tools used
D. Papers Published/Certificates


➢ Use appropriate plagiarism tools , reference managers ,Latex Lyx/latest Word for efficient and effective project writing.

**Term Work:**

➢ The term work will consist of a report and presentation prepared by the student on the project allotted to them.


**Reference Books**

1. UML2 Bible by Tom Pender, Wiley India Pvt. Limited 2011
2. Applying UML and Patterns Second Edition by Craig Larman, Pearson Education
3. UML 2 and the Unified Process, Second Edition, JIM Arlow, Ila Neustadt, Pearson
4. Design Patterns: Elements of Reusable Object Oriented Software, Erich Gamma, Pearson
5. Design Patterns in Java Second Edition by Steven John Metsker, Pearson

All the assignments should be conducted on Latest version of Open Source Operating Systems, tools and Multi-core CPU supporting Virtualization and Multi-Threading

## Savitribai Phule Pune University
## Fourth Year of Information Technology Engineering (2015 Course)
## 414461: Audit Course-V

In addition to credits, it is recommended that there should be audit course in preferably in each semester from second year to supplement their knowledge and skills. Student will be awarded the
bachelor's degree if he/she earns credits and clears all the audit courses specified in the syllabus. The student may opt for one of the audit courses per semester, starting in second year first semester. Though not mandatory, such a selection of the audit courses helps the learner to explore the subject of interest in greater detail resulting in achieving the very objective of audit course's inclusion. List of options offered is provided. Each student has to choose one audit course from the list per semester. Evaluation of audit course will be done at institute level itself. Method of conduction and method of assessment for audit courses are suggested.

### Criteria

The student registered for audit course shall be awarded the grade PP and shall be included such grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory in-semester performance and secured a passing grade in that audit course. No grade points are associated with this 'PP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA

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

1. Lectures/ Guest Lectures
2. Visits (Social/Field) and reports
3. Demonstrations
4. Surveys
5. Mini Project
6. Hands on experience on Specific focused topic

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

1. Written Test
2. Demonstrations/ Practical Test
3. Presentations
4. IPR/Publication
5. Report

**Audit Course V Options**

| Course Code | Audit Course Title |
|---|---|
| 414461A | 1. Emotional Intelligence |
| 414461B | 2. Green Computing |
| 414461C | 3. Critical Thinking |
| 414461D | 4. Statistical Learning model using R. |

## Savitribai Phule Pune University
## Fourth Year of Information Technology Engineering (2015 Course)
## 414461A: Audit Course-V
## Emotional Intelligence

This Emotional Intelligence (EI) training course will focus on the five core competencies of emotional intelligence: self-awareness, self-regulation, motivation, empathy and interpersonal skills. Participants will learn to develop and implement these to enhance their relationships in work and life by increasing their understanding of social and emotional behaviors, and learning how to adapt and manage their responses to particular situations. Various models of emotional intelligence will be covered.

**Course Objectives:**

1) To develop an awareness of EI models.
2) To recognize the benefits of EI.
3) To understand how you use emotion to facilitate thought and behaviour.
4) To know and utilize the difference between reaction and considered response.

**Course Outcomes:**

By the end of the course, students should be able to,

1) Expand your knowledge of emotional patterns in yourself and others.
2) Discover how you can manage your emotions, and positively influence yourself and others.
3) Build more effective relationships with people at work and at home.
4) Positively influence and motivate colleagues, team members, and managers.
5) Increase your leadership effectiveness by creating an atmosphere that engages others.
6) Apply EI behaviours and supports high performance.

| Unit I | Introduction to Emotional Intelligence (EI) . | |
|---|---|---|

Emotional Intelligence and various EI models, The EQ competencies of self-awareness, self-regulation, motivation, empathy, and interpersonal skills, Understand EQ and its importance in life and the workplace

| Unit II | Know and manage your emotions. | |
|---|---|---|

Emotions, The different levels of emotional awareness, Increase your emotional knowledge of yourself, Recognize 'negative' and 'positive' emotions. The relationship between emotions, thought and behavior, Discover the importance of values, The impact of not managing and processing 'negative' emotions, Techniques to manage your emotions in challenging situations.

| Unit III | Recognize Emotions in others. | |
|---|---|---|

The universality of emotional expression, Learn tools to enhance your ability to recognize and appropriately respond to others' emotions, Perceiving emotions accurately in others to build empathy 4

| Unit IV | Relate to others. | |
|---------|-------------------|---|

Applying EI in the workplace, the role of empathy and trust in relationships, Increase your ability to create effective working relationships with others (peers, subordinates, managers, clients, Find out how to deal with conflict, Tools to lead, motivate others and create a high performing team.

### Books

1) Daniel Goleman," Emotional Intelligence – Why It Matters More Than IQ," , Bantam Books,
2) ISBN-10: 055338371X13: 978-0553383713   2. Steven Stein , "The EQ Edge" , Jossey-Bass, ISBN : 978-0-470-68161-9
3) Drew Bird , "The Leader's Guide to Emotional Intelligence" , ISBN: 9781535176002

**Savitribai Phule Pune University**

**Fourth Year of Information Technology Engineering (2015 Course)**

**414461B: Audit Course-V**

**Green Computing**

Green computing is the study and practice of using computing resources efficiently. Green computing or green IT, refers to environmentally sustainable computing or IT. The goals of green computing are similar to green chemistry; reduce the use of hazardous materials, Maximize energy efficiency during the product's lifetime, and promote the recyclability or biodegradability of defunct products and factory waste.

**Course Objectives:**

1) To acquire knowledge to adopt green computing practices to minimize negative impacts on the environment.

2) To examine technology tools that can reduce paper waste and carbon footprint by user.

3) To understand how to minimize equipment disposal requirements.

4) To gain skill in energy saving practices in their use of hardware

**Course Outcomes:**

By the end of the course, students should be able to,

1) Understand the concept of green IT and relate it to sustainable development.

2) Apply the green computing practices to save energy.

3) Discuss how the choice of hardware and software can facilitate a more sustainable operation,

4) Use methods and tools to measure energy consumption

| Unit I | Fundamentals of Green IT. | |
|---|---|---|

Green IT Fundamentals: Business, IT, and the Environment – Green computing: carbon foot Print - Measuring, Details, reasons to bother, Plan for the Future, Cost Savings: Hardware, Power.

| Unit II | Green Assets and Power Problems. | |
|---|---|---|

Green Assets: Buildings, Data Centers, Networks, and Devices, Green Information Systems : Design and Development Models, Monitoring Power Usage, Servers, Low-Cost Options, Reducing Power Use, Data De-Duplication, Low-Power Computers and peripheral devices.

| Unit III | Green Information Systems. | |
|---|---|---|

Initial Improvement Calculations, Selecting Metrics, Tracking Progress, Change Business Processes, Customer Interaction, Paper Reduction, Green Supply Chain, Improve Technology Infrastructure, Reduce PCs and Servers, Shared Services, Hardware Costs, Cooling.

| Unit IV | Green Grid Framework. | |
|---|---|---|

Virtualizing of IT systems, Role of electric utilities, Telecommuting, teleconferencing and teleporting, Materials recycling, Best ways for Green PC, Green Data center Case Studies, Applying Green IT Strategies and Applications to a Home Hospital, Packaging Industry and Telecom Sector.

### Reference Books

1. Woody Leonhard, Katherrine Murray, "Green Home computing for dummies", August2009, ISBN: 978-0-470-46745-9
2. Alvin Galea, Michael Schaefer, Mike Ebbers, "Green Data Center: steps for the Journey", Shoff/IBM rebook, 2011. ISBN: 10: 1-933742-05-4;  13: 978-1-933742-05-2
3. John Lamb, "The Greening of IT", Pearson Education, 2009, ISBN 10: 0137150830
4. Jason Harris, "Green Computing and Green IT- Best Practices on regulations & industry",Lulu.com, 2008, ISBN: 1558604898
5.  Bud E. Smith, "Green Computing Tools and Techniques for Saving Energy, Money and Resources", CRC Press, 2014,  9781466503403

## Savitribai Phule Pune University
## Fourth Year of Information Technology Engineering (2015 Course)
## 414461C: Audit Course-V
## Critical Thinking

Thinking about one's thinking in a manner designed to organize and clarify, raise the efficiency of, and recognize errors and biases in one's own thinking. Critical thinking is not 'hard' thinking nor is it directed at solving problems (other than 'improving' one's own thinking). Critical thinking is inward-directed with the intent of maximizing the rationality of the thinker. One does not use critical thinking to solve problems—one uses critical thinking to improve one's process of thinking.

### Course Objectives:

1) Critical thinking is considered among the most important "higher order cognitive skills" expected from students graduating with professional degrees (e.g. engineering, management, etc.)

2) This course will make you a better thinker, it will sharpen your mind, clarify your thoughts, and help you make smarter decisions (especially about your career). It will help you argue assertively and hence make you a forceful communicator – both in public speaking and in one-on-one situations.

3) Most employers complain that fresh graduates need too much of direction and they are incapable of "independent decision making". We intend to overcome this shortcoming

### Course Outcomes:

By the end of the course, students should be able to,

1) If students whole-heartedly participate in the course, they can expect to be smarter, stronger and more confident thinkers.

2) They can embark on a life-long journey of "self-directed learning".

| Unit I | Introduction to Critical Thinking. | |
|---|---|---|

What is Critical Thinking o It's role in problem solving o The difference between a critical thinker and one who is not, Barriers that prevent us from thinking critically

| Unit II | Importance of being logical. | |
|---|---|---|

Key concepts of "Thinking fast and slow" - Logical fallacies & Mistakes we make when do not think "statistically"

| Unit III | Pattern in deductive logic. | |
|---|---|---|

Hypothetical syllogism - Categorical syllogism( Set theory concepts), Argument by elimination, based on maths, based on definition, Evaluating deductive arguments validity & soundness

| Unit IV | Argumentation – Foundation of Critical Thinking. | |
|---|---|---|

Recognizing arguments and their structural components & indicator words Analysis of arguments, Categorical logic - VENN Diagrams to test logical "validity", Propositional logic - Complex statements & arguments, Truth Tables – to test validity of complex statements

**Reference Books**

1) "Thinking Fast and Slow"- Daniel Kahneman – Penguin Books
2) "Critical Thinking – Students Introduction" - Bassham, Irwin, Nardone, Wallace – McGraw Hill

| Savitribai Phule Pune University |
|---|
| **Fourth Year of Information Technology Engineering (2015 Course)** |
| **414461D: Audit Course-V** |
| **Statistical Learning Model using R** |

Statistical learning theory is a framework for machine learning drawing from the fields of statistics and functional analysis Statistical learning theory deals with the problem of finding a predictive function based on data. Statistical learning theory has led to successful applications in fields such as computer vision, speech recognition, bioinformatics and baseball.

**Course Objectives:**

1) To get familiar With the explosion of "Big Data" problems, statistical learning /machine learning has become a very hot field.
2) To learn statistical learning and modelling skills which are in high demand also cover basic concepts of statistical learning / modelling methods that have widespread use in business and scientific research.
3) To get hands on the applications and the underlying statistical / mathematical concepts that are relevant to modelling techniques. The course are designed to familiarize students in implementing the statistical learning methods using the highly popular statistical software package R.

**Course Outcomes:**

By the end of the course, students should be able to,

1) Students will be familiar with concepts related to "data science", "analytics", "machine learning", etc. These are important topics, and will enable students to embark on highly rewarding careers.
2) Students will capable of learning "big data" concepts on their own

| Unit I | Introduction to Statistical Learning. | |
|---|---|---|
| What is Statistical Learning, Various issues to consider while "modeling" | | |

| Unit II | Getting started with R programming. | |
|---|---|---|
| Introduction to the R-Studio, user-interface, Basic commands, Data Structures in R, Graphics, Reading data into R. | | |

| Unit III | Linear Regression models including Lab. | |
|---|---|---|
| Instructor should select a problem statement and design the assignment for Linear Regression. | | |

| Unit IV | Classification models (Logistic Regression and LDA) with Lab. | |
|---|---|---|
| Instructor should select a problem statement and design the assignment for Logistic Regression and LDA. | | |

| Unit VI | Tree based methods (regression trees, classification tree) with Lab. | |
|---|---|---|
| Instructor should select a problem statement and design the assignment for Tree based methods (regression trees, classification tree) with lab. | | |

**Reference Books**

1) An Introduction to Statistical Learning with Applications in R Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani – 6th edition- Springer Publications.

# SEMESTER-II

## Savitribai Phule Pune University
## Fourth Year of Information Technology Engineering (2015 Course)
## 414462: Distributed Computing System

| Teaching Scheme:<br>TH:03 Hours/Week | Credits: 03 | Examination Scheme:<br>In-Sem (Paper): 30 Marks<br>End-Sem (paper): 70 Marks |
|---|---|---|

**Prerequisites:**

1. Web Technology, Computer Network Technology and Operating System.

**Course Objectives :**

1. To understand the fundamentals and knowledge of the architectures of distributed systems.
2. To gain knowledge of working components and fault tolerance of distributed systems
3. To make students aware about security issues and protection mechanism for distributed environment.

**Course Outcomes :**

By the end of the course, students should be able to

1. Understand the principles and desired properties of distributed systems based on different application areas.
2. Understand and apply the basic theoretical concepts and algorithms of distributed systems in problem solving.
3. Recognize the inherent difficulties that arise due to distributed-ness of computing resources.
4. Identify the challenges in developing distributed applications

| UNIT I | FUNDAMENTALS AND ARCHITECTURES | 7 Hrs |
|---|---|---|

Introduction: Characteristics and examples of distributed systems, Design goals, Types of distributed systems, Trends in distributed systems, Focus on Resource Sharing, Challenges. Architectures: Architectural styles, middleware and middleware organization, system architectures, Example architectures.
**Case Study: The World Wide Web**

| UNIT II | COMMUNICATION AND COORDINATION | 7 Hrs |
|---|---|---|

Communication: Introduction, Layered protocols , Types of communication, Inter-process Communication, Remote Procedure Call (RPC), Message oriented communication, Multicast Communication, Network Virtualization: Overlay Network Coordination: Clock Synchronization, Logical Clocks, Mutual Exclusion, Election algorithms, Distributed event matching, Gossip Based coordination
**Case Study: IBM's Websphere Message-Queuing System**

| UNIT III | REPLICATION AND FAULT TOLERANCE | 7 Hrs |
|---|---|---|

Replication: Reasons for replication, Replica management, Failure masking and replication, Consistency protocols, Catching and replication in web,

Fault Tolerance: Introduction, Failure models, Fault systems with arbitrary failures, Reliable client server communication, Reliable group communication, Distributed commit, Recovery, Checkpoints.

**Case Study: Catching and Replication in Web**

| UNIT IV | DISTRIBUTED FILES AND MULTIMEDIA SYSTEMS | 7 Hrs |
|---|---|---|

Distributed File Systems: Introduction, File System Architecture, Sun Network File System, and HDFS. Name Services: Introduction, Name Services and the Domain Name System, Directory Services.

Case Study: 1. The Global Name Service, 2. The X.500 Directory Service.

Distributed Multimedia Systems: Characteristics of Multimedia Data, Quality of Service Management, Resource management, Stream Adaptation.

**Case Study: BitTorrent and End System Multicast.**

| UNIT V | DISTRIBUTED WEB BASED SYSTEM | 7 Hrs |
|---|---|---|

Architecture of Traditional Web-Based Systems, Apache Web Server, Web Server Clusters, Communication by Hypertext Transfer Protocol, Synchronization, Web Proxy Caching, Replication for Web Hosting Systems, Replication of Web Applications, Fault Tolerance in distributed web based systems, Security Concerns.

**Case Study: HyperText Transfer Protocol (HTTP)**

| UNIT VI | SECURITY IN DISTRIBUTED SYSTEMS | 7 Hrs |
|---|---|---|

Introduction to Security: Security Threats, Policies, and Mechanisms, Design Issues, Cryptography. Secure Channels: Authentication, Message Integrity and Confidentiality, Secure Group Communication,

Access Control: General Issues in Access Control, Firewalls, Secure Mobile Code, Denial of Service(DOS). Security Management: Key Management, Secure Group Management, Authorization Management. Emerging Trends In Distributed Systems: Grid Computing, Service Oriented Architectures(SOA).

**Case Study: Kerberos.**

**Text Books**

1. Maarten van Steen, Andrew S. Tanenbaum, Distributed Systems , PHI, 3rd Edition Version 3.01, ISBN:978-15-430573-8-6(Printed)
2. Andrew S. Tanenbaum, Maarten van Steen, Distributed Systems – Principles and Paradigms, PHI ,2nd Edition, ISBN: 978-0130888938

**Reference Books**

1. George Coulouris, Distributed Systems: Concepts and Design,Pearson, 5th edition, Jean Dollimore, Tim Kindberg, Gordon Blair, ISBN:13: 978-0132143011,   ISBN:10: 0132143011
2. Abhijit Belapurkar, Anirban Chakrabarti, Harigopal Ponnapalli, Niranjan Varadarajan, Srinivas Padmanabhuni, Srikanth Sunderrajan, Distributed System Security: Issues, Processes and solutions, Willey online Library, ISBN: 978-0-470-51988-2
3. Sunita Mahajan, Seema Shah, Distributed Computing, Oxford University Press, 2nd Edition, ISBN-13: 978-0198093480

## Savitribai Phule Pune University
## Fourth Year of Information Technology Engineering (2015 Course)
## 414463: Ubiquitous Computing

| Teaching Scheme: | Credits:03 | Examination Scheme: |
|---|---|---|
| TH:03 Hours/Week | | In-Sem (Paper): 30 Marks |
| | | End-Sem (paper): 70 Marks |

**Prerequisites:**
1. Human Computer Interaction
2. Computer Network Technology

**Course Objectives :**
1. To describe ubiquitous computing, its properties applications and architectural design.
2. To explain various smart devices and services used in ubiquitous computing.
3. To teach the role of sensors and actuators in designing real time applications using Ubicomp.
4. To explore the concept of human computer interaction in the context of Ubicomp.
5. To explain Ubicomp privacy and challenges to privacy.
6. To describe Ubicomp network with design issues and Ubicomp management.

**Course Outcomes:**

By the end of the course, students should be able to
1. Demonstrate the knowledge of design of Ubicomp and its applications.
2. Explain smart devices and services used Ubicomp.
3. Describe the significance of actuators and controllers in real time application design.
4. Use the concept of HCI to understand the design of automation applications.
5. Classify Ubicomp privacy and explain the challenges associated with Ubicomp privacy.
6. Get the knowledge of ubiquitous and service oriented networks along with Ubicomp management.

| UNIT I | INTRODUCTION TO UBIQUITOUS COMPUTING | 7 Hrs |
|---|---|---|

Concept of Ubiquitous Computing and Advantages, Ubiquitous Computing Applications and Scope, Properties of Ubiquitous Computing, Modelling the Key Ubiquitous Computing Properties. Ubiquitous System Environment Interaction. Architectural Design for UbiCom Systems: Smart DEI Model.

| UNIT II | UBIQUITOUS COMPUTING SMART DEVICES AND SERVICES | 7 Hrs |
|---|---|---|

Smart Devices and Service properties, Smart mobile devices and Users, Mobile code, Smart Card Devices and Networks, Service Architecture Models. Service Provision Life-Cycle. Virtual Machines and Operating Systems, OS for Mobile Computers and Communicator Devices.

| UNIT III | ACTUATION AND CONTROL | 7 Hrs |
|---|---|---|

Tagging the Physical World, Sensors and Networks, Micro- Electro-Mechanical Systems (MEMS), Embedded Systems and Real-Time Systems. Programmable and PID type control system, Robots.

| UNIT IV | HUMAN COMPUTER INTERACTION | 7 Hrs |
|---------|---------------------------|-------|

User Interfaces and Interaction for devices, Abstract user interface through Basic Smart Wearable and Implanted Devices. Human- Centered Design (HCD). User Models: Direct and indirect user input and modelling, modelling users' planned tasks and multiple tasks-based computing.

| UNIT V | UBIQUITOUS COMPUTING PRIVACY | 7 Hrs |
|--------|------------------------------|-------|

Ubiquitous computing privacy definition, Solove's taxonomy of privacy, leagal background, Interpersonal privacy, Ubicomp challenges to privacy: Collection scale, manner and motivation, data types, data accessibility; Case study of privacy solution such as Protecting RFID tags, Ways of addressing privacy in Ubicomp.

| UNIT VI | UBIQUITOUS COMMUNICATION AND MANAGEMENT | 7 Hrs |
|---------|------------------------------------------|-------|

Data Networks, Audio Networks, Wireless Data Networks, Ubiquitous Networks, Service oriented networks, network design issues; Configuration and Security management, Service oriented computer and information management, Context awareness.

**Text Books**

1. Stefan Poslad, Ubiquitous Computing, Wiley, Student Edition, ISBN:9788126527335
   John Krumm, Ubiquitous Computing Fundamentals

**Reference Books**

1. Yin-Leng Theng and Henry B. L. Duh, Ubiquitous Computing, IGI, 2nd Edition, ISBN: 9781599046938
2. Adam Greenfield, Everyware the Drawing age of Ubiquitous Computing, AIGA, 1st Edition , ISBN: 9780321384010
3. Laurence T. Yeng, Evi Syukur and Seng W. Loke, Handbook on Mobile and Ubiquitous Computing, CRC, 2nd Edition, ISBN: 9781439848111

| Savitribai Phule Pune University<br>Fourth Year of Information Technology Engineering (2015 Course)<br>414464A: Elective III<br>Internet of Things (IoT) |
|---|

| Teaching Scheme:<br>TH:03 Hours/Week | Credits:04 | Examination Scheme:<br>In-Sem (Paper): 30 Marks<br>End-Sem (paper): 70 Marks |
|---|---|---|

**Prerequisites:**
1. Fundamentals of Communication and Computer Network
2. Computer Network Technology

**Course Objectives :**
1. To understand what is Internet of things
2. Describe architecture, Design, underlying technologies, platforms and cloud interface.

**Course Outcomes:**

By the end of the course, students should be able to
1. Explain what is internet of things.
2. Explain architecture and design of IoT
3. Describe the objects connected in IoT
4. Understand the underlying Technologies.
5. Understand the platforms in IoT
6. Understand cloud interface to IoT

| UNIT I | INTRODUCTION TO INTERNET OF THINGS | 8 Hrs |
|---|---|---|

What is the Internet of Things? Internet of Things Definitions and Frameworks : IoT Definitions, IoT Architecture, General Observations, ITU-T Views, Working Definition, IoT Frameworks, Basic Nodal Capabilities, Physical Design of IoT: IoT Protocols, Logical Design of IoT: Functional block, communication Model, Communication API's, IoT Enabling Technologies: WSN, cloud computing, Big data Analytics, communication Protocols, Embedded systems, IoT levels and Deployment templates: Level 1 to Level 5

| UNIT II | IoT NETWORK ARCHITECTURE AND DESIGN | 8 Hrs |
|---|---|---|

The one M2M IoT Standardized Architecture, The IoT World Forum (IoTWF) Standardized Architecture, A Simplified IoT Architecture, IoT protocol stack, The Core IoT Functional Stack, IoT Data Management and Compute Stack: Fog Computing, Edge Computing, The Hierarchy of Edge, Fog, and Cloud IoT and M2M: Introduction to M2M, Difference between IoT and M2M, SDN and NFV for IoT

| UNIT III | SMART OBJECTS: THE "THINGS" IN IoT | 8 Hrs |
|---|---|---|

Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects: Communications Criteria, IoT Access Technologies: IEEE 802.15.4, IEEE 802.15.4g and 802.15.4e, IEEE 1901.2a, LoRaWAN

| UNIT IV | ADDRESSING TECHNIQUES FOR THE IoT | 8 Hrs |
|---|---|---|

Address Capabilities, IPv6 Protocol Overview, IPv6 Tunneling, IPsec in IPv6, Header Compression Schemes, Quality of Service in IPv6, Migration Strategies to IPv6, Mobile IPV6 technologies for the IoT: Protocol Details, IPv6 over low-power WPAN (6LoWPAN).

| UNIT V | IoT PLATFORMS | 8 Hrs |
|---|---|---|

What is an IoT Device, Exemplary Devices: Raspberry Pi, Raspberry Pi Interfaces, Other IoT Devices: pcDuino, BeagleBone Black ,CubieBoard, ARDUINO

| UNIT VI | IoT PHYSICAL SERVERS AND CLOUD OFFEREINGS | 8 Hrs |
|---|---|---|

Introduction to cloud storage models and communication API's, WAMP-AutoBahn for IoT, Python web application framework, Designing a RESTful web API, AMAZON web services for IoT, SkyNet IoT messaging platform, IoT case studies: Home Automation, Cities, Environment

**Text Books**

1. Internet of Things: A Hands-On Approach Arshdeep Bahga, Vijay Madisetti VPT – Paperback 2015 978- 0996025515 628/- 2
2. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things David Hanes, Gonzalo Salgueiro, Patrick Grossetete Cisco Press – Paperback – 16 Aug 2017 978-1- 58714-456- 1 599/-
3. Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications Daniel Minoli Willy Publication s - 2013 978-1-118- 47347-4, 466/-

**Reference Books**

1. Smart Internet of things projects Agus Kurniawan Packt - Sep 2016 978-1- 78646- 651-8 2 The Internet of Things Key Olivier Willy Publication 2nd Edition 978-
2. Applications and protocols Hersent s 119- 99435-0, 3 The Internet of Things Connecting Objects to the Web  Hakima Chaouchi,  Willy Publications 978-1- 84821- 140-7

**Savitribai Phule Pune University**

**Fourth Year of Information Technology Engineering (2015 Course)**

**414464A: Elective III**

**Internet of Things Laboratory**

| Teaching Scheme: | Credits:04 | Examination Scheme: |
|---|---|---|
| Practical:02 Hours/Week | | TW:25 Marks |
| | | OR: 25 Marks |

**Prerequisites:**

1. Computer Network Technology
2. Processor Architecture and Interfacing

**Course Objectives:**

1. To study IoT platforms such as Raspberry-Pi/Beagle board/Arduino.
2. To study operating systems for platforms such as Raspberry-Pi/Beagle board/Arduino.
3. To get knowledge for communicating with objects.
4. To explore cloud environment for IoT.
5. To provide knowledge for IoT related protocols such as MQTT / CoAP etc.
6. To design the web interface for IoT.

**Course Outcomes:**

By the end of the course, students should be able to

1. To understand IoT platforms such as Raspberry-Pi/Beagle board/Arduino.
2. To understand operating systems for platforms such as Raspberry-Pi/Beagle board/Arduino.
3. To communicate with objects using IoT platforms such as Raspberry-Pi/Beagle board/Arduino.
4. To interface cloud environment for IoT application.
5. To implement IoT related protocols such as MQTT / CoAP etc.
6. To implement the web interface for IoT

**Guidelines for Instructor**

1. The faculty member should choose a suitable IoT platform from Raspberry-Pi, Beagle board, Arduino for study and implementation.
2. The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant

**Suggested List of Assignments**

**Assignment 1**

Study of Raspberry-Pi, Beagle board, Arduino.

**Assignment 2**

Study of different operating systems for Raspberry-Pi/Beagle board/Arduino. Understanding the process of OS installation on Raspberry-Pi/Beagle board/Arduino

**Assignment 3**

Open source prototype platform- Raspberry-Pi/Beagle board/Arduino -Simple program digital read/write using LED and Switch -Analog read/write using sensor and actuators

**Assignment 4**

Upload data from environmental sensor to cloud server ( You can use any public cloud IBM

Watson IoT cloud or Google or AWS etc.)

**Assignment 5**

Introduction to MQTT/ CoAP and sending sensor data to cloud using Raspberry-Pi/Beagle board/Arduino.

**Assignment 6**

Design a web interface to control connected LEDs remotely using Raspberry-Pi/Beagle board/Arduino.

**Assignment 7**

Install, configure XMPP server and deployed an application on Raspberry Pi/Beagle board/Arduino.

Write client applications to get services from the server application

**Assignment 8**

Install, configure APACHE server and deployed an application on Raspberry Pi/Beagle

board/Arduino. Write client applications to get services from the server application

**Reference Books**

1. The Internet of Things Key applications and protocols Olivier Hersent Willy Publications 2nd Edition 978-1-119- 99435-0,

2.The Internet of Things Connecting Objects to the Web Hakima Chaouchi, Willy Publications 978-1-84821- 140-7

3.The Internet of Things Donald Norris TAB 4 Smart Internet of Things Projects Agus Kurniawan PACKT

4.Getting Started with the Internet of Things Cuno Pfister SPD O'REILL Y IOT

## Savitribai Phule Pune University
## Fourth Year of Information Technology Engineering (2015 Course)
## 414464B: Elective III
## Information Storage and Retrieval

| Teaching Scheme:<br>TH:03 Hours/Week | Credits:04 | Examination Scheme:<br>In-Sem (Paper): 30 Marks<br>End-Sem (paper): 70 Marks |
|---|---|---|

**Prerequisites:**
1. 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 and understand user interfaces for searching.
5. To understand information sharing on semantic web.
6. To understand the various applications of Information Retrieval giving emphasis to multimedia and distributed IR, web Search.

**Course Outcomes :**

By the end of the course, students should be able to
1. 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. Students should be able to design user interfaces
5. Student should be able to understand importance of recommender system.
6. Student should be able to understand concept of multimedia and distributed information retrieval.

| UNIT I | INTRODUCTION | 8 Hrs |
|---|---|---|

Basic Concepts of IR, Data Retrieval & Information Retrieval, text mining and IR relation, IR system block diagram.
Automatic Text Analysis: Luhn's ideas, Conflation Algorithm, Indexing and Index Term Weighing, Probabilistic Indexing
Inverted file, Suffix trees & suffix arrays, Signature Files, Scatter storage or hash addressing, Clustered files, Hypertext and XML data structures.

| UNIT II | CLASSIFICATOIN AND RETRIEVAL SEARCH STRATEGIES | 8 Hrs |
|---|---|---|

Retrieval strategies: Vector Space model, Probabilistic retrieval strategies, Language models, Inference networks, Extended boolean retrieval, Latent semantic indexing, neural networks, Fuzzy set retrieval

Retrieval utilities: Relevance feedback, Cluster Hypothesis, Clustering Algorithms: Single Pass Algorithm, Single Link Algorithm.

| UNIT III | RETRIEVAL PERFORMANCE EVALUATION AND VISUALISATION | 8 Hrs |
|----------|-----------------------------------------------------|-------|

Performance evaluation: Precision and recall, MRR, F-Score, NDCG, user oriented measures, cross fold evaluation.

Visualisation in Information System: Starting points, document context, User relevance judgement, Interface support for search process.

| UNIT IV | DISTRIBUTED AND MULTIMEDIA IR | 8 Hrs |
|---------|-------------------------------|-------|

Distributed IR: Introduction, Collection Partitioning, Source Selection, Query Processing, web issues.

MULTIMEDIA IR: Introduction, Data Modeling, Query languages, Generic multimedia indexing approach, One dimensional time series, two dimensional color images, Automatic feature extraction

| UNIT – V | WEB SEARCHING | 8 Hrs |
|----------|---------------|-------|

Searching the Web: Challenges, Characterizing the Web, Search Engines, Browsing, Mata-searchers, Web crawlers, Meta-crawler, Web data mining, Finding needle in the Haystack, Searching using Hyperlinks, Page ranking algorithms:  Pagerank, Rank SVM

| UNIT VI | ADVANCED INFORMATION RETRIEVAL | 8 Hrs |
|---------|--------------------------------|-------|

Semantic Search systems: G Semantic Web oogle knowledge graphs, Ontology, Searching across ontologies, semantic web search.

Recommendation system: Collaborative Filtering and Content Based Recommendation of Documents and Products, Information

Extraction and Integration: Extracting Data from Text., Collecting and Integrating Specialized Information on the web.

## Text Books

1. Yates & Neto, Modern Information Retrieval, Pearson Education, ISBN:81-297-0274-6
2. C.J. Rijsbergen, Information Retrieval, (www.dcs.gla.ac.uk).,2ndISBN:978- 408709293
3. David Grossman, Ophir Frieder ,Information Retrieval - Algortihms and Heuristics, Springer International Edition, Nnd, ISBN:978-1-4020-3004-8
4. Grigoris Antoniou and Frank van Harmelen, A semantic Web Primer, Massachusetts Institute of Technology, ISBN:978-0-262-01242-3
5. Pascal Hitzler, Markus Krötzsch, Sebastian  Rudolph, Foundations of Semantic Web Technologies, Chapman & Hall/CRC,ISBN:9781420090505
6. Hang Li, Learning to Rank forInformation Retrievaland Natural Language
7. Processing, Morgan & Claypool, ISBN:9781608457076

## Reference Books

1. Christopher D. Manning, Prabhakar Raghavan and HinrichSchutzen, Introduction to Information Retrieval, Cambridge University Press, Online book, ISBN:978-0-521-86571-5
2. Robert Korfhage, Information Storage and Retrieval, John Wiley & Sons,1 Edition, ISBN:9788126507702
3. Kowalski, Gerald, Maybury, Mark, Information Storage and Retrieval Systems :Theory and Implementation, Springer US, 2$^{nd}$ Edition,ISBN:978-0-7923-7924-9
4. Zhang, Jin, Visualization for Information Retrieval, Springer-Verlag Berlin Heidelberg,1$^{st}$

Edition,ISBN:978-3-642-09442-2Mark leven, Introduction to search engines and web navigation, John Wiley and sons Inc, 2$^{nd}$ Edition,ISBN 9780-170-52684-2

5. V. S. Subrahamanian, Satish K. Tripathi , Multimedia information System,Kulwer Academic Publisher
6. ChabaneDjeraba, Multimedia mining A highway to intelligent multimedia documents, Kulwer Academic Publisher,ISBN:1-4020-7247-3
7. Ricci, F, Rokach, L. Shapira, B.Kantor,Recommender Systems Handbook,
8. Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack,Information Retrieval Implementing and Evaluating Search Engines, The MIT Press, Cambridge

## Savitribai Phule Pune University
## Fourth Year of Information Technology Engineering (2015 Course)
## 414464B:
## Information Storage and Retrieval Laboratory

| Teaching Scheme: | Credits:04 | Examination Scheme: |
|---|---|---|
| Practical:02 Hours/Week | | TW:25 Marks<br>OR: 25 Marks |

### Prerequisites:

1.      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 with Storage, Organization & Access to Information Items.
4. To evaluate the performance of IR system and understand user interfaces for searching.
5. To understand information sharing on semantic web.
6. To understand the various applications of Information Retrieval giving emphasis to multimedia and distributed IR, web Search.
7. To apply the gained knowledge in recent fields of advancements in the subject

### Course Outcomes:
1. Student should be able to understand the concept, data structure and preprocessing algorithms 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. Students should be able to design user interfaces
5. Student should be able to understand importance of recommender system. (take decision on design parameters of recommender system.)
6. Student should be able to understand concept of multimedia and distributed information retrieval.
7. Students must be able to map the concepts of the subject on recent developments in the Information retrieval field

### Guidelines for Instructor

Faculty member should frame Practical Assignments based on below given list of assignments. Students will submit term work in the form of journal containing handwritten write-ups/ source code and output. Staff incharge should maintain a record of continuous assessment and produced at the time of oral examination.

| Suggested List of Assignments |
|---|

**Assignment 1**

To implement Conflation Algorithm using File Handling.

**Assignment 2**

To implement single pass algorithm for clustering.

**Assignment 3**

To implement a program Retrieval of documents using inverted files.

**Assignment 4**

To implement a program for feature extraction in 2D colour images (any features like colour, texture etc

**Assignment 5**

To implement a simple Web Crawler in Java.

**Assignment 6**

Extract features from input image and plot histogram for the features.

**Assignment 7**

Write a program to recommend a product / learning course based on person preferences / education details.

**Assignment 8**

Consider set of 25 to 30 documents on 5 to 7 distinct topics. Define 5 queries and map the document that will be retrieved for every query. Write a program using any algorithm to retrieve documents. Evaluate the algorithm using all evaluation methods.

**Assignment 9**

Case study on Image retrieval for ADAS (Advanced Driver Assistance System) (Here students are expected to research the topics like Lane Change Assist (LCA), Driver Drowsiness and inattentiveness, Lane Change Assist, Automatic Parking, ACC etc.)

**Reference Books**

1. Yates & Neto, "Modern Information Retrieval", Pearson Education
2. C.J. Rijsbergen, "Information Retrieval", (www.dcs.gla.ac.uk)
3. R. C. Gonzalez, R. E. Woods, "Digital Image Processing", Pearson Education
4. Zhang, Jin, "Visualization for Information Retrieval", Springer-Verlag Berlin Heidelberg
5. V. S. Subrahamanian, Satish K. Tripathi, "Multimedia information System", Kulwer Academic Publisher.
6. Ricci, F, Rokach, L. Shapira, B.Kantor, "Recommender Systems Handbook"

## Savitribai Phule Pune University
## Fourth Year of Information Technology Engineering (2015 Course)
### 414464C: Elective III
### Multimedia Techniques

| Teaching Scheme:<br>TH:03 Hours/Week | Credits:04 | Examination Scheme:<br>In-Sem (Paper): 30 Marks<br>End-Sem (paper): 70 Marks |
|---|---|---|

**Prerequisites:**
1. Data Structures and Files
2. Basics of computer graphics and animation.

**Course Objectives :**
1. To learn basic components of multimedia (text, image, audio, video and animation)
2. To learn compression techniques for various multimedia components
3. To learn rendering
4. To learn animation and gaming.
5. Become acquainted with some advanced topics in multimedia.

**Course Outcomes :**

By the end of the course, students should be able to
1. To create own file formats for specific application
2. To do some projects based on current trends in multimedia
3. To use open sources for authoring tool for animation and presentations
4. Understand some research areas of current multimedia techniques

| UNIT I | INTRODUCTION TO MULTIMEDIA | 8 Hrs |
|---|---|---|

Goals, objectives, and characteristics of multimedia, Multimedia building blocks, Multimedia architecture, Multimedia Applications Media Entertainment, Media consumption, web-based applications, e-learning and education

| UNIT II | TEXT AND IMAGE PROCESSING | 8 Hrs |
|---|---|---|

Text: Text file formats: TXT, DOC; RTF, PDF, PS
Text compression: Huffman coding, LZ & LZW
Image: Basic Image fundamentals, Image File formats - (BMP, TIFF, JPEG, GIF)
Image processing cycle- Image acquisition, storage, Communication, and display, Image Enhancement, Image Compression: Types of Compression: Lossy & Lossless,
Lossless: RLE, Shannon - Fano algorithm, Arithmetic coding.
Lossy: Vector quantization, Fractal Compression Technique, Transform coding andHybrid: JPEG-DCT

| UNIT III | AUDIO AND VIDEO PROCESSING | 8 Hrs |
|---|---|---|

AUDIO: Nature of sound waves, characteristics of sound waves, psycho-acoustic, MIDI, digital audio, CD formats.
Audio file formats: WAV, AIFF, VOC, AVI, MPEG Audio File formats, RMF, WMA

Audio compression techniques: DM, ADPCM and MPEG

Video: Video signal formats, Video transmission standards: EDTV, CCIR, CIF, SIF, HDTV, digitization of video,

Video file formats: MOV, Real Video, H-261, H-263, Cinepack, Nerodigtal,Video editing, DVD formats, MPEG,

| UNIT IV | ANIMATION AND VIRTUAL REALITY | 8 Hrs |
|---|---|---|

Animation: Basics of animation, types of animation, principles of animation,

Methods of controlling animation, frame-by-frame animation techniques, real-time animation techniques, Programming aspects in creating simple animation, OpenGL: Open GL over windows/Linux, Extension.

Virtual Reality: Concept, Forms of VR, VR applications, VR devices: Hand Gloves, Head mounted tracking system, VR chair, CCD, VCR, 3D Sound system, Head mounted display

| UNIT – V | RENDERING | 8 Hrs |
|---|---|---|

Introduction, Basics of illumination and shading models, Transparency,

Shadows and textures, Ray tracing from the light source, cone, beam and pencil tracing. Point based rendering, Mesh Simplification, Spatial partitioning, Solid Modeling

| UNIT – VI | ADVANCES IN MULTIMEDIA | 8 Hrs |
|---|---|---|

Multimedia Communication and applications, Study of Multimedia networking, Quality of data transmission, Multimedia over IP, Media on Demand.

Multimedia in Android: Android Multimedia Framework Architecture

Gaming: Facial Recognition, Voice Recognition, Gesture Control, High-Def Displays, Augmented Reality, Mobile Gaming, Cloud Gaming, On-Demand Gaming.

| Text Books |
|---|

1. Ralf Steinmetz and Klara Nahrstedt "Multimedia Computing, Communication and Applications", Pearson Education.
2. K.R. Rao, "Multimedia Communication Systems: Techniques, Standards, and Networks", TMH.
3. Ranjan Parekh, "Principles of Multimedia", 2/E, Tata McGraw-Hill, ISBN: 1259006506
4. David F. Rogers, "Procedural Elements for Computer Graphics", 2nd Ed - Tata McGraw Hill Edition.
5."OpenGL Programming Guide: The Official Guide to Learning OpenGL", Mason Woo, Jackie, Tom Davis, Version 2.1, 6th Edition, Pearson Education, ISBN 978-81-317-2184-1.

| Reference Books |
|---|

1. Ashok Banerji, AnandaGhosh, "Multimedia Technologies", ISBN: 9780070669239
2. Gonzalez, Woods, "Digital Image Processing" Addison Wesley
3. Ze-Nian Li, Marks S. Drew, "Fundamentals of Multimedia", Pearson Education.
4. Edward Angel, "OpenGL: A Primer", Addison-Wesley.
5. Parag Havaldar, Gerard Medioni, "Multimedia Systems", Cengage Learning.
6. Hill, Kelly, "Computer Graphics using OpenGL", 3rd Ed, Eastern Economy Edition.
7. Alan H. Watt and Mark Watt,"Advanced Animation and Rendering Techniques: Theory and Practice", Addison-Wesley, ACM Press, ISBN: 0201544121
8.Foley, Dam, Feiner, Hughes,"Computer Graphics Principles & Practice", 2nd Ed, Pearson Education.
9. Introduction to Game Development Using Processing ,by J. R. Parker ,Mercury Learning & Information; Pap/Com edition

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## Savitribai Phule Pune University
## Fourth Year of Information Technology Engineering (2015 Course)
## 414464C: Multimedia Techniques Laboratory

| Teaching Scheme: | Credits:04 | Examination Scheme: |
|---|---|---|
| Practical:02 Hours/Week | | TW:25 Marks |
| | | OR: 25 Marks |

**Prerequisites:**
1. Data Structures and Files
2. Basics of computer graphics and animation.

**Course Objectives:**

To learn basic components of multimedia (text, image, audio, video and animation)
2. To learn compression techniques for various multimedia components
3. To learn rendering
4. To learn animation and gaming.
5. Become acquainted with some advanced topics in multimedia.

**Course Outcomes:**

By the end of the course, students should be able to
1. To create own file formats for specific application
2. To do some projects based on current trends in multimedia
3. To use open sources for authoring tool for animation and presentations.

| Suggested List of Assignments |
|---|
| **Assignment 1** |
| Write a program to open and display Images in Python or Java using OpenCV tool. |
| **Assignment 2** |
| Write a program for generating Huffman codes for a gray scale 8-bit image |
| **Assignment 3** |
| Write a program for implementation of ray-tracing algorithm in Java. |
| **Assignment 4** |
| Create a simple animation using OpenGL |
| **Assignment 5** |
| Study of any virtual reality tool/software. (3DS MAX, BLENDER, GOOGLE VR) |
| **Assignment 6** |
| Write a Program to compress image using Python |
| **Assignment 7** |

| |
|---|
| Create a short movie clip using open source tool |

| |
|---|
| **Assignment 8** |
| Build a Virtual Reality web application using open source tool |

| |
|---|
| **Assignment 9** |
| Write a Program to implement basic game in Python |

| |
|---|
| **Reference Books** |
| 1. Ralf Steinmetz and Klara Nahrstedt "Multimedia Computing, Communication and Applications", Pearson Education.<br>2. K.R. Rao, "Multimedia Communication Systems: Techniques, Standards, and Networks", TMH.<br>3. Ranjan Parekh, "Principles of Multimedia", 2/E, Tata McGraw-Hill, ISBN: 1259006506<br>4. David F. Rogers, "Procedural Elements for Computer Graphics", 2nd Ed - Tata McGraw Hill Edition.<br>5."OpenGL Programming Guide: The Official Guide to Learning OpenGL", Mason Woo, Jackie, Tom Davis, Version 2.1, 6th Edition, Pearson Education, ISBN 978-81-317- |

## Savitribai Phule Pune University
## Fourth Year of Information Technology Engineering (2015 Course)
## 414464D: Elective III
## Internet and Web Programming

| Teaching Scheme:<br>TH:03 Hours/Week | Credits:04 | Examination Scheme:<br>In-Sem (Paper): 30 Marks<br>End-Sem (paper): 70 Marks |
|---|---|---|

**Prerequisites Courses :**
1. Internet and Web Programming

**Course Objectives :**
1. To understand Internet and Web Programming basic concepts.
2. To develop client side web programming skills.
3. To develop server side web programming skills.
4. To understand Web Services and Content Management System.
5. To understand mobile web development and develop mobile web development skills.
6. To understand web security and cyber ethics.

**Course Outcomes :**
By the end of the course, students should be able to
1. Demonstrate static website using basic tools.
2. Develop client side programming skills.
3. Develop server side programming skills.
4. Understand web services and handle content management tools.
5. Develop mobile website using mobile web development tools.
6. Understand aspects of web security and cyber ethics.

| UNIT I | INTERNET AND WEB PROGRAMMING ESSENTIALS | 8 Hrs |
|---|---|---|

The Internet, Introduction Basic Internet Protocol, The World Wide Web, Introduction to Web Programming, Web Clients, Web Servers, Browser and Search Engines.
Markup Languages : Introduction to HTML, Static and dynamic HTML, Structure of HTML documents, HTML Elements, Linking in HTML, Anchor Attributes, Image Maps, Meta Information, Image Preliminaries, Layouts, Backgrounds, Colors and Text, Fonts, Tables, Frames and layers, Audio and Video Support with HTML Database integration, , Forms Control, Form Elements, Applying Styles, values, selectors, class, ids, inheritance, layout, backgrounds, borders, margin, padding, lists, fonts, text formatting, positioning. HTML5. Introduction to Style Sheet, Inserting CSS in an HTML page, CSS selectors, Introduction to XML, XML key component, Transforming XML into

XSLT, DTD: Schema, elements, attributes, Introduction to JSON.

| UNIT II | CLIENT SIDE PROGRAMMING | 8 Hrs |
|---|---|---|

JavaScript: Overview of JavaScript, using JS in an HTML (Embedded, External), Data types, Control Structures, Arrays, Functions and Scopes, Objects in JS, DOM: DOM levels, DOM Objects and their properties and methods, Manipulating DOM, JQuery: Introduction to JQuery, Introduction to AJAX, Working of AJAX, AJAX processing steps, coding AJAX script. Introduction to Angular JS.

| UNIT III | SERVER SIDE PROGRAMMING | 8 Hrs |
|---|---|---|

Introduction to Server Side technology and TOMCAT, Servlet: Introduction to Servlet, need and advantages, Servlet Lifecycle, Creating and testing of sample Servlet, session management. JSP: Introduction to JSP, advantages of JSP over Servlet, elements of JSP page: directives, comments, scripting elements, actions and templates, JDBC Connectivity with JSP. PHP: Introduction to PHP, Features, PHP script, PHP syntax, conditions & Loops, Functions, String manipulation, Arrays & Functions, Form handling, Cookies & Sessions, using MySQL with PHP.

| UNIT IV | WEB SERVICES AND CONTENT MANAGEMENT SYSTEMS | 8 Hrs |
|---|---|---|

Introduction to Web Services, Web Services Architecture, XML Messaging, SOAP,WSDL, UDDI, REST, Java Web Services, Amazon Web Services, DevOps , Introduction to Content Management System(CMS) ,Wordpress / Joomala, Advanced Technology: Bootstrap, JSF, Spring.

| UNIT V | MOBILE WEB DEVELOPMENT | 8 Hrs |
|---|---|---|

What is Mobile Web? Understanding Mobile Devices, Mobile Data Usage, Mobiles and Desktops, Building an HTML page, Getting jQuery Mobile, Implementing jQuery Mobile, Working with data attributes, Working with jQuery Mobile Pages, Enhancing Pages with Headers, Footers, and Toolbars; Working with Lists, Building a Simple Mobile Website, Working with Forms and jQuery Mobile, Creating Modal Dialogs and Widgets, Creating Grids, Panels, and Other Widgets; jQuery Mobile Configuration, Utilities, and JavaScript Methods; Working with Events.

| UNIT VI | WEB SECURITY AND CYBER ETHICS | 8 Hrs |
|---|---|---|

Overview of Web Security: Need of Web Security, Breach of Web Security, What need to be Secure on Web? Can Web be secure? Aspects of Web Security, Purpose of Web Security, A Security Equation, Defining Security Equation, Common Threats on Web, User level Security, Server Level Security, Cyber ethics, Issues in Cyber ethics.

**Text Books**

1. Kogent Learning Solutions Inc,Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, XML and AJAX, Blackbook, Dreamtech Press, Second Edition ,ISBN:9788177228496
2. Raymond Camden, Andy Matthews, jQuery Mobile Web Development Essentials, Packt Publishing, Second Edition, 9781782167891
3. Ethan Cerami, Web Services Essentials, O'Reilly Media, First Edition, 0-596-00224-6
4. Shweta Bhasin, Web Security Basics, Premier Press, First Edition, ISBN:l978-1592000067

**Reference Books**

1. Dr.Hiren Joshi, Web Technology and Application Development, DreamTech, First,ISBN:978-93- 5004-088-1
2. Santosh Kumar K., DT Editorial Services,Black Book, JDBC 4.2, Servlet 3.1 & JSP 2.3,Dreamtech Press, Second Edition, ISBN:978-8177228700
3. Steven M. Schafer, "HTML, XHTML and CSS", Wiley India Edition, Fourth Edition, 978- 81- 265-1635-3
4. B. V. Kumar, S. Sangeetha, S.V. Subrahmanya, J2EE Architecture, an illustrative gateway to

enterprise solutions, Tata McGraw Hill Publishing Company, Second Edition, ISBN:978-0-070-621-633

5. Ivan Bayross, "Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP,BPB Publications,4th Edition,ISBN:978-8183330084

6. Brain Fling, Mobile Design and Development, O'REILLY, First Edition, ISBN:13:978-81-8404-817-9

7. Jason Hunter, Java Servlet Programming, O'reilly Publications, 2nd Edition, ISBN: 978-0-596-00040-0

8. Adam Bretz & Colin J Ihrig, Full Stack Javascript Development with MEAN, SPD, First Edition, ISBN:978-0992461256

## Savitribai Phule Pune University
## Fourth Year of Information Technology Engineering (2015 Course)
## 414464D: Internet and Web Programming Laboratory

| Teaching Scheme: | Credits:04 | Examination Scheme: |
|---|---|---|
| Practical:02 Hours/Week | | TW:25 Marks |
| | | OR: 25 Marks |

**Prerequisites:** Basic Programming Skills

**Course Objectives:**
1. Making Student familiar with client server architecture.
2. To develop ability for making   web application using JavaScript.
3. To develop web applications using Angular JS
4. To design and implement web services with content management
5. To understand use of Content Management Tolls in Website Development

**Course Outcomes:**

By the end of the course, students should be able to
1. Use fundamental skills to develop and maintain website and web application
2. Apply scripting skills for Server side and Client-side Programming
3. Develop web services to transfer data and add interactive components to website.
4. Combine multiple web technologies to create advanced web components

**Guidelines for Instructor's Manual**

The instructor's manual is to be developed as hands - on resource and reference. The instructor's manual need to include prologue (about University/program/ institute/ department/foreword/ preface etc), University syllabus, conduction & Assessment guidelines, topics under consideration - concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references

**Guidelines for Student Journal**

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept/technology/tool in brief, design, test cases, conclusion/analysis. Program codes with sample output of all performed assignments are to be submitted as softcopy. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory

| Guidelines for Assessment |
|---|
| Continuous assessment of laboratory work is done based on overall performance and laboratory assignments performance of student. Each laboratory assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness |

| Guidelines for Practical Examination |
|---|
| Both internal and external examiners should jointly set problem statements. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at the time of evaluation to test the student's for advanced learning, understanding of the fundamentals, effective and efficient implementation. So encouraging efforts, transparent evaluation and fair approach of the evaluator will not create any uncertainty or doubt in the minds of the students. So adhering to these principles will consummate our team efforts to the promising start of the student's academics. |

| Guidelines for Laboratory Conduction |
|---|
| The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications. Encourage students for appropriate use of Hungarian notation, proper indentation and comments. Use of open source software is to be encouraged. In addition to these, instructor may assign one real life application in the form of a mini-project based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus. |

| Suggested List of Assignments |
|---|

| Assignment 1 |
|---|
| 1.1    Using HTML5 layout tags develop informative page with sections which include various images, links to other pages for navigation, make use of all possible formatting (for example font, color etc.). <br><br> 1.2    Apply CSS properties Border, margins, Padding, Navigation, dropdown list to page created in first assignment. |

| Assignment 2 |
|---|
| Design an online registration form for any application and validate it using JQuery |

| Assignment 3 |
|---|
| Design Login Application using PHP and add essence of Ajax in it |

| Assignment 4 |
|---|
| Create any Java Web Service and integrate it with any suitable application |

| Assignment 5 |
|---|
| Create JSP login page and validate it. Make use of Servelets |

| Assignment 6 |
|---|

| Create an application for bill payment using Angular JS |
|---|
| **Assignment 7** |
| Develop website using any CMS tool which falls into one of the categories blog, social networking, News updates, Wikipedia, E-commerce store. Website must include home page, and at least 3 |
| **Assignment 8** |
| Develop Mini Project using any front end  tool with database connectivity |
| **Reference Books** |

1. Aleksa Vukotic and James Goodwill, "Apache Tomcat 7", Apress, 2011, ISBN: 10: 1430237236
2. Bryan Basham, Kathy Sierra, Bert Bates, "JSP: Passing the Sun Certified Web Component Developer Exam", O'Reilly Media ISBN: 978-0-596-51668-0
3. Chirag Rathod, Jonathan Wetherbee, Peter Zadrozny, and Raghu R. Kodali, "Beginning EJB 3: Java EE 7 Edition", Apress, 2013, ISBN : 9781430246923
4. Richard Monson-Haefel, "J2EE Web Services", Addison-Wesley Professional, First Edition, 2004, ISBN: 10: 0321146182
5. Chuck Cavaness, "Programming Jakarta Struts", O'relly Media, second edition 2004, ISBN: 978-0-596-00651-8;
6. Michael Morrison, Lynn Beighley, "Head First PHP & MySQL: A Brain-Friendly Guide", O'relly Media, second edition 2008, ISBN :13: 9788184046588
7. Dan Rahmel, "Advanced Joomla!", Apress, First Edition, 2013, ISBN: 13: 9781430216285
8. Iwein Fuld, Marius Bogoevici, Mark Fisher, Jonas Partner", Spring Integration in Action", Manning, 2012, ISBN : 13: 9781935182436

**Savitribai Phule Pune University**
**Fourth Year of Information Technology Engineering (2015 Course)**
**414464E: Elective III**
**Computational Optimization**

| Teaching Scheme:<br>TH:03 Hours/Week | Credits :04 | Examination Scheme: |
|---|---|---|
| | | In-Sem (Paper): 30 Marks<br>End-Sem (paper): 70 Marks |

**Prerequisites Courses :**
1. Mathematical preliminaries like Linear algebra, matrices, Elements of probability theory & Elementary multivariable calculus.
2. Design and Analysis of Algorithms
3. Genetic Algorithms

**Course Objectives :**
1. To enable the student to learn and acquire mathematical methods in engineering disciplines.
2. To introduce the methods of optimization to solve a linear programming problem by various methods.
3. To introduce few advanced optimization techniques.

**Course Outcomes :**
By the end of the course, students should be able to
1. Learn and implement various optimization techniques
2. Learn model real-world problems in optimization framework
3. Apply various optimization models to solve optimization problems in computer-science & IT Engineering.

| UNIT I | INTRODUCTION | 8 Hrs |
|---|---|---|

Overview, Operation Research Modeling Approach and Various Real Life Situations, Linear Programming Problems (LPP): Basic LPP and Applications; Various Components of LP Problem Formulation, Solving Linear Programming Problems: Using Simultaneous Equations and Graphical Method; Simplex Method; Duality Theory; Charnes' Big – M Method. Transportation Problems and Assignment Problems, 0/1 knapsack problem using brute force and dynamic approach

| UNIT II | NETWORK ANALYSIS | 8 Hrs |
|---|---|---|

Shortest Path: Dijkstra Algorithm; Floyd Algorithm; Maximal Flow Problem (Ford-Fulkerson); PERT-CPM, network design algorithms

| UNIT III | INVENTORY CONTROL | 8 Hrs |
|---|---|---|

Introduction; Economic Order Quantity (EOQ) models, Deterministic and probabilistic Models, Safety Stock, Buffer Stock, Inventory Model of Central Warehouse

| UNIT IV | GAME THEORY | 8 Hrs |
|---|---|---|

Introduction ; 2- person Zero – sum Game; Saddle Point ; Mini-Max and Maxi-Min Theorems, Games without saddle point ; Graphical Method ; Principle of Dominance

| UNIT V | QUEUING THEORY | 8 Hrs |
|---|---|---|

Introduction; Basic Definitions and Notations; Axiomatic Derivation of the
Arrival & Departure (Poisson Queue). Pure Birth and Death Models; Poisson
Queue Models: M/M/1: $\infty$ /FIFO and M/M/1: N/ FIFO.

| UNIT VI | ADVANCED OPTIMIZATION TECHNIQUES | 8 Hrs |
|---|---|---|

Direct and indirect search methods, Evolutionary algorithms for optimization and search, Concepts of multi-objective optimization, genetic algorithms and simulated annealing, optimization of machine learning algorithms, ant colony optimization, Applications of IT Engineering: Search Engine Optimization, Smart Grid Optimization

### Text Books

1. H.A. Taha, "Operations Research", Fifth Edn. Macmillan Publishing Company, 1992.
2. K. Deb, "Optimization for Engineering Design- Algorithms and Examples", Prentice-Hall Of India Pvt. Ltd., New Delhi, 1995.
3. Hadley G., "Linear Programming" Narosa Publishers, 1987.
4. Mital : Optimization Methods, New Age International
5. Kalyanmoy Deb, Mulitobjective Optimization –An evolutionary Algorithmic Approcach, John Wiley & Sons, New York

### Reference Books

1. V.K.Kapoor – "Operations Research"
2. Kanti Swaroop – "Operations Research"
3. Hillier F. & Liebermann G.J., "Introduction to Operations Research" 7/e
4. (with CD ) , THM
5. Hillier F.& Liebermann G.J., "Operations Research", Holder Day Inc, 1974
6. Mustafi : Operations Research, New Age International
7. Shenoy : Operations Research for Management , New Age International
8. Mahapatra : Introduction to System Dynamics Modelling, Universities Press
9. Rao : Engineering Optimization , New Age International
10. Schaum Outline Series – "Operations Research" , TMH
11. Introduction to Optimization – Edwin K P Chong, Stainslaw H Zak
12. Nonlinear programming – Dimitry Bertsekas
13. J.C.Pant, Introduction to Optimization, Jain Brothers, New Delhi, 1983
14. kershenbaum A., " Telecommunication network design algorithms", TMH

## Savitribai Phule Pune University

## Fourth Year of Information Technology Engineering (2015 Course)

## 414464E: Computational Optimization Laboratory

| Teaching Scheme: | Credits:04 | Examination Scheme: |
|---|---|---|
| Practical:02 Hours/Week | | TW:25 Marks |
| | | OR: 25 Marks |

**Prerequisites:**

Optimization Algorithms, Basics of Problem Solving, Fundamentals of Design and Analysis of Algorithms

**Course Objectives:**

1. To understand how to solve knapsack problem by brute force method
2. Understand different problem-solving algorithms

**Course Outcomes:**

By the end of the course, students should be able to

1. understand Transportation problem
2. learn different measures in shortest path algorithms
3. understand and learn Queuing Model

**Guidelines for Instructor**

Instructor should design and implement at least 08 assignments and 2 study assignments on Computational Optimization

| Suggested List of Assignments |
|---|

**Assignment 1**

Transportation problem

**Assignment 2**

Assignment problem

**Assignment 3**

0/1 knapsack problem solved by brute force method

**Assignment 4**

0/1 knapsack problem solved by dynamic programing

**Assignment 5**

Duality

**Assignment 6**

Simplex

**Assignment 7**

| |
|---|
| Dijkstra's and Floyd algorithm for shortest path |
| **Assignment 8** |
| Maximal flow problem |
| **Assignment 9** |
| PERT/CPM problem |
| **Assignment 10** |
| Mini-Max and Maxi-Min theorem |
| **Study Assignments** |
| **Assignment 1** |
| EOQ Models |
| **Assignment 2** |
| Safety stock and buffer stock |
| **Assignment 3** |
| M/M/1:∞/FIFO |
| **Assignment 4** |
| M/M/1:N/FIFO |

## Savitribai Phule Pune University
## Fourth Year of Information Technology Engineering (2015 Course)
## 414465A: Elective IV
## Rural Technologies and Community Development

| Teaching Scheme: | Credits:03 | Examination Scheme: |
|---|---|---|
| TH:03 Hours/Week | | In-Sem (Paper): 30 Marks |
| | | End-Sem (paper): 70 Marks |

**Course Objectives :**
3. Understand theories and practices in the rural development model
4. Learn and analyse rural life and rural economy
5. Understand different measures in rural development
6. Learn different technologies used in upliftment of rural life.
7. To participate in visits and case studies for better understanding for rural development and its impact on overall economy.

**Course Outcomes :**
By the end of the course, students should be able to
4. understand rural development model
5. learn different measures in rural development and its impact on overall economy
6. understand and learn importance of technologies in rural and community development
7. understand challenges and opportunities in rural development.

| UNIT I | INTRODUCTION | 7 Hrs |
|---|---|---|

RURAL DEVELOPMENT - Concepts and connotations, Basic Elements, Growth Vs. Development, Why rural development, Rising expectations and development, Development and Change, Human beings as cause and consequences of development.

RURAL ECONOMY OF INDIA - Introduction, size and structure, The characteristics of rural sector, The role of agricultural sub-sector, The role of non-agricultural sub-sector, Challenges and opportunities

| UNIT II | RURAL DEVELOPMENT - MEASURES AND PARADIGMS | 7 Hrs |
|---|---|---|

MEASURES OF DEVELOPMENT - Introduction, Measures of level of rural development, Measures of income distribution, Measures of development simplified, Concepts and measures of rural poverty
PARADIGMS OF RURAL DEVELOPMENT - Introduction, The modernization theory, The dependency theory of Marxist School, Rosenstein- Rodan's theory of 'Big Push', Lewis' model of economic development, The human capital model of development, The Gandhian Concept of Rural Development theories from other social sciences.

| UNIT III | TECHNOLOGIES FOR RURAL DEVELOPMENT | 7 Hrs |
|---|---|---|

Using Water Resources - The water cycle, Drinking Water, Water quality testing, Water filtering ,Extraction from Groundwater ,Pumps Rope and washer pump ,Manuel pumps, Treadle pump, Irrigation for agriculture, Channel systems, Sprinkler systems, Drip systems Water diversion ,Water

storage

Building Infrastructures, Creating Energy - Basic energy uses , Energy Sources - Firewood, Solar Energy, Hydroelectricity, Hydromechanical, Wind Energy, Energy Storage,Connecting to the Electrical Network, Environmental Considerations

Use of ICT in Rural and agricultural development - Education, Healthcare, Agriculture, Business, Resource Mapping, Digital and Social Media Marketing Decision Support Systems for soil conservation and farm management Waste Management and Sanitation.

| UNIT IV | COMMUNITY DEVELOPMENT | 7 Hrs |
|---------|----------------------|-------|

DEVELOPING COMMUNITIES - Introduction, Service Learning and community development, Theory and practice of community development, Community development issues. The diverse meaning of community development, The knowledge base of community development, International community development

| UNIT V | COMMUNITY DEVELOPMENT - RURAL ENTREPRENEURSHIP | 7 Hrs |
|--------|------------------------------------------------|-------|

Different forms of Rural Entrepreneurship, Significance , Business planning for a new venture: the concept of planning paradigm, Forms of business enterprises-Sole proprietorship, partnership and corporations, Product and Process development, Marketing analysis and competitive analysis, strategies; Financial resources; debt financing, banks and financial institutions and other non-bank financial sources; Government programmes : direct loan assistance and subsidies; Industrial and legal issues for rural enterprises

| UNIT VI | CASE STUDIES AND FIELD VISIT | 7 Hrs |
|---------|------------------------------|-------|

Role of Micro-Finance institutions in rural development, Use of ICT in Rural development, Watershed Management - Water-Cup Competition by Paani Foundation, Community Safe Water Solutions, Visit to a 'Woman Self help group' nearby and study of its functioning and its role in development. Visit to model villages in nearby region - Ralegan-Siddhi, Dist - Ahemadnagar, Hiware Bazar Dist - Ahemadnagar, Tikekarwadi - Dist. - Pune, Buchekarwadi Dist- Pune etc.

## Text Books

1. "Rural Development: Principles, Policies and Management" - Katar Singh , Sage Publications
2. "Introduction to Community Development - Theory, Practice and Service Learning", Edited by J W Robinson, Sage Publications
3. G. N. Tiwari, Solar Energy: Fundamentals, Design, Modeling and Applications, Narosa, 2002.
4. "Fundamentals of Entrepreneurship", H. Nandan, Third Edition, PHL Learning Pvt. Ltd.,
5. "Monetary Economics-Institutions, Theory and Policy" , First Edition, S B Gupta, S Chand Publications, ISBN - 9788121904346

## Reference Books

1. "KURUKSHETRA" - A Journal on Rural Development
2. "Energy conversion" , R. Y. Goswami, Frank Kreith, CRC Press, 2007.
3. "Solar Energy: Fundamental and Application" , H. P. Garg and S. Prakash,Tata McGraw Hill, 1997.
4. "Technologies for Sustainable Rural Development: Having Potential of Socio Economic Upliftment" , TSRD 2014 , edited by Jai Prakash Shukla, Allied Publishers Pvt. Ltd.

| Savitribai Phule Pune University<br>Fourth Year of Information Technology Engineering (2015 Course)<br>414465B: Elective IV<br>Parallel Computing |
|---|

| Teaching Scheme:<br>TH:03 Hours/Week | Credits:03 | Examination Scheme: |
|---|---|---|
| | | In-Sem (Paper): 30 Marks<br>End-Sem (paper): 70 Marks |

**Prerequisites Courses :** System Programming, Operating System

**Course Objectives :**
1. Understand theories and practices in parallel computing
2. Learning hardware concepts and various languages used in parallel computing
3. Understand different challenges in parallel computing.

**Course Outcomes :**
By the end of the course, students should be able to
1. understand fundamentals in parallel computing
2. understand and learn importance of technologies including different hardware structures used in parallel computing
3. understand challenges and opportunities in parallel computing

| UNIT I | FUNDAMENTALS OF PARALLEL COMPUTING | 7 Hrs |
|---|---|---|

Need for Parallel Computing, Different Parallel Computer Models, ILP, TLP and Data Parallelism, Parallel Programming Overview, Shared Memory Programming, Message Passing Paradigm, Interaction and Communication, Interconnection Networks

| UNIT II | PARALLEL HARDWARE AND LANGUAGES | 7 Hrs |
|---|---|---|

Introduction to parallel hardware: Multi-cores and multiprocessors; shared memory and message passing architectures; cache hierarchy and coherence; sequential consistency, Parallel languages and compilers: Language features for parallelism, parallel language constructs, optimizing compilers for parallelism, dependency analysis, code optimization and scheduling, loop parallelization and pipelining

| UNIT III | CHALLENGES OF PARALLEL PROGRAMMING | 7 Hrs |
|---|---|---|

Identifying Potential Parallelism , Techniques for Parallelizing Programs , Issues , Cache Coherence issues, Memory Consistency Models, Maintaining Memory Consistency, Synchronization Issues , Performance Considerations.

| UNIT IV | OPENMP PROGRAMMING | 7 Hrs |
|---|---|---|

OpenMP Execution Model, Memory Model and Consistency , Open MP Directives , Run Time Library Routines , Handling Data and Functional Parallelism

| UNIT V | MPI PROGRAMMING AND PROGRAMMING HETEROGENEOUS PROCESSORS | 7 Hrs |
|---|---|---|

The MPI Programming Model, Global Operations, Asynchronous Communication , Collective Communication , Other MPI Features ,Performance Issues , Combining OpenMP and MPI, GPU Architecture

| UNIT VI | GPU PROGRAMMING | 7 Hrs |
|---|---|---|

Introduction to GPU programming: GPU architecture; Introduction to CUDA programming, CUDA Threads and Memories, Concept of SIMD and SIMT computation; Thread blocks; Warps; Global memory; Shared memory; Thread divergence in control transfer; Example case studies,  CUDA Threads and Memories , Application Development. Introduction to OpenCL

### Text Books

1. John L. Hennessey and David A. Patterson, "Computer Architecture , A quantitative approach", Morgan Kaufmann / Elsevier Publishers, 5th. Edition, 2012.

2. Peter S. Pacheco, "An Introduction to Parallel Programming", Morgan Kaufmann, 2011.

3. Michael J Quinn, "Parallel programming in C with MPI and OpenMP", Tata McGraw Hill, 2003.

4. David B. Kirk and Wen,mei W. Hwu, "Programming Massively Parallel Processors", Morgan Kaufmann, 2010.

5. David Culler: Parallel Computer Architecture: A Hardware/Software Approach, Morgan Kaufmann.

6. Jack Dongarra et al., Sourcebook of Parallel Computing, Morgan Kaufman Publishers, San Francisco, CA, 2003

### Reference Books

1 Ananth Grama, George Karypis, Vipin Kumar and Anshul Gupta, "Introduction to Parallel Computing", Second Edition, Pearson Education Limited, 2003.

2. Shameem Akhter and Jason Roberts, "Multi,core Programming", Intel Press, 2006.

3. Ian Foster, "Designing and Building Parallel Programs: Concepts and Tools for Parallel Software Engineering", Addison Wesley Longman Publishing Co., USA, 1995.

4. David E. Culler, Jaswinder Pal Singh, "Parallel Computing Architecture: A hardware Software approach" , Morgan Kaufmann / Elsevier Publishers, 1999.

## Savitribai Phule Pune University
## Fourth Year of Information Technology Engineering (2015 Course)
## 414464C: Elective IV
## Computer Vision

| Teaching Scheme:<br>TH:03 Hours/Week | Credits:03 | Examination Scheme: |
|---|---|---|
| | | In-Sem (Paper): 30 Marks<br>End-Sem (paper): 70 Marks |

**Prerequisites Courses :**
1. Students should know vectors, linear algebra (i.e., matrix operations, solution of linear equations),
2. Programming language (e.g., Matlab and/or C)

**Course Objectives :**
1. To review image processing techniques for computer vision
2. To understand shape and region analysis
3. To understand three-dimensional image analysis techniques
4. To understand Object detection and tracking
5. To study some applications of computer vision algorithms

**Course Outcomes :**
By the end of the course, students should be able to
1. To implement fundamental image processing techniques required for computer vision
2. To implement boundary tracking techniques
3. To apply Hough Transform for line, circle, and ellipse detections
4. To implement motion related techniques
5. to develop skills to develop applications using computer vision techniques

| UNIT I | FUNDAMENTALS OF DIGITAL IMAGE PROCESSING | 7 Hrs |
|---|---|---|

Review of image processing techniques , classical filtering operations ,Thresholding techniques, edge detection techniques, corner and interest point detection , mathematical morphology and textures.

| UNIT II | SHAPES AND REGIONS | 7 Hrs |
|---|---|---|

Binary shape analysis – connectedness – object labeling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments

| UNIT III | HOUGH TRANSFORM | 7 Hrs |
|---|---|---|

Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line

localization – line fitting – RANSAC for straight line detection – HT based circular object detection – accurate center location – speed problem – ellipse detection –

Applications and case study: Human Iris location – hole detection – generalized Hough Transform – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation

| UNIT IV | 3D VISION AND MOTION | 7 Hrs |
|---------|----------------------|-------|

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline based motion – optical flow – layered motion

| UNIT V | OBJECT DETECTION AND TRACKING | 7 Hrs |
|--------|-------------------------------|-------|

Introduction to Motion Detection , Applications of Motion Detection and Tracking, Background Subtraction (BGS), Basic BGS Algorithms, Mixture of Gaussians (MoG), Block matching for object tracking. Single object and multi-object tracking

| UNIT VI | COMPUTER VISION APPLICATIONS | 7 Hrs |
|---------|------------------------------|-------|

Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians

**Text Books**

1. Simon J. D. Prince, "Computer Vision: Models, Learning, and Inference", Cambridge University Press, 2012.

**Reference Books**

2. E. R. Davies, "Computer & Machine Vision", Fourth Edition, Academic Press, 2012.
3. R. Szeliski, "Computer Vision: Algorithms and Applications", Springer 2011.
4. Mark Nixon and Alberto S. Aquado, "Feature Extraction & Image Processing for Computer Vision", Third Edition, Academic Press, 2012.
5. D. L. Baggio et al., "Mastering OpenCV with Practical Computer Vision Projects", Packt Publishing, 2012.
6. Jan Erik Solem, "Programming Computer Vision with Python: Tools and algorithms for analyzing images", O'Reilly Media, 2012.
7. Sudha Challa, " Fundamentals of Object Tracking", Cambridge University Press, 2011

**ONLINE REFERENCES**

http://kercd.free.fr/linksKCD.html

http://www.cs.ubc.ca/spider/lowe/vision.html

http://www.teiath.gr/seyp/optics/Vision.htm

http://www.visionscience.com/

## Savitribai Phule Pune University
## Fourth Year of Information Technology Engineering (2015 Course)
## 414464D: Elective IV
## Social Media Analytics

| Teaching Scheme:<br>TH:03 Hours/Week | Credits:03 | Examination Scheme:<br>In-Sem (Paper): 30 Marks<br>End-Sem (paper): 70 Marks |
| --- | --- | --- |

**Prerequisites Courses :**
1. Basic knowledge of Graphs, Data mining
2. Data Analysis

**Course Objectives :**
1. To understand foundations of Social Media Analytics
2. To Visualize and understand the data mining aspects in social networks
3. To solve mining problems by different algorithms
4. To understand network measures for social data.
5. To understand behavioral part of web applications for Analysis
6. To analyze the data available on any social media applications

**Course Outcomes :**
By the end of the course, students should be able to
1. Understand the basics of Social Media Analytics
2. Explain the significance of Data mining in Social media
3. Demonstrate the algorithms used for text mining
4. Apply network measures for social media data
5. Explain Behavior Analytics techniques used for social media data
6. Apply social media analytics for Face book and Twitter kind of applications

| UNIT I | ANALYTICS IN SOCIAL MEDIA AND TYPES OF ANALYTICS TOOLS | 7 Hrs |
| --- | --- | --- |

The foundation for analytics, Social media data sources, Defining social media data, data sources in social media channels, Estimated Data sources and Factual Data Sources, Public and Private data, data gathering in social media analytics

| UNIT II | VISUALIZING SOCIAL NETWORKS | 7 Hrs |
| --- | --- | --- |

Introduction, A Taxonomy of Visualization, The convergence of Visualization, Interaction and Analytics. Data mining in Social Media: Introduction, Motivations for Data mining in Social Media, Data mining methods for Social Media, Related Efforts.

| UNIT III | TEXT MINING IN SOCIAL NETWORKS | 7 Hrs |
| --- | --- | --- |

Introduction, Keyword search, Classification Algorithms, Clustering Algorithms-Greedy Clustering, Hierarchical clustering, k-means clustering, Transfer Learning in heterogeneous Networks, Sampling of online social networks, Comparison of different algorithms used for mining, tools for text mining

| UNIT IV | NETWORK MEASURES | 7 Hrs |
|---|---|---|

Centrality: Degree Centrality , Eigenvector Centrality, Katz Centrality , PageRank, Betweenness Centrality, Closeness Centrality ,Group Centrality ,Transitivity and Reciprocity, Balance and Status, Similarity: Structural Equivalence, Regular Equivalence

| UNIT V | BEHAVIOR ANALYTICS | 7 Hrs |
|---|---|---|

Individual Behavior: Individual Behavior Analysis, Individual Behavior Modeling, Individual Behavior Prediction

Collective Behavior: Collective Behavior Analysis, Collective Behavior Modeling, Collective Behavior Prediction

| UNIT VI | CASE STUDY | 7 Hrs |
|---|---|---|

Mining Twitter:

Overview, Exploring Twitter's API, Analyzing 140 Characters

Mining Facebook:

Overview, Exploring Facebook's Social Graph API's, Analyzing Social Graph Connections.

| Text Books |
|---|

Reza Zafarani Mohammad Ali Abbasi Huan Liu, Social Media Mining, Cambridge University Press, ISBN:10: 1107018854

Charu C. Aggarwal, Social Network Data Analytics, Springer, ISBN: 978-1-4419-8461-6

| Reference Books |
|---|

Marshall Sponder, Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics, McGraw Hill Education, 978-0-07-176829-0,

Matthew A. Russell, Mining the Social Web, O'Reilly, 2nd Edition, ISBN:10: 1449367615

Jiawei Han University of Illinois at Urbana-Champaign Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann, 2nd Edition, ISBN: 13: 978-1-55860-901-3 ISBN: 10: 1-55860-901-6

Bing Liu, Web Data Mining : Exploring Hyperlinks, Contents and Usage Data, Springer, 2nd Edition, ISBN: 978-3-642-19459-7

**Savitribai Phule Pune University**

**Fourth Year of Information Technology Engineering (2015 Course)**

**414465E: Elective IV**

**Open Elective**

| Teaching Scheme:<br>**TH:03 Hours/Week** | Credits:03 | Examination Scheme:<br>**In-Sem (Paper): 30 Marks**<br>**End-Sem (paper): 70 Marks** |
|---|---|---|

In this subject, a student can opt from other branch of engineering (preferably *Computer Engineering* and *Electronics & Telecommunication*). An institution may design the syllabus of a subject in consultation with a software company/industry. This syllabus should be approved by the University authorities and then students can opt for the same as an open elective.

**Savitribai Phule Pune University**

**Fourth Year of Information Technology Engineering (2015 Course)**

**414466: COMPUTER LABORATORY-IX**

| Teaching Scheme:<br>Practical:04 Hours/Week | Credits:02 | Examination Scheme:<br>TW:50Marks<br>PR: 50Marks |
|---|---|---|

**Prerequisites:**
1. Operating Systems
2. Computer Network Technology

**Course Objectives :**
1. The course aims to provide an understanding of the principles on which the distributed systems are based; their architecture, algorithms and how they meet the demands of Distributed applications.
2. The course covers the building blocks for a study related to the design and the implementation of distributed systems and applications.

**Course Outcomes :**
Upon successful completion of this course student will be able to:
1. Demonstrate knowledge of the core concepts and techniques in distributed systems.
2. Learn how to apply principles of state-of-the-Art Distributed systems in practical application.
3. Design, build and test application programs on distributed systems.

**Guidelines:**
This Computer Laboratory-IX course has Distributed Systems as a core subject. The problem statements should be framed based on first six assignments mentioned in the syllabus. The teachers will frame the problem statements with due consideration that students have three hours to complete that. The practical examination will comprise of implementation and related theory. All assignments to be performed in Java 9.

| Assignment | 1 |
|---|---|

To develop any distributed application through implementing client-server communication programs based on Java Sockets and RMI techniques.

| Assignment | 2 |
|---|---|

To develop any distributed application using Message Passing Interface (MPI).

| Assignment | 3 |
|---|---|

To develop any distributed application with CORBA program using JAVA IDL.

| Assignment | 4 |
|---|---|

To develop any distributed algorithm for leader election.

| Assignment | 5 |
|---|---|

To create a simple web service and write any distributed application to consume the web service.

| Assignment | 6 |
|---|---|

To develop any distributed application using Messaging System in Publish-Subscribe paradigm.

| Assignment | 7 |
|---|---|

To develop Microservices framework based distributed application.

**Term work:**

Staff in-charge will suitably frame the above assignments and flexibility may be incorporated. Students will submit term work in the form of journal. Each assignment has to be well documented with problem definition, code documented with comments. Staff in-charge will assess the assignments continuously and grade or mark each assignment on completion date. All the assignments should be conducted on Latest version of Open Source Operating Systems, tools and Multi-core CPU supporting Virtualization and Multi-Threading.

**Reference books:**

1. George Coulouris, Jean Dollimore, Tim Kindberg & Gordon Blair,Distributed Systems –Concept and Design,Pearson,5th Edition ,ISBN:978-13-214301-1
2. Nancy Ann Lynch, Distributed Algorithms, Morgan Kaufmann Publishers, illustrated, reprint, ISBN:9781558603486

## Savitribai Phule Pune University
## Fourth Year of Information Technology Engineering (2015 Course)
## 414467: COMPUTER LABORATORY-X

| Teaching Scheme:<br>Practical:02 Hours/Week | Credits:01 | Examination Scheme:<br>TW:25Marks<br>OR: 25Marks |
|---|---|---|

**Prerequisites:**
1. Computer Network Technology
2. Human Computer Interface

**Course Objectives :**
1. To design and implement user interfaces for performing database operations
2. To design applications for accessing smart devices and data generated through sensors and services
3. To implement authentication protocols for providing security

**Course Outcomes :**
Upon successful completion of this course student will be able to:
1. set up the Android environment and explain the Evolution of cellular networks (BT-2)
2. develop the User Interfaces using  pre-built Android UI components (BT -6)
3. create applications for performing CURD SQLite database operations using  Android(BT-6)
4. create the smart android applications using the data captured through sensors (BT-6)
5. implement the authentication protocols between two mobile devices for providing security (BT-3)
6. analyze the data collected through android sensors using any machine learning algorithm (BT-4).

**Guidelines:**
This Computer Laboratory-IX course has Distributed Systems as a core subject. The problem statements should be framed based on first six assignments mentioned in the syllabus. The teachers will frame the problem statements with due consideration that students have three hours to complete that. The practical examination will comprise of implementation and related theory. All assignments to be performed in Java 9.

**Tools Required**: Android SDK / Android Studio, SQL Lite, Sensors, Ardunio kit

| Assignment | 1 |
|---|---|

Android development environment. Installing and setting up the environment.  Hello world application. Running the emulator. Inserting debug messages.

| Assignment | 2 |
|---|---|

Android UI Design: Design a User Interface using pre-built UI components such as structured layout objects, UI controls and special interfaces such as dialogs, notifications, and menus. Also make this UI attractive using Android graphics platform OpenGL

| **Assignment** | **3** |
|---|---|

Android-database Connectivity: Create a SQLite Database for an Android Application and perform CRUD (Create, Read, Update and Delete) database operations

| **Assignment** | **4** |
|---|---|

Sensors for building Smart Applications: Use any sensors on the device to add rich location and motion capabilities to your app, from GPS or network location to accelerometer, gyroscope, temperature, barometer, and more

| **Assignment** | **5** |
|---|---|

Develop a Smart Light System (Light that automatically switched on in evening and gets   off in morning) using open source Hardware platform like Arduino and some sensors (Light dependent resistor) and actuator (An LED).

| **Assignment** | **6** |
|---|---|

Design and Develop a GUI for FAN regulator that uses Android platform.

| **Assignment** | **7** |
|---|---|

Develop an Android based FAN regulator using open source Hardware platform like NodeMcu and actuator (a SERVO Motor).

| **Assignment** | **8** |
|---|---|

Android and Machine Learning: Mobile multimodal sensing- Draw inferences over the data coming from phone's sensing hardware (e.g. accelerometer, GPS, microphone), and processing these samples with the help of machine learning. (Any Application: Healthcare, Smart City, Agriculture, etc.)

| **Assignment** | **9** |
|---|---|

Android API: Implement an application that uses Android APIs like Google Map, recording and playing audio and video, using the built-in camera as an input device

| **Assignment** | **10** |
|---|---|

Wireless Network: Develop an app for a rolling display program of news on computer display. The input strings are supplied by the mobile phone/ by another computer connected through wireless networks.

| **Assignment** | **11** |
|---|---|

Android Security:  Authentication of two mobile devices

| **Assignment** | **12** |
|---|---|

Case Study : Evolution of cellular networks all the way up to 7G.

| Savitribai Phule Pune University<br>Fourth Year of Information Technology Engineering (2015 Course)<br>414468: Project Work | | |
|---|---|---|
| **Teaching Scheme:**<br>**TUT:06 Hours/Week** | **Credits:06** | **Examination Scheme:**<br>**TW:50 Marks**<br>**OR:100 Marks** |

**Prerequisites:**

1. BE-Project Phase I – Semester I
2. Project Based Seminar

**Course Objectives:**

1. The object of Project Work II & Dissertation is to enable the student to extend further the investigative study taken up under Project stage 1, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry.
2. To expose students to product development cycle using industrial experience, use of state of art technologies.
3. To encourage and expose students for participation in National/International paper presentation activities and funding agency for sponsored projects.
4. Exposure to Learning and knowledge access techniques using Conferences, Journal papers and anticipation in research activities.
5. Evaluate the various validation and verification methods
6. Analyzing professional issues, including ethical, legal and security issues, related to computing projects

**Course Outcomes:**

By the end of the course, Students will

1. learn teamwork.
2. be well aware about Implementation phase.
3. get exposure of various types of testing methods and tools.
4. understand the importance of documentation.

| Contents |
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**Review 3:**

Based on Implementation (50% implementation expected)

**Review 4:**

Complete Project and Testing

All the groups should try to  overcome all the lacunas identified by the external examiner during Project Phase I exam

The group will submit following at the end of semester II.

1. The Workable project.
2. Project report (in Latex/Lyx/latest Word) in the form of bound journal complete in all respect – 1 copy for the Institute, 1 copy for guide and 1 copy of each student in the group for

certification.

The project report contains the details.

1. Problem definition
2. Requirement specification
3. System design details (UML diagrams)
4. System implementation – code documentation – dataflow diagrams/ algorithm, protocols used.
5. Test result and procedure – test report as per ATP.
6. Conclusions.
7. Appendix
   a. Tools used
   b. References
   c. Papers published/certificates
   d. Plagiarism Report of paper and project report from any open source tool

One paper should be published in reputed International conference/International.

## Savitribai Phule Pune University
## Fourth Year of Information Technology Engineering (2015 Course)
## 414461: Audit Course-VI

In addition to credits, it is recommended that there should be audit course in preferably in each semester from second year to supplement their knowledge and skills. Student will be awarded the bachelor's degree if he/she earns credits and clears all the audit courses specified in the syllabus. The student may opt for one of the audit courses per semester, starting in second year first semester. Though not mandatory, such a selection of the audit courses helps the learner to explore the subject of interest in greater detail resulting in achieving the very objective of audit course's inclusion. List of options offered is provided. Each student has to choose one audit course from the list per semester. Evaluation of audit course will be done at institute level itself. Method of conduction and method of assessment for audit courses are suggested.

### Criteria

The student registered for audit course shall be awarded the grade PP and shall be included such grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory in-semester performance and secured a passing grade in that audit course. No grade points are associated with this 'PP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA

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

1. Lectures/ Guest Lectures
2. Visits (Social/Field) and reports
3. Demonstrations
4. Surveys
5. Mini Project
6. Hands on experience on Specific focused topic

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

1. Written Test
2. Demonstrations/ Practical Test
3. Presentations
4. IPR/Publication
5. Report

**Audit Course V Options**

| Course Code | Audit Course Title |
|---|---|
| 414469A | 1. IoT – Application in Engineering field |
| 414469B | 2. Entrepreneurship |
| 414469C | 3. Cognitive Computing |
| 414469D | 4. AI and Robotics |

## Savitribai Phule Pune University

## Fourth Year of Information Technology Engineering (2015 Course)

## 414469A: Audit Course-VI

## IoT Applications in Engineering field.

IOT as a game changer in several fields of applications and poised for phenomenal growth. This course introduces Students to IOT applications in various Engineering disciplines: Civil, Chemical, Electrical, E&TC, Mechanical and Metallurgical Engineering  This 20 hour course is aimed at covering various components involved in IOT, concepts, definitions and mainly Engineering Applications associated with IOT/IIOT.

**Course Objectives:**

1. To get the detailed insight of Internet of Things.
2. To learn the IoT terms in Engineering.
3. To understand how IoT concepts can be implement.
4. To know the protocols, Sensors and other elements for IoT implementation.

**Course Outcomes:**

By the end of the course, students should be able to,

1. Expand your knowledge of Internet of Things.
2. Discover how can you use IoT in your Engineering applications.
3. Build more effective hands on with IoT elements.
4. Expand the practical knowledge of using IoT components like sensors, processors.
5. Expand the understanding of using different protocols.

| | | |
|---|---|---|
| **Unit I** | **Basics of IOT – Difference between IOT and IIOT.** | |
| Overview of System Components of IOT. | | |
| **Unit II** | **Architecture.** | |
| Importance, Advantages & Disadvantages | | |
| **Unit III** | **Sensors, Transducers, Special requirements for IIOT sensors, Actuators, Types of Sensors, Actuators.** | |
| Sensors, Transducers, Special requirements for IIOT sensors, Actuators, Types of Sensors, Actuators. | | |
| **Unit IV** | **Protocols - HART, MODBUS-Serial & Parallel, Ethernet, BACNet** | |
| Protocols - HART, MODBUS-Serial & Parallel, Ethernet, BACNet | | |
| **Unit V** | **Introduction to IIOT Cloud  Platform   and  Security  Aspects  Importance and likely Risk Elements** | |
| Introduction to IIOT Cloud  Platform  and Security Aspects  Importance and likely Risk Elements | | |

| Unit VI | Quiz, Case Studies and Student Presentations | |

Illustrative IIOT applications in Engineering Disciplines – Civil, Chemical, Electrical, E & TC, Mechanical and Metallurgical.

**References**

1. Internet of Things (A Hands-on-Approach)  ISBN: 978-0996025515 - by ArshdeepBahga and Vijay Madisetti
2. Inside the Internet of Things (IoT), Deloitte University Press
3. Internet of Things- From Research and Innovation to Market Deployment;  By Ovidiu& Peter; River Publishers Series
4.Five thoughts from the Father of the Internet of Things; by By Phil Wainewright - Kevin Ashton, who coined the word IoT

## Savitribai Phule Pune University
### Fourth Year of Information Technology Engineering (2015 Course)
### 414469B: Audit Course-VI
### Entrepreneurship

Today Entrepreneurship & Start -Ups are Key Words. Developing Entrepreneurs & Jobs is National Requirement. Separate PPT - presentation from our EEC Group can be Guideline as Reference Though reference books are available, it is best to see - Google Search videos and films that elaborate most of these concepts. You tube is a rich source of such content on each of these topics. This module also helps students get better prepared for interviews and group discussions.

**Course Objectives:**
1. To get the detailed about Entrepreneurship.
2. To understand the abilities to become a Entrepreneur.
3. To understand how  Business Finance concepts can be implement.

**Course Outcomes:**

By the end of the course, students should be able to,
1. Expand your knowledge of Entrepreneurship & Startups.
2. Discover how you can use Entrepreneur Qualities.
3. Expand the practical knowledge of Finance, Legal-Patents, Intellectual Property, and Business Associations.
4. Expand the understanding of Deliverables & Achieving Target.

| Unit I | Introduction  To  Entrepreneurship & Favorable Environment for Startups | |
|---|---|---|
| | | |
| Unit II | Entrepreneur -  Qualities,  Strengths & Challenges - Govt. Regulations & Taxes | |
| | | |
| Unit III | Road Map  - Goal Setting & Methodology, Case Studies | |
| | | |
| Unit IV | Skill Sets Various Skills - Communication, Linguistic, Analytical & Abstract Thinking. Engineering etc. | |

**References**

Burns, Paul, 1949- author. Title: **Entrepreneurship** and small business :
Hisrich R D and Peters M P; "**Entrepreneurship**"; 5th Edition Tata **McGraw**-**Hill**.

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**Savitribai Phule Pune University**

**Fourth Year of Information Technology Engineering (2015 Course)**

**414469C: Audit Course-VI**

**Cognitive computing**

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This course explores the area of cognitive computing and its implications for today's world of big data analytics and evidence-based decision making.  Topics covered include: cognitive computing design principles, natural language processing, knowledge representation, Students will have an opportunity to build cognitive applications, as well as explore how knowledge-based artificial intelligence and deep learning are impacting the field of data science.

This course is open to students in Business Intelligence and Analytics, Information Systems, and Masters of Business Administration, or with the permission of the instructor

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**Course Objectives:**
1. To develop algorithms that use AI and machine learning along with human interaction and feedback to help humans make choices/decisions
4. To get the detailed about appealing new model for application development.
5. To understand how to evaluate patterns and complex relationships in large unstructured data sets.
6. To understand how Cognitive computing supports human reasoning by evaluating data in context and presenting relevant findings along with the evidence that justifies the answers.

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**Course Outcomes:**

By the end of the course, students should be able to,
1. Understand and discuss what cognitive computing is, and how it differs from traditional approaches.
2. Plan and use the primary tools associated with cognitive computing.
3. Plan and execute a project that leverages cognitive computing.
4. Understand and discuss the business implications of cognitive computing.

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<tr><td>**Unit I**</td><td>**Introduction to Cognitive Systems and computation, Knowledge based AI:**</td></tr>
<tr><td colspan="2">Cognitive systems, Different modes of Computing: Turning machine Lambda, Calculus, Hyper Computing, Super Computing, Pan Computing and Interactive Computing.</td></tr>
<tr><td>**Unit II**</td><td>**Cognitive Functioning:**</td></tr>
<tr><td colspan="2">Learning, Memorising, Adaptation, Self Origination, Control, Thinking, Reasoning, Decision Making & Judgement.</td></tr>
<tr><td>**Unit III**</td><td>**Mental States:**</td></tr>
<tr><td colspan="2">Belief Desire Intention (BDI) emotion and feeting. Computation of Cognitive Functioning in machines:</td></tr>
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| | |
|---|---|
| Robotics, Human Robotics Interaction, Hepatic. | |
| **Unit IV** **Perception and sensing:** | |
| Hardware machines of vision and audition with reference to human and machine. | |
| **References:** | |
| Hurwitz, Kaufman, and Bowles, Cognitive Computing and Big Data Analytics, Wiley, Indianapolis, IN, 2005, ISBN: 978-1-118-89662-4. | |

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**Savitribai Phule Pune University**

**Fourth Year of Information Technology Engineering (2015 Course)**

**414469D: Audit Course-VI**

**AI and Robotics**

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Robotics is a branch of AI, which is composed of Electrical Engineering, Mechanical Engineering, and Computer Science for designing, construction, and application of robots. The robots have mechanical construction, form, or shape designed to accomplish a particular task. They have electrical components which power and control the machinery. They contain some level of computer program that determines what, when and how a robot does something.

**Course Objectives:**

1. To get the detailed robotics and rapid development.
2. To understand the robots functions.
3. To understand how mechanical devices converting into intelligent machines through a branch of computer science called artificial intelligence (AI)

**Course Outcomes:**

By the end of the course, students should be able to,

1. The goal of this course is to familiarize the students with the basic concepts of robotics, artificial intelligence and intelligent machines.
2. It will help students to understand and apply principles, methodology and techniques of intelligent systems to robotics

| **Unit I** | **Intelligent Robotics:** | |
|---|---|---|

Automation and Robots, Robot Classification, Robot Specifications, Sensory perception, Robot control and Intelligence.

| **Unit II** | **Direct Kinematics:** | |
|---|---|---|

Coordinate Frames, Rotations, Homogeneous Coordinates, The arm Equation, (DK analysis of - 2 Axis and 3 Axis Planar robot, Four axis SCARA Robot, Five axis Articulated robot).

| **Unit III** | **Inverse Kinematics:** | |
|---|---|---|

General Properties of Solutions, Tool Configuration, (IK analysis of - 2 Axis and 3 Axis Planar robot, Four axis SCARA Robot, Five axis Articulated robot).

| **Unit IV** | **Workspace Analysis and Trajectory Planning:** | |
|---|---|---|

Workspace analysis, Work envelope of 4-axis SCARA Robot, Work envelope of 5-axis articulated Robot, Workspace Fixtures, The pick-and-place operation, Continuous-Path Motion, Interpolated Motion, Straight Line Motion.

**References:**

1. Robotics and AI", Andrew Staugaard, PHI
2. Fundamentals of Robotics- Analysis and Control", Robert Schilling, Pearson Education

3. Introduction to Robotics", J. J. Craig, Pearson Education.
4. "Robotics", Fu, Gonzales and Lee, McGraw Hill.
5. "Artificial Intelligence: Structures and Strategies for Complex Problem Solving", George F. Luger, Pearson Education.
6. "Industrial Robotics- Technology, programming, and applications", Groover, Weiss, Nagel and Odrey, McGraw Hill
7. Elaine Rich and Kevin Knight, "Artificial Intelligence", TMH