Savitribai Phule Pune University
Faculty of Science & Technology

Curriculum

For

First Year
Bachelor of Engineering
(Choice Based Credit System)

(2019 Course)

(With Effect from Academic Year 2019-20)

TABLE -1 First Engineering _Structure for Semester-I

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credits			
		Theory	Practical	Tutorial	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
107001	Engineering Mathematics-I	03	--	01	30	70	25	--	--	125	03	--	01	04
107002/ 107009	Engineering Physics / Engineering Chemistry	04	02	--	30	70	--	25	--	125	04	01	--	05
102003	Systems in Mechanical Engineering	03	02	--	30	70	--	25	--	125	03	01	--	04
103004 / 104010	Basic Electrical Engineering / Basic Electronics Engineering	03	02	--	30	70	--	25	--	125	03	01	--	04
110005/ 101011	Programming and Problem Solving / Engineering Mechanics	03	02	--	30	70	--	25	--	125	03	01	--	04
111006	Workshop[@]	--	02	--	--	--	--	25	--	25	--	01	--	01
	Total	16	10	01	150	350	25	125	--	650	16	05	01	22
101007	Audit Course 1[&]	02	Environmental Studies-I											

Induction Program : 2 weeks at the beginning of semester-I and 1 week at the beginning of semester-II

TABLE -2 First Engineering_ Structure for Semester-II

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credits			
		Theory	Practical	Tutorial	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
107008	Engineering Mathematics-II	04	--	01	30	70	25	--	--	125	04	--	01	05
107002/ 107009	Engineering Physics/ Engineering Chemistry	04	02	--	30	70	--	25	--	125	04	01	--	05
103004 / 104010	Basic Electrical Engineering / Basic Electronics Engineering	03	02	--	30	70	--	25	--	125	03	01	--	04
110005/ 101011	Programming and Problem Solving / Engineering Mechanics	03	02	--	30	70	--	25	--	125	03	01	--	04
102012	Engineering Graphics [¤]	01	02	01	--	50	25		--	75	01	01		02
110013	Project Based Learning[§]	--	04	--	--	--	25	50	--	75	--	02	--	02
	Total	15	12	02	120	330	75	125	--	650	15	05	02	22
101014	Audit Course 2[&]	02	Environmental Studies-II											
107015		--	Physical Education-Exercise and Field Activities											

Home

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214441: Discrete Mathematics

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory (TH) : 03 hrs/week Tutorial(TUT): 01 hrs/week	03 01	Mid_Semester : 30 Marks End_Semester : 70 Marks Term Work : 25 Marks

Prerequisite Courses, if any: Basic Mathematics

Companion Course, if any:

Course Objectives:

1. To gain sound knowledge to formulate and solve problems with sets and propositions.
2. To understand and solve counting problems by applying elementary counting techniques to solve problems of discrete probability.
3. To understand Graph and Tree terminologies and models to be applied in real life problems.
4. To recognize types of relation, formulate and solve problems with relations and functions.
5. To understand basics of number theory and its applications.
6. To understand the various types' algebraic structures and its applications.

Course Outcomes:

On completion of the course, students will be able to–

CO1: Formulate and apply formal proof techniques and solve the problems with logical reasoning.
CO2: Analyze and evaluate the combinatorial problems by using probability theory.
CO3: Apply the concepts of graph theory to devise mathematical models.
CO4: Analyze types of relations and functions to provide solution to computational problems.
CO5: Identify techniques of number theory and its application.
CO6: Identify fundamental algebraic structures.

COURSE CONTENTS

Unit I	Sets And Propositions	(06 hrs + 2 hrs Tutorial)

Sets: Sets, Combinations of Sets, Venn Diagram, Finite and Infinite Sets, Countable Sets, Multisets, Principle of Inclusion and Exclusion, Mathematical Induction.

Propositions: Propositions, Logical Connectives, Conditional and Bi-conditional Propositions, Logical Equivalence, Validity of Arguments by using Truth Tables, Predicates and Quantifiers, Normal forms. Applications of Sets and Propositions**.**

Mapping of Course Outcomes for Unit I	CO1

Unit II	Combinatorics And Discrete Probability	(06 hrs + 2 hrs Tutorial)

Combinatorics: Rules of Sum and Product, Permutations, Combinations.

Discrete Probability: Discrete Probability, Conditional Probability, Bayes Theorem, Information and Mutual Information, Applications of Combinatorics and Discrete Probability.

Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**Graph Theory**	**(06 hrs + 2hrs Tutorial)**
Graphs: Basic Terminologies, Multi-Graphs, Weighted Graphs, Sub Graphs, Isomorphic graphs, Complete Graphs, Regular Graphs, Bipartite Graphs, Operations on Graphs, Paths, Circuits, Hamiltonian and Eulerian graphs, Travelling Salesman Problem, Factors of Graphs, Planar Graphs, Graph Colouring. **Trees:** Tree Terminologies, Rooted Trees, Path Length in Rooted Trees, Prefix Codes, Spanning Trees, Fundamental Cut Sets and Circuits, Max flow –Min Cut Theorem (Transport Network). Applications of Graph Theory.		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Relations And Functions**	**(06 hrs + 2hrs Tutorial)**
Relations: Properties of Binary Relations, Closure of Relations, Warshall'sAlgorithm, Equivalence Relations, Partitions, Partial Ordering Relations, Lattices, Chains and Anti Chains. **Functions:** Functions, Composition of Functions, Invertible Functions, Pigeonhole Principle, Discrete Numeric Functions. **Recurrence Relations:** Recurrence Relation, Linear Recurrence Relations with Constant Coefficients, Total Solutions, Applications of Relations and Functions.		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**Introduction To Number Theory**	**(06 hrs + 2hrs Tutorial)**
Divisibility of Integers: Properties of Divisibility, Division Algorithm, Greatest Common Divisor GCD and its Properties, Euclidean Algorithm, Extended Euclidean Algorithm, Prime Factorization Theorem, Congruence Relation, Modular Arithmetic, Euler Phi Function, Euler's Theorem, Fermat's Little Theorem, Additive and Multiplicative Inverses, Chinese Remainder Theorem.		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**Algebraic Structures**	**(06 hrs + 2hrs Tutorial)**
Algebraic Structures: Introduction Semigroup, Monoid, Group, Abelian Group, Permutation Groups, Cosets, Normal Subgroup, Codes and Group Codes, Ring, Integral Domain, Field. Applications of Algebraic Structures.		
Mapping of Course Outcomes for Unit VI	**CO6**	
Text Books:		
1. C. L. Liu and D. P. Mohapatra, "Elements of Discrete Mathematics", 4th Edition, McGraw-Hill 2. Kenneth H. Rosen, "Discrete Mathematics and its Applications", & 7th edition, McGraw-Hill		

Reference Books:
1. Bernard Kolman, Robert C. Busby, Sharon Cutler Ross, "Discrete mathematical structures", 6th edition, Prentice Hall of India
2. Edgar G. Goodaire, Michael M. Parmenter, "Discrete Mathematics with Graph Theory", 3rd Edition, Pearson Education
3. Tremblay J. S., "Discrete mathematical structures with application", 3rdEdition, Tata McGraw Hill
4. Lipschutz Seymour, "Discrete mathematics", 4th Edition, Tata McGraw-Hill
5. Johnsonbaugh Richard, "Discrete Mathematics", 7th edition, Pearson
6. Biggs Norman L, "Discrete mathematics", 6th edition, Oxford
7. David M. Burton, "Elementary Number Theory", &7th Edition, McGraw-Hill

Guidelines for Tutorial and Term Work

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

Examples on various topics of respective unit must be explained and discussed will be covered in tutorial sessions based on following:

1. **Problems for deep understanding of concepts.**
2. **Identify applications and device mathematical models for real time problems.**

Sr. No.	Name of the Tutorial	Description	Applicable CO
1	Introduction to Set Theory	Formulate problems to illustrate 1. Sets, universal sets, multisets, and operations on sets such as union, intersection, complement and set difference. 2. Introduce sets as mathematical model to classify data sets.	**CO1**
2	Propositional Logic	Formulate problems that comprises 1. Translation of English sentences into logical propositions by using logical connectives. 2. Proof for logical equivalences by using truth table analysis. 3. Propositions by using Predicates and Quantifiers. 4. Conjunctive and Disjunctive Normal Forms. 5. 5. Proof by using Mathematical Induction	**CO1**
3	Combinatorics	Design problems to illustrate counting techniques by using 1. Permutation and Combinations 2. Permutation with repetition	**CO2**

Sr. No.	Name of the Tutorial	Description	Applicable CO
		3. Properties of *nCr and nPr* 4. Addition and Multiplication Principle	
4	Discrete Probability	Formulate problems for better understanding of 1. Discrete Probability 2. Conditional Probability and Bay's theorem Identify applications of probability to Computer Science	**CO2**
5	Graph Theory	Design problems to study 1. Graph properties and operations on graphs 2. Connectedness, Hamiltonian and Eulerian graphs. 3. Introduce graph as a mathematical model to understand transport, communication, and social networks.	**CO3**
6	Tree	Problems to be formulated on 1. Prefix codes, Huffman codes 2. Fundamental cut sets and Fundamental circuits 3. Transport network by using Maximum Flow Minimum cut Theorem 4. Identify applications of tree for Searching Algorithms, Polish notation	**CO3**
7	Relations and Functions	Problems to understand 1. Types of Relations 2. Equivalence relation and Equivalence classes 3. Transitive closure by using Warshall's Algorithm. 4. Injective, Surjective and Bijective Functions. 5. Pigeonhole principle and its applications	**CO4**
8	Recurrence Relation	Problems based on 1. Formation of recurrence relation 2. Solving homogeneous recurrence relation with constant coefficients 3. Solving non-homogeneous recurrence relations to find total solution. 4. Identify applications of recurrence relation in counting.	**CO4**
9	Introduction to Number Theory	Problems to illustrate concepts such as- 1. Divisibility and its properties 2. Greatest common divisor and its properties 3. Prime numbers and prime factorization theorem to find GCD and LCM of two numbers	**CO5**
10	Modular Arithmetic	Problems to demonstrate applications of- 1. Euler's theorem and Fermat's theorem in counting remainders 2. Linear congruences 3. Chinese Remainder Theorem 4. Applications of Modular arithmetic to Cryptography and Security	**CO5**

Sr. No.	Name of the Tutorial	Description	Applicable CO
11	Algebraic Structures-I	Problems to be formulated to illustrate 1. Concept of algebraic structure 2. Examples of semigroup, monoid, group and abelian group 3. Generating group codes by using normal subgroups 4. Application of Algebraic Structure in operator overloading.	**CO6**
12	Algebraic Structures-II	Problems to illustrate 1. Definition and examples of Ring, types of Ring 2. Zero divisors and Integral domain 3. Multiplicative inverses in different rings, and Field 4. Identify Applications of Ring and Field in Coding Theory	**CO6**

* Subject Teacher can design different tasks to students as well can accept the student ideas within the above stated guidelines.

Case Study

Sr. No.	Unit	Case Study	Description	Applicable CO
1	Unit-I	Apply rules of logic to explain Barber's paradox, The Lair's paradox	i. Discuss logical paradoxes like, Jourdain's card paradox, Barber's paradox, The Lair's paradox etc. by using rules of mathematical logic. Explain how these paradoxes are resolved ii. Describe the limitations of classical logic and how fuzzy logic is applied to practical applications	**CO1**
2	Unit-II	Demonstrate counting techniques to form telephone numbering plan.	**i.** Discuss ways in which telephone numbering plan can be extended to accommodate the rapid demand for more telephone numbers, for each numbering plan find how different telephone numbers can be formed.	**CO2**
3	Unit-III	Model a social network group as a connected graph and study simple properties of graphs	**i.** Investigate the properties of web graph, analyze web graphs by correlating the graph theoretic concepts with properties of web graph **ii.** Construct a social network graph, for example graph for Whats-App group	**CO3**

Sr. No.	Unit	Case Study	Description	Applicable CO
			of your friends. Study the properties of social network graph **iii.** Define and analyze AVL-tree, Quad-tree. Describe heaps, how heap can be built by using tree. Identify practical applications of these special trees	
4	Unit-IV	Demonstrate the correlation of the concept of relations with the relational database	**i.**Describe basic principles of relational databases. Find the correlation between relational databases and relations that you have studied. **ii.**Describe the importance of fuzzy relations in smart applications **iii.**Built input-output models by using function for simple machines.	**CO4**
5	Unit-V	Generate a public key cryptosystem with small primes*p, q* for a set of alphabets.	**i.**Apply the number theoretic concepts to generate public keys and private keys for public key cryptography **ii.** Find the day of the week for any given date by using congruence relation.	**CO5**
6	Unit-VI	Demonstrate the application of group properties in generating group codes.	**i.**Correlate the properties of binary operation with operator overloading. **ii.**Identify applications of encoding-decoding functions in satellite communication.	**CO6**

Home

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214442:Logic Design & Computer Organization

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory(TH) :03hrs/week	3	Mid_Semester: 30 Marks End_Semester: 70 Marks

Prerequisite Courses, if any: Basics of electronics engineering

Companion Course, if any:

Course Objectives:

1. To make undergraduates, aware of different levels of abstraction of computer systems from hardware perspective.
2. To make undergraduates, understand the functions, characteristics of various components of Computer& in particular processor & memory.

Course Outcomes:

On completion of the course, students will be able to–

CO1: Perform basic binary arithmetic & simplify logic expressions.

CO2: Grasp the operations of logic ICs and Implement combinational logic functions using ICs.

CO3: Comprehend the operations of basic memory cell types and Implement sequential logic functions using ICs.

CO4: Elucidate the functions & organization of various blocks of CPU.

CO5: Understand CPU instruction characteristics, enhancement features of CPU.

CO6: Describe an assortment of memory types (with their characteristics) used in computer systems and basic principle of interfacing input, output devices.

COURSE CONTENTS

Mapping of Course Outcomes for Unit I	CO1	
Unit 1	**Introduction To Digital Electronics**	**06 hrs**

Digital Logic families: Digital IC Characteristics; **TTL:** Standard TTL characteristics, Operation of TTL NAND gate; **CMOS:** Standard CMOS characteristics, operation of CMOS NAND gate; Comparison of TTL & CMOS.

Signed Binary number representation and Arithmetic: Sign Magnitude, 1's complement & 2's complement representation, unsigned Binary arithmetic (addition, subtraction, multiplication, and division), subtraction using 2's complement; IEEE Standard 754 Floating point number representations.

Codes: Binary , BCD, octal , hexadecimal , Excess-3 , Gray code & their conversions

Logic minimization: Representation of logic functions: logic statement, truth table, SOP form, POS form; Simplification of logical functions using K-Maps up to 4 variables.

Case Study:1) CMOS 4000 series ICs 2) practical applications of various codes in computers 3) four basic arithmetic operations using floating point numbers in a calculator.		
Mapping of Course Outcomes for Unit I	**CO1**	
Unit 2	**Combinational Logic Design**	**06 hrs**

Design using SSI chips: Code converters, Half- Adder, Full Adder, Half Subtractor, Full Subtractor, n bit Binary adder.

Introduction to MSI chips: Multiplexer (IC 74153), Demultiplexer (IC 74138), Decoder (74238) Encoder (IC 74147), Binary adder (IC 7483)

Design using MSI chips: BCD adder & subtractor using IC 7483, Implementation of logic functions using IC 74153 & 74138.

Case Study : Use of combinational logic design in 7 segment display interface		
Mapping of Course Outcomes for Unit II	**CO2**	
Unit 3	**Sequential Logic Design**	**06 hrs**

Introduction to sequential circuits: Difference between combinational circuits and sequential circuits; Memory element-latch & Flip-Flop**.**

Flip- Flops: Logic diagram, truth table & excitation table of SR, JK, D, T flip flops; Conversion from one FF to another , Study of flip flops with regard to asynchronous and synchronous, Preset & Clear, Master Slave configuration ; Study of 7474, 7476 flip flop ICs.

Application of flip-flops: Counters- asynchronous, synchronous and modulo n counters, study of 7490 modulus n counter ICs & their applications to implement mod counters; Registers- shift register types (SISO, SIPO, PISO &PIPO)& applications.

Case Study : Use of sequential logic design in a simple traffic light controller		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit 4	**Computer Organization &Processor**	**06 hrs**

Computer organization & computer architecture, organization, functions & types of computer units- CPU(typical organization ,Functions , Types), Memory (Types & their uses in computer), IO(types & functions) & system bus(Address, data & control , Typical control lines, Multiple-Bus Hierarchies); Von Neumann & Harvard architecture; Instruction cycle

Processor: Single bus organization of CPU; ALU(ALU signals, functions & types); Register (types & functions of user visible, control & status registers such as general purpose, address registers, data registers, flags, PC, MAR, MBR, IR)& control unit (control signals & typical organization of hard wired & microprogrammed CU).

Micro Operations (fetch, indirect, execute, interrupt) and control signals for these micro operations.

Case Study : 8086 processor , PCI bus

Mapping of Course Outcomes for Unit IV	**CO4**	
Unit 5	**Processor Instructions &Processor Enhancements**	**06 hrs**

Instruction : elements of machine instruction ; instruction representation (Opcode& mnemonics, Assembly language elements) ; Instruction Format & 0-1-2-3 address formats, Types of operands

Addressing modes; Instruction types based on operations (functions & examples of each); key characteristics of RISC& CISC; Interrupt: its purpose, types , classes & interrupt handling (ISR , multiple interrupts), exceptions; instruction pipelining(operation & speed up)

Multiprocessor systems: Taxonomy of Parallel Processor Architectures, two types of MIMD clusters & SMP (organization & benefits) & multicore processor (various Alternatives & advantages 0f multicores), typical features of multicore intel core i7.

Case Study : 8086 Assembly language programming	
Mapping of Course Outcomes for Unit V	**CO5**

Unit 6	**Memory &Input / Output Systems**	**06 hrs**

Memory Systems: Characteristics of Memory Systems, Memory Hierarchy, signals to connect memory to processor, memory read & write cycle, characteristics of semiconductor memory: SRAM, DRAM &ROM, Cache **Memory –** Principle of Locality, Organization, Mapping functions, write policies, Replacement policies, Multilevel Caches, Cache Coherence,

Input / Output Systems: I/O Module, Programmed I/O, Interrupt Driven I/O, Direct Memory Access (DMA).

Case Study : USB flash drive	
Mapping of Course Outcomes for Unit VI	**CO6**

Text Books:

1. "Modern Digital Electronics", R.P. Jain, Tata McGraw-Hill, Third Edition
2. "Computer organization and architecture, designing for performance" by William Stallings , Prentice Hall ,Eighth edition

Reference Books:

1. "Digital Design", M Morris Mano, Prentice Hall, Third Edition
2. "Computer organization" , Hamacher and Zaky, Fifth Edition
3. "Computer Organization and Design: The Hardware Software Interface" D. Patterson, J. Hennessy, Fourth Edition, Morgan Kaufmann
4. " Microprocessors and interfacing-programming and hardware" Douglas V. Hall and SSSP Rao, McGraw-Hill ,Third Edition

Home

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214443:Data Structure & Algorithms

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory(TH):03hrs/week	03	Mid_Semester: 30 Marks End_Semester: 70 Marks

Prerequisite Courses, if any: Fundamental knowledge of programming language and basics of algorithms

Companion Course, if any: Discrete Structures/Discrete Mathematics

Course Objectives:

1. To study data structures and their implementations and applications.
2. To learn different searching and sorting techniques.
3. To study some advanced data structures such as trees, graphs and tables.
4. To learn different file organizations.
5. To learn algorithm development and analysis of algorithms.

Course Outcomes:

On completion of the course, students will be able to–

CO1: Perform basic analysis of algorithms with respect to time and space complexity.
CO2: Select appropriate searching and/or sorting techniques in the application development.
CO3: Implement abstract data type (ADT) and data structures for given application.
CO4: Design algorithms based on techniques like brute -force, divide and conquer, greedy, etc.
CO5: Apply implement learned algorithm design techniques and data structures to solve problems.
CO6: Design different hashing functions and use files organizations.

COURSE CONTENTS

Unit- I	Introduction	07hrs

Introduction to Data Structures: Concept of data, Data object, Data structure, Concept of Primitive and non-primitive, linear and Nonlinear, static and dynamic, persistent and ephemeral data structures, Definition of ADT

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,

Sequential Organization: Single and multidimensional array and address calculation.

Linked Organization: Concept of linked organization, Singly Linked List, Doubly Linked List, Circular Linked List (Operations: Create, Display, Search, Insert, Delete).

Case Study	**Set Operation, String Operation**
Mapping of Course Outcomes for Unit I	**CO1, CO3, CO5**

Unit- II	Searching and Sorting	06 hrs

Searching and sorting: Need of searching and sorting, Concept of internal and external sorting, sort stability, Searching methods: Linear and binary search algorithms, Fibonacci Series.

Sorting methods: Bubble, insertion, Quick, Merge, shell and comparison of all sorting methods. Analyze Insertion sort, Quick Sort, binary search, hashing for Best, Worst and Average case.

Case Study	**Study and Analyze Selection sort, bucket sort,radix sort.**	
Mapping of Course Outcomes for Unit II	**CO1, CO2, CO4, CO5**	
Unit- III	**Stack &Queue**	**06 hrs**
Stack: Concept of stack, Concept of implicit and explicit stack, stack as an ADT using sequential and linked organization, Applications of stack: recursion, converting expressions from infix to postfix or prefix form, evaluating postfix or prefix form. **Queue:** Concept of queues as ADT, Implementation of queue using array and linked organization, Concept of circular queue, double ended queue, Applications of queue: priority queue.		
Case Study	**Reversing a string, balanced parentheses in algebraic expressions, Towers of Hanoi problem, double ended queue as Stack and Queue.**	
Mapping of Course Outcomes for Unit III	**CO1, CO3, CO4,CO5**	
Unit- IV	**Trees**	**06 hrs**
Tree : Trees and binary trees-concept and terminology, Expression tree, Binary tree as an ADT, , Binary search tree, Recursive and Non recursive algorithms for binary tree traversals ,Binary search tree as ADT(Insert Search Delete, level wise Display) **Threaded binary tree:** Concept of threaded binary tree (inorder, preorder and postorder). Preorder and In-order traversals of in-order threaded binary tree, Applications of trees.		
Case Study	**Construction of BST from pre and postorder traversal, Expression Tree construction**	
Mapping of Course Outcomes for Unit IV	**CO1, CO2, CO3, CO5**	
Unit- V	**Graph and Symbol Table**	**07hrs**
Graph -Concept and terminologies, Graph as an ADT, Representation of graphs using adjacency matrix and adjacency list, Breadth First Search traversal, Depth First Search traversal, Prim's and Kruskal's algorithms for minimum spanning tree, Shortest path using Dijkstra's algorithm, topological sorting. **Symbol Table -**Notion of Symbol Table, OBST, AVL Trees Heap: Heap data structure, Min and Max Heap, Heap sort, applications of heap		
Case Study	**Consider a network of computers connected to each other. The connection has various parameters associated with it as distance, propagation delay, bandwidth (capacity of carrying data), etc. Based on these parameters, decide which path should be chosen to send data from one computer to every other on the network.** **In a system, jobs are submitted for execution at different times. If the system is idle, the job is taken for executed immediately. If there is a job in execution, the newly submitted job is added to a queue. The jobs are assigned a number, which indicates tells the priority of the jobs. The system must execute the high priority jobs first for execution. Implement the above said system using heap data structure.**	
Mapping of Course Outcomes for Unit V	**CO1, CO2, CO3, CO4, CO5**	

Unit- VI	Hashing and File Organization	06 hrs
Hashing: 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 with and without replacement. **File:**Concept of File, File types and file organization (sequential, index sequential and Direct Access), Comparison of different file organizations.		
Case Study	**What are the advantages of binary tree and binary search in file handling?** **Study Hashing techniques for expandable Files(Extendible, Dynamic and Linear Hashing)**	
Mapping of Course Outcomes for Unit VI	**CO1, CO3,CO5,CO6**	

Text Books:

1. E. Horowitz, S. Sahni, D. Mehta, "Fundamentals of Data Structures in C++", Galgotia Book Source, New Delhi, 1995, ISBN 16782928
2. Y. Langsam, M. Augenstin, A. Tannenbaum, "Data Structures using C and C++", 2nd Edition, Prentice Hall of India, 2002, ISBN-81-203-1177-9.

Reference Books:

1. G. A.V, PAI , “Data Structures and Algorithms “, McGraw Hill, ISBN -13: 978-0-07-066726-6
2. A. Tharp ,"File Organization and Processing", 2008 ,Willey India edition, 9788126518685
3. M. Folk, B. Zoellick, G. Riccardi, "File Structure An Object Oriented Approach with C++", Pearson Education, 2002, ISBN 81 - 7808 - 131 - 8.
4. M. Welss, “Data Structures and Algorithm Analysis in C++", 2nd edition, Pearson Education, 2002, ISBN-81-7808-670-0

Home

Savitribai Phule Pune University
Second Year Information Technology (2019 Course)
214444: Object-Oriented Programming

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory (TH): 03hrs/Week	03	Mid_Semester: 30 Marks End_Semester: 70 Marks

Prerequisites: Principles of Programming Languages

Course Objectives:

1. Apply concepts of object-oriented paradigm.
2. Design and implement models for real life problems by using object-oriented programming.
3. Develop object-oriented programming skills.

Course Outcomes:

On completion of the course, students will be able to–

CO1: Differentiate various programming paradigms.

CO2: Identify classes, objects, methods, and handle object creation, initialization, and Destruction to model real-world problems.

CO3: Identify relationship among objects using inheritance and polymorphism principles.

CO4: Handle different types of exceptions and perform generic programming.

CO5: Use of files for persistent data storage for real world application.

CO6: Apply appropriate design patterns to provide object-oriented solutions.

COURSE CONTENTS

Unit I	Foundations of Object Oriented Programming	06 hrs

Introduction OOP : Software Evolution, 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, Static and Dynamic Binding, Message Passing.

Case Study	**Model a real world scenario (vehicle class, fruit class, student management in university etc.) using Object Oriented Paradigm**
Mapping Course Outcomes for Unit 1	**CO1**

Unit II	Classes, Objects and Methods	06 hrs

Class: Creating a Class, Visibility/Access Modifiers, Encapsulation, Methods: Adding a Method to Class, Returning a Value, Adding a Method That Takes Parameters, The 'this' Keyword, Method Overloading, Object Creation, Using Object as a Parameters, Returning Object, Array of Objects, Memory Allocation: 'new', Memory Recovery: 'delete', Static Data Members, Static Methods, Forward Declaration, Class as Abstract Data Types (ADTs), Classes as Objects.

Case Study	**Represent a vector using class and include appropriate methods to perform various tasks.**

Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**Constructors and Destructors**	**06 hrs**
Constructors: Introduction, Use of Constructor, Characteristics of Constructors, Types of Constructor, Constructor Overloading, Dynamic Initialization of an Object, Constructor with Default Arguments, Symbolic Constants, Garbage Collection: Destructors and Finalizes.		
Case Study	**A book shop inventory**	
Mapping of Course Outcomes for Unit III	**CO2**	
Unit IV	**Inheritance and Polymorphism**	**06 hrs**
Inheritance: Introduction, Need of Inheritance, Types of Inheritance, Benefits of Inheritance, Cost of Inheritance, Constructors in derived Classes, Method Overriding, Abstract Classes and Interfaces. Polymorphism and Software Reuse: Introduction, Types of Polymorphism (Compile Time and Run Time Polymorphism), Mechanisms for Software Reuse, Efficiency and Polymorphism		
Case Study	**A bank account system**	
Mapping of Course Outcomes for Unit IV	**CO3**	
Unit V	**Exception Handling and Generic Programming**	**06 hrs**
Exception: Errors, Types of Errors, Exception and its Types, Exception-Handling Fundamentals, Uncaught Exception, Using try and Catch, Multiple Catch Clauses, Nested Try Statements, User Define Exception using Throw. **Generics:** What are Generics? Introduction to Language Specific Collection Interface: List Interface and Set Interface, Collection Classes: ArrayList Class and LinkedList Class.		
Case Study	**Exception handling and generic programming using array list (ArrayList class)**	
Mapping of Course Outcomes for Unit V	**CO4**	
Unit VI	**File Handling and Design Patterns**	**06 hrs**
File Handling: Introduction, Concepts of Stream, Stream Classes, Byte Stream Classes, Character Stream, Classes, Using Stream, and Other Useful I/O Classes, Using the File Class, Input/output Exceptions, Creation of Files, Reading/Writing Character, Reading/Writing Bytes, Handling Primitive Data Types, Concatenating and Buffering Files, Random Access Files. **Design Patterns:** Introduction, Types of Design Patterns, Adapter, Singleton, Iterator		
Case Study	**Student Management System**	
Mapping of Course Outcomes for Unit VI	**CO5 and CO6**	
Text Book:		
1. An Introduction to Object Oriented Programming (3rd Ed), by Timothy A. Budd, published by Addison-Wesley,2002		

2. E. Balaguruswamy, “Object Oriented Programming Using C++ and Java”, Tata McGraw Hill

Reference Books:

1. Object-Oriented Programming and Java by Danny Poo (Author), Derek Kiong (Author), Swarnalatha Ashok (Author)Springer; 2nd ed. 2008 edition (12 October 2007), ISBN-10: 1846289629, ISBN-13: 978-1846289620,2007
2. Java The complete reference, 9th edition, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd.
3. Object-Oriented Design Using Java, Dale Skrien, McGraw-Hill Publishing, 2008, ISBN - 0077423097, 9780077423094. 4. UML for Java Programmers by Robert C. Martin, Prentice Hall, ISBN 0131428489,2003.

Home

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214445: Basics of Computer Network

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory(TH):03hrs/week	03	Mid_Semester: 30 Marks End_Semester: 70 Marks

Prerequisite Courses, if any: Basics of communication

Course Objectives:

1. To understand the fundamentals of communication system.
2. To understand the basics of internetworking.
3. To understand services and protocols used at Physical, Data Link, Network, Transport Layer.

Course Outcomes:

On completion of the course, students will be able to–

CO1: Understand and explain the concepts of communication theory and compare functions of OSI and TCP/IP model.
CO2: Analyze data link layer services, error detection and correction, linear block codes, cyclic Codes, framing and flow control protocols.
CO3: Compare different access techniques, channelization and IEEE standards.
CO4: Apply the skills of subnetting, supernetting and routing mechanisms.
CO5: Differentiate IPv4 and IPv6.
CO6: Illustrate services and protocols used at transport layer.

COURSE CONTENTS

Unit I	Data Communication and Network Models	06 hrs

Introduction to communication Theory - Basics of data communication, Types of Signals, A/D, D/A, A/A, D/D Signal Conversion Methods, Bandwidth Utilization and Data Rate Limits, Multiplexing Techniques, Data rate limits, Topologies, Noise, types of noise, Shannon Hartley Theorem, Channel capacity, Nyquist and Shannon Theorem, Bandwidth S/N trade off.

Network Models And addressing - OSI Model TCP/IP Model (Data Format, Addressing Mechanisms, Devices)

Case Study	**Study of Physical layer components such as Cable, NIC, hub, etc. available in the computers /laboratories of your department**
Mapping of Course Outcomes for Unit I	**CO1**

Unit II	Error Detection, Correction and Data Link Control	06 hrs

Data Link Layer: Data Link Layer Services, Error Detection and Correction: Introduction, Error Detection and Error Correction. Linear Block Codes: hamming code, Hamming Distance, parity check code. Cyclic Codes: CRC (Polynomials), Advantages of Cyclic Codes, Other Cyclic Codes (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 (ARQ), go-back-n ARQ, Selective repeat ARQ, piggybacking.

Case Study	**Draw PPPoE connection diagram with multiple devices, FFTH connection diagram**	
Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**Multi-Access Mechanism and Ethernet Standards**	**06 hrs**

Random Access Techniques: CSMA, CSMA/CD, CSMA/CA, Controlled Access Techniques: Reservation, Polling, Token Passing, Channelization: FDMA, TDMA, CDMA, Ethernet: IEEE Standards- 802.3, 802.4, 802.5, 802.6 Comparison of Ethernet Standards: Standard Ethernet, Fast Ethernet, Gigabit Ethernet with reference to MAC layer and Physical Layer (Wired Network Only)

Case Study	**Campus network design case study**	
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Network Layer: Services and Addressing**	**06 hrs**

Network Layer : Network Layer Services, IPv4 Addresses: Static and Dynamic Configuration Classful and Classless Addressing, Special Addresses, NAT, Subnetting, Supernetting, Delivery and Forwarding of IP Packet, Structure of Router, IPv4: Datagrams, Fragmentation, Options, Checksum, IPv6Addressing: Notations, Address Space, Packet Format, Transition from Ipv4 to IPv6

Case Study	**Visit server room of campus and understand how IP addressing is done for your respective Campus →Institute→Department**
Mapping of Course Outcomes for Unit IV	**CO4, CO5**

Unit V	**Network Layer : Routing Protocols**	**06 hrs**

Routing: Metric, Static vs Dynamic Routing Tables, Routing Protocol, Unicast Routing Protocols - Optimality Principle, Intra and Inter Domain Routing, Shortest Path Routing, Flooding, Distant Vector Routing, Link State Routing, Path Vector Routing Interior Gateway Routing Protocol- OSPF, EIGRP, RIP, Exterior Gateway Routing Protocol– BGP

Case Study	**Case study on network simulation tools such as Packet tracer**
Mapping of Course Outcomes for Unit V	**CO4**

Unit VI	**TRANSPORT LAYER - SERVICES AND PROTOCOLS**	**06 hrs**

Transport layer : Transport layer services(Duties), TCP: COTS, TCP header, Services, Segments, Connection Establishment, Flow control, Congestion Control, Congestion Control Algorithms, Leaky Bucket, Token Bucket and QoS, Timers, UDP: CLTS, UDP header, Datagram, Services, Applications, Socket: Primitives, TCP & UDP Sockets.

Case Study	**Case study on Client server model using simple socket programming,** **Case Study on Transport Layer Security - Firewall (Stateless Packet**

	Filtering), Stateful, Application
Mapping of Course Outcomes for Unit VI	**CO6**

Text Books:

1. Behrouz A. Forouzan, TCP/IP Protocol Suite, McGraw Hill Education, ISBN: 978-0-07-070652-1, 4th Edition
2. Andrew S. Tanenbaum, David J. Wethrall, Computer Network, Pearson Education, ISBN: 978-0-13-212695-3

Reference Books:

1. Kurose Ross, Computer Networking: A Top Down Approach Featuring the Internet, Pearson Education, ISBN: 978-81-7758-878-1
2. Behrouz A. Forouzan, Data Communication and Networking, McGraw Hill Education, ISBN: 978-1-25-906475-3, 5th Edition
3. Mayank Dave, Computer Network, Cengage Learning, ISBN: 978-81-315-0986-9

Home

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214446: Logic Design &Computer Organization Lab

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR) : 02hrs/week	01	PR : 25Marks TW : 25Marks

Prerequisites: Basic Electronics Engineering

Course Objectives :

1. To design & implement combinational and sequential circuits.
2. To learn simulation of digital systems.

Course Outcomes :

On completion of the course, students will be able to–

CO1: Use logic function representation for simplification with K-Maps and design Combinational logic circuits using SSI & MSI chips.

CO2: Design Sequential Logic circuits: MOD counters using synchronous counters.

CO3: Understand the basics of simulator tool & to simulate basic blocks such as ALU & memory.

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, algorithms, sample test cases, data sheets of various elements of computer system, ICs, tools 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 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 output using coding standards, sample test cases etc.)
2. Practical Examination will be based on the term work.
3. The practical examination should be conducted if the teamwork is completed, submitted by the student and is duly assessed, 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. Examiners will assess the term work based on performance of students; 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 tools software and hardware such as ICs, digital

trainer kits, IC tester& simulation software, should be checked by the faculty member.

Guidelines for Laboratory Conduction

The instructor is expected to understand the prerequisites, technological aspects, utility and recent trends related to the topic. The instructor may set multiple sets of assignments. It is appreciated if the assignments are based on real world problems/applications. Use of open source software is encouraged.

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.

List of Laboratory Assignments

Group A

Combinational Logic Design– CO1

1. Design and implement 4-bit BCD to Excess-3 code
2. Design and implement 1 digit BCD adder usingIC7483
3. Design and implement following using multiplexer IC 74153 1) full adder 2) Any three variable function (cascade method)
4. Design and implement full subtractor using decoder IC 74138

Group B

Sequential Logic Design– CO 2

1. Design and implement 3 bit Up and 3 bit Down Asynchronous Counters using master slave JK flip-flop IC 7476
2. Design and implement 3 bit Up and 3 bit Down Synchronous Counters using master slave JK flip-flop IC 7476
3. Design and implement Modulo 'N' counter using IC7490. (N= 100 max)

Group C

Computer organization– CO 3

Any **two** of following , using virtual lab simulator

1. Design& simulate single bit RAM cell **OR** 4 address*2bit memory using 8 single bit RAM cells.
2. Design& simulate single bit ALU with four functions(AND, OR, XOR, ADD).
3. Design& simulation of single instruction CPU.

Student should submit term work in the form of a journal based on the above assignments.

Note - Instructor should take care that datasheets of all the required ICs are available in the laboratory& students will be able to verify 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. Virtual Lab simulator Link **http://vlabs.iitkgp.ac.in/coa/**

Home

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214447: Data Structure & Algorithms Lab

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR) : 04 hrs/week	02	PR : 25 Marks TW: 25 Marks

Prerequisite Courses, if any: Fundamental knowledge of programming language and basics of algorithms

Course Objectives:

1. To study data structures and their implementations and applications.
2. To learn different searching and sorting techniques.
3. To study some advanced data structures such as trees, graphs and tables.
4. To learn different file organizations.
5. To learn algorithm development and analysis of algorithms.

Course Outcomes:

On completion of the course, students will be able to–

CO1: Analyze algorithms and to determine algorithm correctness and time efficiency class.

CO2: Implement abstract data type (ADT) and data structures for given application.

CO3: Design algorithms based on techniques like brute -force, divide and conquer, greedy, etc.).

CO4: Solve problems using algorithmic design techniques and data structures.

CO5: Analyze of algorithms with respect to time and space complexity.

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. Experiments to be conducted in C++.

Guidelines for Student's Lab Journal

1. The laboratory assignments are to be submitted by students in the form of journals. 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

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.

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.

List of Assignments

Virtual Laboratory

- **https://ds1-iiith.vlabs.ac.in/data-structures-1/**
- **https://ds2-iiith.vlabs.ac.in/data-structures-2/**
- **http://cse01-iiith.vlabs.ac.in/**

1. Searching and Sorting -- CO1, CO2, CO3, CO5

Consider a student database of SEIT class (at least 15 records). Database contains different fields of every student like Roll No, Name and SGPA.(array of structure)

a) Design a roll call list, arrange list of students according to roll numbers in ascending order (Use Bubble Sort)
b) Arrange list of students alphabetically. (Use Insertion sort)
c) Arrange list of students to find out first ten toppers from a class. (Use Quick sort)
d) Search students according to SGPA. If more than one student having same SGPA, then print list of all students having same SGPA.
e) Search a particular student according to name using binary search without recursion. (all the

student records having the presence of search key should be displayed)

(Note: Implement either Bubble sort or Insertion Sort.)

2. Stack -- CO1, CO2, CO3, CO5

Implement stack as an abstract data type using singly linked list and use this ADT for conversion of infix expression to postfix, prefix and evaluation of postfix and prefix expression.

3. Circular Queue -- CO1, CO2, CO3, CO5

Implement Circular Queue using Array. Perform following operations on it.

a) Insertion (Enqueue)
b) Deletion (Dequeue)
c) Display

(Note: Handle queue full condition by considering a fixed size of a queue.)

4. Expression Tree -- CO1, CO2, CO3, CO5

Construct an Expression Tree from postfix and prefix expression. Perform recursive and non-recursive In-order, pre-order and post-order traversals.

5. Binary Search Tree -- CO1, CO2, CO3, CO5

Implement binary search tree and perform following operations:

a) Insert (Handle insertion of duplicate entry)
b) Delete
c) Search
d) Display tree (Traversal)
e) Display - Depth of tree
f) Display - Mirror image
g) Create a copy
h) Display all parent nodes with their child nodes
i) Display leaf nodes
j) Display tree level wise

(Note: Insertion, Deletion, Search and Traversal are compulsory, from rest of operations, perform Any three)

6. Threaded Binary Tree -- CO1, CO2, CO3, CO5

Implement In-order Threaded Binary Tree and traverse it in In-order and Pre-order.

7. Graph: Minimum Spanning Tree -- CO1, CO2, CO3, CO5

Represent a graph of your college campus using adjacency list /adjacency matrix. Nodes should represent the various departments/institutes and links should represent the distance between them. Find minimum spanning tree

a) Using Kruskal's algorithm.
b) Using Prim's algorithm.

8. Graph: Shortest Path Algorithm -- CO1, CO2, CO3, CO5

Represent a graph of city using adjacency matrix /adjacency list. Nodes should represent the various

landmarks and links should represent the distance between them. Find the shortest path using Dijkstra's algorithm from single source to all destination.

9. Heap Sort -- CO1, CO2, CO4

Implement Heap sort to sort given set of values using max or min heap.

10. FILE Handling -- CO1, CO3, CO5

Department maintains student's database. 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 student. If record of student does not exist an appropriate message is displayed. If student record is found it should display the student details.

Text Books :

1. Richard F. Gilberg, Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach using C++", Cengage Learning, 5th Edition, ISBN 978-8131504925
2. Mark Allen Weiss, "Data structures and Algorithm Analysis in C++ ", Pearson Education India, 3 edition (2007), ISBN 978-8131714744
3. Ellis Horowitz, Sartaj Sahni, Dinesh Mehta, "Fundamentals of Data Structures in C++", University Press (2008), ISBN 978-8173716065

Reference Books

1. Hemant Jain, "Problem Solving in Data Structures & Algorithms using C++", CreateSpace Independent Publishing Platform (2017), ISBN 978-1542396479
2. G A V PAI, "DATA STRUCTURES and Algorithms Concepts, Techniques and Applications", McGraw Hill (2017), ISBN 978-0070667266
3. Michael T. Goodrich, Roberto Tamassia, David Mount, "Data Structures and Algorithms in C++ ", Wiley (2007), ISBN 978-8126512607
4. E Balagurusamy, "Object-Oriented Programming with C++", McGraw Hill Education; Seventh edition (2017), ISBN 978-9352607990

Home

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214448: Object Oriented Programming Lab

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR) : 04 hrs/week	02	PR: 25 Marks TW: 25 Marks

Prerequisites: Student should have knowledge of programming language.

Course Objectives:

1. Apply concepts of object-oriented paradigm.
2. Design and implement models for real life problems by using object-oriented programming.
3. Develop object-oriented programming skills.

Course Outcomes:

On completion of the course, students will be able to–

CO1: Differentiate various programming paradigms.
CO2: Identify classes, objects, methods, and handle object creation, initialization, and destruction to model real-world problems.
CO3: Identify relationship among objects using inheritance and polymorphism.
CO4: Handle different types of exceptions and perform generic programming.
CO5: Use file handling for real world application.
CO6: Apply appropriate design patterns to provide object-oriented solutions.

Guidelines for Instructor's Manual

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

Guidelines for Student's Lab Journal

1. The laboratory assignments are to be submitted by student in the form of journal.
2. 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- OOP feature/Concept in brief, algorithm, flowchart, test cases, conclusion/analysis.
3. Program codes with sample output of all performed assignments are to be submitted as hardcopy.
4. 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.
5. Use of DVD containing students programs maintained by lab In-charge is highly encouraged.
6. For reference one or two journals may be maintained with program prints at Laboratory.

Guidelines for Lab /TW Assessment

1. Continuous assessment of laboratory work is done based on overall performance and lab

assignments performance of student.
2. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage.
3. 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.

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 without changing its complexity level and distribute among batches of students. Encourage students for the use of industry coding standards such as appropriate use of Hungarian notation, Indentation and comments. Use of open source software is encouraged. Set of suggested assignment list is provided, instructors may take different case studies with similar complexity level. Operating System recommended :- 64-bit Open source Linux or its derivative
Programming tools recommended: - JAVA IDE

List of Assignments

1.Classes and object -- CO1 and CO2

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.

2. Polymorphism -- CO3

Identify commonalities and differences between Publication, Book and Magazine classes. Title, Price, Copies are common instance variables and saleCopy is common method. The differences are, Bookclass has author and orderCopies(). Magazine Class has methods orderQty, Current issue, receiveissue().Write a program to find how many copies of the given books are ordered and display total sale of publication.

3.Inheritance -- CO3

Design and develop inheritance for a given case study, identify objects and relationships and implement inheritance wherever applicable. Employee class hasEmp_name, Emp_id, Address,

Mail_id, and Mobile_noas members. Inherit the classes: Programmer, Team Lead, Assistant Project Manager and Project Manager from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.

4.Dynamic Binding -- CO3

Design a base class shape with two double type values and member functions to input the data and compute_area() for calculating area of shape. Derive two classes: triangle and rectangle. Make compute_area() as abstract 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. Implement dynamic binding for given case study.

5.Interface -- CO1, CO3

Design and develop a context for given case study and implement an interface for Vehicles Consider the example of vehicles like bicycle, car and bike. All Vehicles have common functionalities such as Gear Change, Speed up and apply breaks. Make an interface and put all these common functionalities. Bicycle, Bike, Car classes should be implemented for all these functionalities in their own class in their own way.

6.Exception handling -- CO4

Implement a program to handle Arithmetic exception, Array Index Out of Bounds. The user enters two numbers Num1 and Num2. The division of Num1 and Num2 is displayed. If Num1 and Num2 are not integers, the program would throw a Number Format Exception. If Num2 were zero, the program would throw an Arithmetic Exception. Display the exception.

7.Template -- CO4

Implement a generic program using any collection class to count the number of elements in a collection that have a specific property such as even numbers, odd number, prime number and palindromes.

8.File Handling -- CO5

Implement a program for maintaining a database of student records using Files.
Student has Student_id,name, Roll_no, Class, marks and address. Display the data for few students.

1. Create Database
2. Display Database
3. Delete Records
4. Update Record
5. Search Record

9.Case Study -- CO2, CO5

Using concepts of Object-Oriented programming develop solution for any one application
1) Banking system having following operations :

1. Create an account 2. Deposit money 3. Withdraw money 4. Honor daily withdrawal limit
5. Check the balance 6. Display Account information.

2) Inventory management system having following operations :
1. List of all products 2. Display individual product information 3. Purchase 4. Shipping
5. Balance stock6. Loss and Profit calculation.

10. Factory Design Pattern -- CO6

Implement Factory design pattern for the given context. Consider Car building process, which requires many steps from allocating accessories to final makeup. These steps should be written as methods and should be called while creating an instance of a specific car type. Hatchback, Sedan, SUV could be the subclasses of Car class. Car class and its subclasses, CarFactory and Test Factory Pattern should be implemented.

11. Strategy Design Pattern -- CO6

Implement and apply Strategy Design pattern for simple Shopping Cart where three payment strategies are used such as Credit Card, PayPal, Bit Coin. Create an interface for strategy pattern and give concrete implementation for payment.

Text Books:

1. E. Balagurusamy, “Programming with Java – A Primer”, Tata – McGraw-Hill Publication, 4th Edition, 2019
2. Kathy Sierra, “OCA /OCP Java SE 7 Programmer I & II Study Guide”(Exams 1Z0-803 & IZ-804) Oracle Press (2017)
3. Steven Holzner et al. “Java 2 Programming”, Black Book, Dreamtech Press, 2009

Reference Books:

1. H.M. Deitel, P.J. Deitel, “Java - How to Program”, PHI Publication, 6th Edition, 2005
2. Bruce Eckel, “Thinking in Java”, PHI Publication
3. Poo, Danny, Kiong, Derek, Ashok, Swarnalatha,“ Object-Oriented Programming and Java”, ISBN 978-1-84628-963-7
4. Erich Gamma,Richard Helm ,Ralph Johnson,JohnVlissides, “Design Patterns ,Elements of Reusable Object- Oriented Software” ISBN-13: 978-0201633610
5. RohitJoshi, “Java Design patterns, Reusable solutions to common problems” Java Code Geeks

Home

Savitribai Phule Pune University
Second Year Information Technology (2019 Course)
214449: Soft Skill Lab

Teaching Scheme:	Credit Scheme :	Examination Scheme:
Practical (PR) : 02 hrs/Week	01	TW : 25 Marks

Prerequisites , If any: ------

Course Objectives:

1. To facilitate a holistic development of students while focusing on enhancing soft skills.
2. To highlight the need to improve soft skills among engineering students so as to become good professionals.
3. To develop and nurture the soft skills of the students through individual and group activities.
4. To expose students to right attitudinal and behavioural aspects and assist in building the same through activities.

Course Outcomes:

On completion of the course, students will be able to–

CO1: Introspect about individual's goals, aspirations by evaluating one's SWOC and think creatively.

CO2: Develop effective communication skills including Listening, Reading, Writing and Speaking.

CO3: Constructively participate in group discussion, meetings and prepare and deliver Presentations.

CO4: Write precise briefs or reports and technical documents.

CO5: Practice professional etiquette, present oneself confidently and successfully handle personal interviews .

CO6: Function effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality.

COURSE CONTENTS

Unit I	Introspective & Self Development	04 hrs
Introduction to soft skills, SWOC analysis, planning career, setting short-term & long-term goals, identifying difference between jobs & career, aligning aspirations with individual skills, understanding self-esteem, developing discipline and critically evaluating oneself		
Mapping of Course Outcomes for Unit I	**CO1, CO6**	
Unit II	**Communication Skills**	**04 hrs**
Essentiality of good communication skills, importance of feedback, different types of communication, barriers in communication and how to overcome these barriers, significance of non-verbal messages as augmentation to verbal communication, group discussion, listening vs hearing, reading to comprehend, learning to skim and scan to extract relevant information, effective digital communication		
Mapping of Course Outcomes for Unit II	**CO2, CO3, CO5**	

Unit III	Language and Writing Skills	04 hrs
Fundamentals of english grammar, improve lexical resource, essential steps to improve spoken and written english, business vocabulary, writing – email, resume, formal letter, official communication, essay, presentation – planning, organizing, preparing and delivering professional presentation		
Mapping of Course Outcomes for Unit III	**CO2, CO4**	
Unit IV	**Leadership Skills and Group Dynamics**	**04 hrs**
Understanding corporate culture and leadership skills, difference between a leader and a manager, importance of resilience in a professional surrounding, developing empathy and emotional intelligence, being assertive and confident, 4-Ds of decision making, creative and solution-centric thinking, resolving conflicts, working cohesively as a team to achieve success, five qualities of an effective team – positivity, respect for others, trust, goal-focused, supportiveness		
Mapping of Course Outcomes for Unit IV	**CO1, CO5, CO6**	
Unit V	**Ethics, Professional Etiquette**	**04 hrs**
Understanding ethics and morals, importance of professional ethics, hindrances due to absence of work ethics, professional etiquette – introductions, with colleagues, attire, events, dinning, telephone, travelling, netiquette, social media, writing		
Mapping of Course Outcomes for Unit V	**CO5, CO6**	
Unit VI	**Stress And Time Management**	**04 hrs**
Stress as integral part of life, identifying signs and sources of stress, steps to cope with stress – open communication, positive thinking, belief in oneself, ability to handle failure, retrospective thinking for future learning, organizing skills to enhance time management, focusing on goals, smart work vs hard work, prioritizing activities, perils of procrastination, daily evaluation of "to-do" list.		
Mapping of Course Outcomes for Unit VI	**CO1, CO3, CO6**	

Text Book :

1. Gajendra Singh Chauhan, Sangeeta Sharma,"Soft Skills – An Integrated Approach to Maximize Personality", WILEY INDIA, ISBN:13:9788126556397

Reference Books :

1. Indrajit Bhattacharya, "An Approach to Communication Skills", Delhi, DhanpatRai, 2008
2. Simon Sweeney, "English for Business Communication", Cambridge University Press, ISBN 13:978-0521754507
3. Sanjay Kumar and Pushpa Lata, "Communication Skills", Oxford University Press, ISBN 10:9780199457069
4. Atkinson and Hilgard, "Introduction to Psychology", 14th Edition, Geoffrey Loftus, ISBN-10:0155050699, 2003
5. Kenneth G. Mcgee, "Heads Up: How to Anticipate Business Surprises & Seize Opportunities

First", Harvard Business School Press, Boston, Massachusetts, 2004, ISBN 10:1591392993
6. Krishnaswami, N. and Sriraman T., "Creative English for Communication" , Macmillan

Guidelines for Student's Lab Journal and TW Assessment

Each student should have a Lab Workbook (sample workbook attached) which outlines each lab activity conducted. The student must respond by writing out their learning outcomes and elaborating the activities performed in the lab. Continuous assessment of laboratory work is to be done based on overall performance and lab assignments and performance of student. Each lab assignment assessment will be assigned grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, punctuality, neatness, enthusiasm, participation and contribution in various activities-SWOC analysis, presentations, team activity, event management, group discussion, group exercises and interpersonal skills and similar other activities/assignments.

Guidelines for Conduction of Soft Skills Lab

The teacher may design specific assignments that can highlight the learning outcomes of each unit. Each activity conducted in the lab should begin with a brief introduction of the topic, purpose of the activity from a professional point of view and end with the learning outcomes as feedback from students. Most of the lab sessions can be designed to be inclusive; allowing students to learn skills experientially; which will benefit them in the professional environment. Every student must be given sufficient opportunity to participate in each activity and constructive feedback from the instructor / facilitator at the end of the activity should learn towards encouraging students to work on improving their skills. Activities should be designed to respect cultural, emotional and social standing of students. Some of the activities can be designed to cater to enhancement of multiple skills – For e.g. – Team Building Activity can highlight 'open communication', 'group discussion', 'respecting perspectives', 'leadership skills', 'focus on goals' which can help students improve their inherent interpersonal skills.

At least one session should be dedicated to an interactive session that will be delivered by an expert from the industry; giving the students an exposure to professional expectations.

Virtual Laboratory

- **https://ve-iitg.vlabs.ac.in/**

Recommended List of Lab Sessions

1. Introduction of Self / SWOC Analysis -- CO1, CO4

a. Explain how to introduce oneself in a professional manner and presenting oneself positively Name, Academic Profile, Achievements, Career Aspirations, Personal Information (hobbies, family, social).

b. Focus on introspection and become aware of one's Strengths, Weakness, Opportunities and Challenges.

Students can write down their SWOC in a matrix and the teacher can discuss the gist personally.

2. Career Goals and Planning -- CO1, CO4

a. Make students understand the difference between a job and a career. Elaborate steps on how to plan a career.
Students can choose a career and they should write down what skills, knowledge, steps are need

to be successful in that particular career and how they can get the right opportunity.

b. Explain to students how to plan short term and long term goals.
Think and write down their short-term goals and long terms goals. Teacher can read and discuss (provide basic counselling) about the choices written.

3. Public Speaking -- (Choose any 2) -- CO3, CO2

a. Prepared Speech
Topics will be shared with students and they will be given 10 minutes to prepare and 3 minutes to deliver followed by Q&A from audience. Teacher will evaluate each student based on content, communication skills, logical and cohesive presentation of topic, perspective of student, ability to handle questions and respond positively.

b. Extempore Speech
Various topics will be laid out in front of the audience and each student is to pick one topic and speak about the topic for 5 minutes followed by Q&A from audience. Teacher will evaluate each student based on ability to think on his/her feet, content, communication skills, logical and cohesive presentation of topic, perspective of student, ability to handle questions and respond positively.

c. Reviewing an Editorial article
Either using e-paper / printed copy, students have to select a recent editorial (that is non-controversial), read it and explain to the audience what the editor's perspective is and what the student's perspective is.

d. Book Review
Each student will orally present to the audience his/her review of a book that he/she has recently read.

4. Group Discussion -- CO3, CO2

a. The class will be divided into groups of 8 – 10 students in for a discussion lasting 10 minutes.

b. Topics should be topical and non-controversial. After each group finishes its discussion, the teacher will give critical feedback including areas of improvement. The teacher should act as a moderator / observer only

5. Listening and Reading Skills -- CO2

a. Listening Worksheets to be distributed among students
Each student will be given specifically designed worksheets that contain blanks / matching / MCQs that are designed to an audio (chosen by the faculty). Students have to listen to the audio (only once) and complete the worksheet as the audio plays. This will help reiterate active listening as well as deriving information (listening to information between the lines)

b. Reading Comprehension Worksheets to be distributed/displayed to students
Teacher will choose reading passages from non-technical domains, design worksheets with questions for students to answer. This will enhance student's reading skills by learning how to skim and scan for information.

6. Writing Skills (Choose any 2) -- CO2

a. Letter / Email Writing
After explaining to the students the highlights of effective writing, students can be asked to write (using digital platforms / paper-based) letter to an organization with the following subject matter,

i. Requesting opportunity to present his/her product.

ii. Complaining about a faulty product / service.

iii. Apologizing on behalf of one's team for the error that occurred.
iv. Providing explanation for a false accusation by a client.

b. Report Writing

After describing various formats to write report and explaining how to write a report, each student should be asked to write a report (digital/ paper-based) on any of the following topics,

i. Industrial visit.
ii. Project participated in.
iii. Business / Research Proposal.

c. Resume Writing

The teacher should conduct a brief session outlining the importance of a CV / Resume and students can write / type out their own resumes

i. Share various professional formats.
ii. Focus on highlighting individual strengths.
iii. Develop personalized professional goals / statement at the beginning of the resume.

7. Team Building Activities -- CO3, CO4

The class will be divided into groups of 4-5 students in each group and an activity will be given to each group.

The activities chosen for each team should be competitive and should involve every student in the team. The activities may be conducted indoors or outdoors depending on infrastructure. While selecting the team, ensure that each team has a mix of students who have varied skills. The teacher should give critical feedback including areas of improvement at the end of the activity.

8. Expert Lecture -- CO4

Highlighting the need to manage stress and time, experts from the fields of health and fitness, counselling, training, medical or corporate HR may be invited to deliver a participatory session that focus on helping students to cope with parental, social, peer and career pressures.

9. Lateral and Creative Thinking -- CO1, CO4

Every student needs to step out of the linear thinking and develop lateral and creative thinking. Teacher can develop creative activities in the classroom / lab that will help students enhance their creative thinking. Some of the suggested activities,

i. Each group (3-4 students) can be given random unrelated items and they will be given sufficient time to come up with creative ideas on how the objects can be used for activities / purposes other than its intended one.
ii. Each student is given a random line and he/she has to spin a fictional story and tell it to the class (3 minutes). Each story should have a beginning, middle and end.
iii. Each group (3-4 students) can be given a fictional / hypothetical dangerous situation and they have to find a solution to that problem. They can present it to the other teams who will then get the opportunity to pick flaws in the ideas.

10. Mock Interviews -- CO2, CO3

Student has to undergo interview session and the teacher should seek the assistance of another faculty member / TPO Officer/ Alumni to act as interview panel. Students will be informed beforehand about the job profile that they are appearing the interview for and they have to come prepared with a printed copy of their resume, formally dressed. Questions will include technical as well as HR. Interviewer can choose to give problems to solve using technical skills. Students will be graded on the basis of their technical knowledge, ability to answer questions well, presentation of self, body language and verbal skills.

11. Presentation Skills -- CO2, CO3
Every student will have to choose a topic of his/her choice and make a 5-minute presentation using audio-video aids / PPT. The topic can either be technical or non-technical. Focus and evaluation of each presentation should be the depth of knowledge about the topic, originality of perspective on the topic, well-researched or not, verbal and non-verbal skills and ability to answer questions effectively. Plagiarism should be discredit and students should be instructed about it.
12. Corporate and Business Etiquette -- CO4, CO1
The teacher can design an interactive session that allows students to be involved in understanding the requirements of a corporate environment. This can be done using innovative quiz competition in the classroom and the teacher explaining the concept / relevance of that particular aspect in the professional context. Alternatively, the teacher can invite professionals to have an interactive session with students about various aspects of professional etiquette.

Home

Savitribai Phule Pune University, Pune

Second Year Information Technology (2019 Course)

214450 (A): Mandatory Audit Course 3:

Ethics and Values in Information Technology

Teaching Scheme:	Credit Scheme:	Examination Scheme:
01hrs/week	Non Credit	Audit Course

Prerequisite Courses, if any:--

Course Objectives:

1. To understand and implement the values and principles in the field of Information Technology.
2. To nurture honest and responsible professionals in Information Technology.
3. To develop student's understanding about social/ professional ethical issues related to Information Technology.
4. To inculcate professional ethics in the field of IT.

Course Outcomes:

On completion of this course students will be able to-

CO1: Adapt the global ethical principles and modern ethical issues.
CO2: Apprehend ethics in the business relationships and practices of IT.
CO3: Implement trustworthy computing to manage risk and security vulnerabilities.
CO4: Analyse concerns of privacy, privacy rights in information-gathering practices in IT.

COURSE CONTENTS

Unit -I	An Overview of Ethics	03hrs

An overview of Ethics: Brief about ethics, Ethics in the Business World, Ethics in IT.

Ethics for IT professionals and IT users: **IT professionals:** Changing Professional Services, Professional Relationships, Codes of Ethics, awareness of IT malpractices, **IT Users***:* Common Ethical Issues for IT Users, Supporting the Ethical Practices of IT Users.

Mapping of Course Outcomes for Unit I	CO1 , CO2

Unit- II	Computer And Internet Crime	03hrs

Introduction: IT security incidents, Types of Exploits, Types of Perpetrators, Laws for Prosecuting Computer Attacks, Implementing Trustworthy Computing, Risk and Vulnerability Assessment, Educating Employees, Contractors, and Part-Time Workers, Establishing a Security Policy

Privacy: The right of Privacy, Privacy Protection and the Law, Key Privacy and Anonymity Issues Identity Theft, Consumer Profiling, Treating Consumer Data Responsibility, Workplace Monitoring

Freedom of Expression: Defamation and Hate Speech, Key issues, Controlling Access to Information on the Internet, Anonymity on the Internet, Corporate Blogging, Pornography

Mapping of Course Outcomes for Unit II	CO3, CO4

Unit- III	Social Networking &Ethics of IT Organization	03 hrs
Social Networking: Brief about Social Networking, **Social Networking Ethical Issues*:*** Cyber bullying, Cyber stalking, Encounters with Sexual Predators, Uploading of Inappropriate Material, **Online Virtual Worlds**: Crime in Virtual Worlds, Educational and Business Uses of Virtual Worlds. **Ethics of IT Organization:** Key Ethical Issues for Organizations, of Workers, Outsourcing, Whistle-blowing, Code of Ethics and Professional Conduct.		
Mapping of Course Outcomes for Unit III	**CO2, CO3, CO4**	
Unit - IV	**Case Study**	**03hrs**
Malware, Medical Implants, Abusive Workplace Behaviour, Automated Active Response Weaponry, Malicious Inputs to Content Filters.		
Mapping of Course Outcomes for Unit IV	**CO1, CO2, CO3, CO4**	

Text Books:

1. George Reynolds,"Ethics in Information Technology", Cengage learning, 5th Edition
2. R. Subramanian, "Professional Ethics", OXFORD University Press, Second Edition

Reference Books:

1. William Lillie,"An Introduction to Ethics", Allied Publishers
2. Charles b. Fleddermann, "Engineering Ethics", Prentice Hall
3. M.Govindarajan,S.Natarajan&V.S.Senthilkumar, "Engineering Ethics &Human Values", PHI Learning
4. "ACM Code of Ethics and Professional Conduct Case Studies" **https://www.acm.org/code-of-ethics/case-studies**
5. "Case Studies of Ethics", **https://flylib.com/books/en/4.269.1.115/1/**
6. "UNODC Case Studies" **https://www.unodc.org/e4j/en/integrity-ethics/module-12/exercises/case-studies.html**

Evaluation :

Students should select any one of the topic in a group of 3 to 5. Students should submit a written report and make a presentation on the topic. The task should not be repeated among students. Report will be evaluated by the faculty as per rubrics defined by him/her/them at start of course.

Home

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214450 (B) : Mandatory Audit Course3:
Quantitative Aptitude & Logical Reasoning

Teaching Scheme:	Credit Scheme:	Examination Scheme:
01hrs/week	Non Credit	Audit Course

Prerequisite Courses, if any:--

Course Objectives:

1. To develop the quantitative, logical and verbal abilities.
2. To enable learners to interpret the data accurately.
3. To build logical thinking ability among the learners.
4. To enable students to comprehend the English text.

Course Outcomes:

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

CO1: Apply basic concepts of quantitative abilities

CO2: Use logical reasoning for solving real world problems

CO3: Compete in examinations like internships, industry placements, postgraduate admissions, civil services etc.

COURSE CONTENTS

Unit I	Fundamental Quantitative Abilities	03 hrs

Concepts and Problems on Number System, HCF and LCM, Average, Ratio and Proportion, Percentage, Year month days counting, SI units and measurements

Mapping of Course Outcomes for Unit I	CO1, CO2, CO3

Unit II	Arithmetic Quantitative Abilities	02 hrs

Concepts and Problems on Ages, Profit and loss, Simple and Compound interest, Time value of money, Time and distance, Time and Work, Geometry and Coordinate Geometry, logarithms

Mapping of Course Outcomes for Unit II	CO1, CO2, CO3

Unit III	Logical Reasoning Ability	02 hrs

Number Series, Pattern recognition, Alpha Numerical, Letter & Symbol Series , Numerical and Alphabet Puzzles, Seating Arrangement

Mapping of Course Outcomes for Unit III	CO2,CO3

Unit IV	Thinking and Reasoning	02 hrs

Objective Reasoning, Graph and Plots, Data sufficiency, Blood Relation, Coding deductive logic, Logical word sequence

Mapping of Course Outcomes for Unit IV	**CO2, CO3**	
Unit V	**Verbal Ability**	**03 hrs**
Synonyms, Antonyms, Contextual Vocabulary, Error Identification, Sentence Correction, Sentence Improvement, Subject-Verb agreement, Tenses and Articles, Reading Comprehension, Preposition & Conjunction		
Mapping of Course Outcomes for Unit V	**CO1, CO2, CO3**	
Text Books:		
1. Quantitative abilities by Arun Sharma, Motilal Uk Books Of India, 2012 2. Quantitative Aptitude for Competitive Examinations by R S Agrawal 3. Verbal and Non-Verbal reasoning by R S Agrawal		
Evaluation :		
Students should select any one of the topic in a group of 3 to 5. Students should submit a written report and make a presentation on the topic. The task should not be repeated among students. Report will be evaluated by the faculty as per rubrics defined by him/her/them at start of course.		

Home

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214450 (C) : Mandatory Audit Course 3:
Language Study Japanese -Module I

Teaching Scheme:	Credit Scheme:	Examination Scheme:
01hrs/week	Non Credit	Audit Course

Prerequisite Courses, if any: Audit Course 4: Language Study Japanese: Module-II

Course Objectives:

1. To teach pronunciation and intonation of Japanese sounds.
2. To enable students to comprehend and speak simple sentences in Japanese.
3. To introduce Japanese language at the basic level, to enable students to read and write the phonetic scripts, *Hiragana* and *Katakana,* and approx.100 *Kanji.,*
4. To teach some aspects of Japanese society and culture.

Course Outcomes:

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

CO1: Converse with simple sentences in Japanese.
CO2: Recognize and read simple sentences in Japanese.
CO3: Write simple sentences in Japanese.
CO4: Be aware about Japanese society and people.

COURSE CONTENTS

Unit I	Japanese Oral Expression	(02 hrs + 04 hrs Self Study)

Oral practice of pronunciation and intonation of Japanese sounds, Japanese greetings, self-introduction, identifying things, time of the day, calendar; counting using Japanese numerical classifiers; describing things; making comparisons; talking of daily activities, kinship terms used for address and reference, seasons, giving and receiving, shopping; making requests, talking of one's likes and dislikes

Mapping of Course Outcomes for Unit I	CO1

Unit II	Japanese Kana and Kanji	(02 hrs + 04 hrs Self Study)

Introduction of the Japanese writing system, i.e. *Hiragana*, *Katakana* and *Kanji* (100-120), word-building, writing foreign names and loan words in Katakana

Mapping of Course Outcomes for Unit II	CO2, CO3

Unit III	Japanese Greetings	(02 hrs + 04 hrs Self Study)

Basic sentence patterns to be applied in self-introduction, identifying things; time of the day; calendar; counting using Japanese numerical classifiers; describing things; making comparisons; talking of daily activities; kinship terms used for address and reference; seasons; giving and receiving; shopping; making requests; talking of one's likes and dislikes

Mapping of Course Outcomes for Unit III	**CO1**	
Unit IV	**Japanese Comprehension**	**(02 hrs+ 04 hrs Self Study)**
Extensive practice of basic patterns at the elementary level through drills and exercises		
Mapping of Course Outcomes for Unit IV	**CO1, CO2**	
Unit V	**Speaking Japanese**	**(02 hrs + 4 hrs Self Study)**
Simple conversation in situations such as describing things, making comparisons, talking of daily activities, giving and receiving of gifts, talking of illnesses and visit to a doctor, shopping, making requests, talking of one's likes and dislikes, talking on telephone etc.		
Mapping of Course Outcomes for Unit V	**CO1**	
Unit VI	**Social Environment of Japan**	**(02 hrs + 4 hrs Self Study)**
An introduction to some aspects of Japanese culture such as festivals, Japanese seasons, Japanese people and their love for nature; Japanese food, sports; society; geography; education system; Japan and the world etc. The objective is to create general awareness in students about life in Japan.		
Mapping of Course Outcomes for Unit VI	**CO4**	

E-Resources for Learning Support:

a. https://www.duolingo.com/course/ja/en/Learn-Japanese
b. https://www.freejapaneselessons.com/
c. https://minato-jf.jp/ **(Japan Foundation)**

Text Books:

1. Taeko Kamiya, Japanese For Fun Phrasebook & Dictionary: The Easy Way to Learn Japanese Quickly, Rev Edition 2017 Tuttle Publishing, (ISBN 10- 4805313986, ISBN 13 -9784805313985)
2. Eri Banno, Genki I: An Integrated Course in Elementary Japanese , 3rd Edition 2020, The Japan Times, (ISBN13: 9784789017305)
3. Sushama Jain, Japan : The Living Culture, Har-anand Publications, 2009, (ISBN 10: 8124114870 / ISBN 13: 9788124114872)

Reference Books:

1. Kanji Power Handbook for the Japanese Language Proficiency Test, 1994, ARC Press (ISBN: 9784872343144)
2. Yukiko Ogata, Kana Sumitani, Yasuko Hidari, Yukiko Watanabe, Nihongo fun and Easy -I Survival Japanese Conversation for Beginners,
3. Eriko Sato, Japanese Demystified: A Self-Teaching Guide, 2008, McGraw-Hill Companies, McGraw-Hill Demystified Series (ISBN 10-0071477268, ISBN 13-9780071477260)

Evaluation :

Students should select any one of the topic in a group of 3 to 5. Students should submit a written report and make a presentation on the topic. The task should not be repeated among students. Report will be evaluated by the faculty as per rubrics defined by him/her/them at start of course.

Home

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214450 (D) : Mandatory Audit Course 3:
Cyber Security and Law

Teaching Scheme:	Credit Scheme:	Examination Scheme:
01hrs/week	Non Credit	Audit Course

Prerequisite Courses, if any: Basics of Computer

Course Objectives:

1. Understand basics of computer and cyber security.
2. To study the information technology law.
3. To understand reasons for cybercrime.
4. To learn investigation techniques.

Course Outcomes:

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

CO1: Understand the basic concepts of cyber security and its abilities
CO2: Analyse and evaluate the cyber security needs of an organization.
CO3: Understand the importance of cyber laws and its practices.
CO4: Determine and analyse software vulnerabilities and security solutions to reduce the risk of exploitation

COURSE CONTENTS

Unit I	Basics of Cyber Security	04 hrs

Information Security Definition and Concepts, Overview of Security Threats , Goals of Security, , Limitations and Challenges in cyber security , Types of Security attacks, Network Security, Malicious Codes, Intrusion detection systems, Hacking Techniques, Password cracking , Insecure Network Connections ,Concept of Firewall and Security.

Mapping of Course Outcomes for Unit I	CO1, CO2

Unit II	Cyber Laws	04 hrs

Introduction, Definition and origin, Cybercrime and Information security, Classification of Cybercrimes, The legal perspectives- Indian perspective- IT Act 2000, Global perspective, Categories of Cybercrime, Reasonable Security Practices

Mapping of Course Outcomes for Unit II	CO2, CO3, CO4

Unit III	Cyber Crime	04 hrs

Definition of Cyber Crime & Computer related Crimes, Classification &Differentiation between traditional crime and cybercrimes, Data Theft, Hacking, Spreading Virus &Worms, Phishing, Cyber Stalking/ Bullying, Identity Theft &Impersonation, Credit card & Online Banking Frauds , Denial of Service Attacks , Cyber terrorism etc.. , Search and Seizure Procedures of Digital Evidence- Data

Acquisition ,Data Analysis, Reporting, Cybercrime Scenario in India	
Mapping of Course Outcomes for Unit III	**CO2, CO3, CO4**

Text Books:

1. William Stallings, “Computer Security: Principles and Practices”, Pearson 6th Ed, ISBN: 978-0-13-335469-0
2. Nina Godbole, Sunit Belapure, “Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley India Pvt.Ltd, ISBN- 978-81-265-2179-1
3. Nina Godbole , “Information Systems Security” , Wiley India Pvt. Ltd, ISBN -978-81-265-1692-6
4. Mark Merkow, “Information Security-Principles and Practices”, Pearson Ed., ISBN- 978-81-317-1288-7
5. Bernard Menezes, “Network Security and Cryptography”, Cengage Learning, ISBN-978-81-315-1349-1
6. “The Information Technology Act, 2000; Bare Act” – Professional Book Publishers

Evaluation :

Students should select any one of the topic in a group of 3 to 5. Students should submit a written report and make a presentation on the topic. The task should not be repeated among students. Report will be evaluated by the faculty as per rubrics defined by him/her/them at start of course.

SEMESTER – IV

Home

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
207003: Engineering Mathematics III

Teaching Scheme:	Credit Scheme:	Examination Scheme:	
Theory (TH) : 03 hrs/week	03	Mid_Semester:	30 Marks
Tutorial (TUT) :01 hrs/ week	01	End_Semester:	70 Marks
		TW :	25 Marks

Prerequisites: Differential & Integral calculus, Taylor series, Differential equations of first order and first degree, Fourier series, Collection, Classification and Representation of data.

Course Objectives:

1. To make the students familiarize with concepts and techniques in Linear differential equations, Fourier transform& Z-transform, Statistical methods, Probability theory and Numerical methods.2. The aim is to equip them with the techniques to understand advanced level mathematics and its applications that would enhance thinking power, useful in their disciplines.

Course Outcomes:

On completion of this course student will be able to –

- **CO1:** Solve Linear differential equations, essential in modelling and design of computer-based systems.
- **CO2:** Apply concept of Fourier transform and Z-transform and its applications to continuous and discrete systems and image processing.
- **CO3:** Apply Statistical methods like correlation& regression analysis and probability theory for data analysis and predictions in machine learning.
- **CO4:** Solve Algebraic &Transcendental equations and System of linear equations using numerical techniques.
- **CO5:** Obtain Interpolating polynomials, numerical differentiation and integration, numerical solutions of ordinary differential equations used in modern scientific computing.

COURSE CONTENTS

Unit I	Linear Differential Equations	06 hrs

LDE of n^{th} order with constant coefficients, Complementary function, Particular integral, General method, Short methods, Method of variation of parameters, Cauchy's & Legendre's DE, Simultaneous & Symmetric simultaneous DE.

Unit II	Transforms	06 hrs

Fourier Transform (FT): Complex exponential form of Fourier series, Fourier integral theorem, Fourier Sine & Cosine integrals, Fourier transform, Fourier Sine & 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	06 hrs

Measures of central tendency, Measures of dispersion, 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**	**06 hrs**
Probability, Theorems on Probability, Bayes theorem, Random variables, Mathematical Expectation, Probability density function, Probability distributions: Binomial, Poisson, Normal and Hyper geometric, Sampling distributions, Test of Hypothesis: Chi-Square test, t-test.		
Unit V	**Numerical Methods**	**06 hrs**
Numerical Solution of Algebraic and Transcendental equations: Bisection, Secant, Regula-Falsi, Newton–Raphson and Successive Approximation Methods, Convergence and Stability. Numerical Solutions of System of linear equations: Gauss elimination, LU Decomposition, Cholesky, Jacobi and Gauss-Seidel Methods.		
Unit VI	**Numerical Methods**	**06hrs**
Interpolation: Finite Differences, Newton's and Lagrange's Interpolation formulae, Numerical Differentiation. Numerical Integration: Trapezoidal and Simpson's rules, Bound of truncation error. Solution of Ordinary differential equations: Euler's, Modified Euler's, Runge-Kutta 4^{th} order methods and Predictor-Corrector methods		
Text Books:		
1. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw-Hill 2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publication, Delhi		
Reference Books:		
1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10ed, Wiley India 2. M. D. Greenberg, "Advanced Engineering Mathematics", 2edPearson Education 3. Peter V. O'Neil , "Advanced Engineering Mathematics", 7ed,Cengage Learning 4. S. L. Ross , "Differential Equations", 3e, Wiley India 5. Sheldon M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists", 5e, Elsevier Academic Press 6. M. K. Jain, S. R. K. Iyengar And R. K. Jain1, "Numerical Methods for Scientific and Engineering Computation", 5e,New Age International Publication		
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.		

Home

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214451: Processor Architecture

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory(TH): 03hrs/week	03	Mid_Semester: 30 Marks End_Semester: 70 Marks

Prerequisites: Logic Design & Computer Organization

Course Objectives :

1. To study architectural details of PIC 18 microcontroller.
2. To study applications of PIC through various interfacing devices.

Course Outcomes :

On completion of this course student will be able to –

CO1: Apprehend architecture and memory organization of PIC 18 microcontroller.
CO2: Implement embedded C programming for PIC 18.
CO3: Use concepts of timers and interrupts of PIC 18.
CO4: Demonstrate real life applications using PIC 18.
CO5: Analyze architectural details of ARM processor.

COURSE CONTENTS

Unit I	PIC Microcontroller Architecture	06 hrs
Introduction: introduction to microcontroller, Brief history of microcontrollers, Difference between microprocessor and microcontroller, Criteria for selection of microcontroller, **PIC18FXXX:** Features and architecture, comparison of PIC 18 series microcontrollers; PIC18F458/452 Pin out connection, Registers of PIC18F, **Program and data memory organization**: The Program Counter and Programmable ROM space in the PIC, File register and Access bank, Bank switching in PIC18; **Addressing modes:** Addressing modes with instruction example, Oscillator configurations, Reset operations, Brownout reset, Watchdog timer, Power down modes & Configuration registers.		
Mapping of Course Outcomes for Unit I	**CO1,CO2**	

Unit II	PIC I/O Ports and Timer	06 hrs
I/O Port: I/O Port structure with programming: I/O Port structure, I/O Port programming, I/O Bit manipulation Programming. **Timer/Counter:** Registers used for Timer/Counter operation, Delay calculations, Programming of Timers using Embedded C.		
Case Study	**Traffic light signal controller using Timer/Counter**	
Mapping of Course Outcomes for Unit II	**CO2, CO3**	

Unit III	PIC Interrupts & Interfacing-I	06 hrs

PIC Interrupts: Interrupt Vs Polling, IVT, Steps in executing interrupt, Sources of interrupts; Enabling and disabling interrupts, Interrupt registers, Priority of interrupts, Programming of: Timer using interrupts, External hardware interrupts, Serial communication interrupt; Interfacing of LED, Interfacing 16X2 LCD (8 bits) and Key board (4 x 4 Matrix), Interfacing Relay & Buzzer.		
Mapping of Course Outcomes for Unit III	**CO2, CO3, CO4**	
Unit IV	**PIC Interfacing-II**	**06 hrs**
CCP modes: Capture, Compare and PWM generation; DC Motor speed control with CCP, Stepper motor interfacing with PIC, **Basics of Serial communication protocols:** Study of RS232, I2C, SPI, UART, Serial communication programming using Embedded C.		
Mapping of Course Outcomes for Unit IV	**CO2, CO4**	
Unit V	**PIC Interfacing-III**	**06 hrs**
Interfacing : Interfacing of ADC and DAC 0808 with PIC, Temperature sensor interfacing using ADC and I2C with PIC, Interfacing of RTC (DS1306) using I2C with PIC, Interfacing of EEPROM using SPI with PIC,		
Case Study	**Home protection system, All programs in Embedded C**	
Mapping of Course Outcomes for Unit V	**CO2, CO4**	
Unit VI	**Current Trends in Processor Architecture**	**06 hrs**
ARM & RISC :ARM and RISC design philosophy, Introduction to ARM processor & its versions ARM 7, ARM 9, ARM 11, Features& advantages of ARM processor, Suitability of ARM processor in embedded applications, ARM 7 dataflow model, Programmers model. CPSR & SPSR registers, Modes of operation, Difference between PIC and ARM.		
Mapping of for Unit VI	**CO5**	

Text Books:

1. Muhammad Ali Mazidi , Danny Causey, RolinMcKinlay, "PIC Microcontroller and Embedded Systems: Using Assembly and C for PIC18", 4th Edition by,Pearson international edition
2. Andrew N. Sloss, Dominic Symes, Chris Wright, Morgan, "ARM System Developer's Guide Designing and Optimizing System Software", Kaufmann Publishers

Reference Books:

1. Peatman, John B, "Design with PIC Microcontroller", Pearson Education PTE
2. Ramesh Gaonkar, "Fundamentals of Microcontrollers and Applications In Embedded Systems(with the PIC18 Microcontroller Family)"Thomson/Delmar Learning; 1 edition (January 8, 2007), ISBN:978-1401879143
3. Microchip's PIC18FXXX Data Sheet
4. Muhammad Ali Mazidi, SarmadNaimi,"ARM Assembly Language Programming & Architecture"

Home

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214452: Database Management System

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory(TH):03hrs/week	03	Mid_Semester: 30 Marks End_Semester: 70 Marks

Prerequisite Courses, if any: Discrete Mathematics

Course Objectives:

1. The objective of the course is to present an introduction to database management system as a subject in its own right.
2. To understand the fundamental concepts of Relational Database management system.
3. To present SQL and procedural interfaces to SQL comprehensively.
4. To provide a strong formal foundation in Relational Database Concepts, database concepts, technology and practice &to introduce the concepts of Query Processing.
5. To introduce the concepts of Transaction Processing and to present the issues and techniques relating to concurrency and recovery in multi-user database environments.
6. To introduce the recent trends in database technology.

Course Outcomes:

On completion of this course student will be able to --

CO1: Apply fundamental elements of database management systems.
CO2: Design ER-models to represent simple database application scenarios.
CO3: Formulate SQL queries on data for relational databases.
CO4: Improve the database design by normalization & to incorporate query processing.
CO5: Apply ACID properties for transaction management and concurrency control.
CO6: Analyze various database architectures and technologies.

COURSE CONTENTS

Unit I	Introduction to DBMS	06 hrs

Introduction : Basic concepts, Advantages of DBMS over file processing systems, Data abstraction, Database languages, Data models, Data independence, Components of a DBMS, Overall structure of DBMS, Multi-user DBMS architecture, System catalogs, Data Modeling: Basic concepts, Entity, attributes, relationships, constraints, keys.

Case Study	**MySQL Database**
Mapping of Course Outcomes for Unit I	**CO1**

Unit II	Relational Model	06 hrs

ER and EER diagrams: Components of ER model, Conventions, Converting ER diagrams into tables Relational Model: Basic concepts, Attributes and Domains, Codd's rules.

Relational Integrity: Nulls, Entity, Referential integrities, Enterprise constraints, Views, Schema diagram		
Case Study	**Student / Timetable / Reservation / any data Management System**	
Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**Introduction to SQL - PL/SQL**	**06 hrs**
Introduction to SQL: Characteristics and advantages SQL Data Types, Literals, DDL, DML, SQL Operators Tables: Creating, Modifying, Deleting, Views: Creating, Dropping, Updation using Views, Indexes, Nulls. **SQL DML Queries**: SELECT query and clauses, Set operations, Tuple Variables, Set comparison, Ordering of Tuples , Aggregate Functions, Nested Queries, Database Modification using SQL Insert, Update, Delete Queries, Stored Procedure, Triggers, Programmatic **SQL** : Embedded SQL, Dynamic SQL, ODBC		
Case Study	**Employee database system**	
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Database Design & Query Processing**	**06 hrs**
Relational Databases Design: Purpose of Normalization, Data Redundancy and Update Anomalies, Functional Dependencies. The process of Normalization: 1NF, 2NF, 3NF, BCNF. Introduction to **Query Processing:** Overview, Measures of Query cost, Selection and Join operations, Evaluation of Expressions **Introduction to Query optimization:** Estimation, Transformation of Relational Expression		
Case Study	**Employee Database design**	
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**Transaction & Concurrency Control**	**06 hrs**
Transaction Management: Basic concept of a Transaction, Properties of Transactions, Database Architecture, Concept of Schedule, Serial Schedule. **Serializability:** Conflict and View, Cascaded aborts Recoverable and Non-recoverable Schedules. **Concurrency Control:** Need Locking methods Dead locks, Time stamping Methods. Optimistic Techniques, Multi-version Concurrency Control. **Different crash recovery methods:** Shadow-Paging, Log-based Recovery: Deferred and Immediate, Check Points		
Case Study	**Banking Transaction**	
Mapping of Course Outcomes for Unit V	**CO5**	

Unit VI	Advanced Databases	06 hrs
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. **Emerging Database Technologies:** Introduction, No SQL Databases- Internet Databases, Cloud databases, Mobile Databases, SQLite database, XML databases		
Case Study	**RealmDB, ORMLite, Couchbase Lite**	
Mapping of Course Outcomes for Unit VI	**CO6**	

Text Books:

1. Silberschatz A., Korth H., Sudarshan S. "Database System Concepts", 6th edition, Tata McGraw Hill Publishers
2. G. K. Gupta "Database Management Systems" , Tata McGraw Hill

Reference Books:

1. Rab P., Coronel C. "Database Systems Design, Implementation and Management", 5th edition, Thomson Course Technology, 2002
2. Elmasri R., Navathe S. " Fundamentals of Database Systems", 4th edition, Pearson Education, 2003
3. Date C. " An Introduction to Database Systems", 7th edition, Pearson Education, 2002
4. Ramkrishna R., Gehrke J. " Database Management Systems", 3rd edition, McGraw Hill

Web Resources:

https://nptel.ac.in/courses/106/105/106105175/

Home

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214453: Computer Graphics

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory (TH): 03 hrs/week	03	Mid_Semester: 30 Marks End_Semester: 70 Marks

Prerequisite Courses, if any: Basic Geometry, Trigonometry, Vectors and Matrices, Data Structures and Algorithms

Course Objectives:

1. Understand the foundations of computer graphics: hardware systems, math basis, light and color.
2. Understand the complexities of modeling realistic objects through modeling complex scenes using a high-level scene description language.
3. Become acquainted with some advanced topics in computer graphics. The student should gain an expanded vocabulary for discussing issues relevant to computer graphics (including both the underlying mathematics and the actual programming).
4. The student should gain an appreciation and understanding of the hardware and software utilized in constructing computer graphics applications.
5. The student should gain a comprehension of windows, clipping and view-ports in relation to images displayed on screen.
6. The student should gain an understanding of geometric, mathematical and algorithmic concepts necessary for programming computer graphics.

Course Outcomes:

On completion of the course, students will be able to–

CO1: Apply mathematical and logical aspects for developing elementary graphics operations like scan conversion of points, lines, circle, and apply it for problem solving.

CO2: Employ techniques of geometrical transforms to produce, position and manipulate Objects in 2 dimensional and 3-dimensional space respectively.

CO3: Describe mapping from a world coordinates to device coordinates, clipping, and projections in order to produce 3D images on 2D output device.

CO4: Apply concepts of rendering, shading, animation, curves and fractals using computer graphics tools in design, development and testing of 2D, 3D modeling applications.

CO5: Perceive the concepts of virtual reality.

COURSE CONTENTS

Unit – I	Computer Graphics Basic, OpenGL and Line, Circle Drawing	06 hrs

Introduction CG :Introduction to computer graphics, basics of graphics systems, raster and random scan, basic display processor

OpenGL – Introduction – Graphics function, OpenGL Interface, primitives and attributes, Control functions, programming events.

Line Drawing: DDA Line drawing algorithm, Bresenham Line drawing algorithm **Circle Drawing:** Bresenham circle drawing algorithm. **Character Generation:** Stroke principle, starburst principle, bitmap method. Introduction to aliasing and anti-aliasing.		
Case Study	**Computer-generated imagery (CGI)**	
Mapping of Course Outcomes for Unit I	**CO1**	
Unit – II	**Polygons, 2D Transformations**	**06 hrs**
Polygons: Polygons and its types, inside test, Polygon filling methods: Seed Fill – Flood fill and Boundary Fill, Scan-line Fill algorithms, **2D Transformations:** Translation, Scaling, Rotation, Reflection and Shearing, Matrix representation and homogeneous coordinate system, composite transformations.		
Case Study	**Transformation of an Object in Computer Graphics: Mathematical Matrix Theory**	
Mapping of Course Outcomes for Unit II	**CO2**	
Unit – III	**Windowing, Clipping,3D Transformation, Projections**	**06 hrs**
Windowing: Concept of window and viewport, viewing transformations **Line Clipping:** Cohen Sutherland method of line clipping **Polygon Clipping:** Sutherland Hodgeman method for convex and concave polygon clipping. **3D Transformation:** Translation, scaling, rotation about X, Y, Z & arbitrary axis, and reflection about XY, YZ, XZ & arbitrary plane. **Projections:** Types of projections- Parallel, Perspective **Parallel:** oblique – Cavalier, Cabinet, Orthographic – isometric, diametric, trimetric **Perspective:** vanishing points as 1 point, 2 point and 3 point.		
Case Study	**3D Rendering and Modeling**	
Mapping of Course Outcomes for Unit III	**CO2 & CO3**	
Unit – IV	**Segments, Illumination models, colour models and shading**	**06 hrs**
Segments: Introduction, Segment table, segment creation, closing, deleting, renaming, and visibility. **Illumination models**: Light sources, ambient light, diffuse light, specular reflection, the Phong model, combined diffuse and specular reflections with multiple light sources. **Color Models:** CIE Chromaticity Diagram, Color Gamut, RGB, CMY, YCbCr,HSVcolor models. **Shading Algorithms:** Constant intensity shading, Halftone, Gourand and Phong Shading.		
Case Study	**Best practices in Day lighting& Passive Systems for Smaller Commercial Buildings**	
Mapping of Course Outcomes for Unit IV	**CO4**	

Unit – V	Curves, fractals and Animation	06 hrs
Curves: Introduction, interpolation and approximation, Spline Interpolation Methods – hermite interpolation, Bezier curves, B-Splines. **Fractals:** Introduction, Classification, fractal Dimension, Fractal dimension and surfaces, Hilbert curve, Koch Curve. **Animation:** Basics of animation, types of animation, principles of animation, design of animation sequences, animation languages, key frame, morphing, motion specification. Methods of controlling animation, frame-by-frame animation techniques, real-time animation techniques.		
Case Study	**3D Animation services for character expressions.**	
Mapping of Course Outcomes for Unit V	**CO4**	
Unit – VI	**Virtual Reality**	**06 hrs**
Introduction of Virtual Reality: Fundamental Concept, Three I's of virtual reality and Classic Components of VR systems, Applications of VR systems. **Multiple Modals of Input and Output Interface in Virtual Reality:** Input – 3D position Trackers and its types, Navigation and Manipulation Interfaces, Gesture Interfaces, Graphics Displays – HMD and CAVE, Sound Displays, Haptic Feedback **Rendering Pipeline:** Graphics rendering Pipeline, Haptics Rendering Pipeline Modeling in Virtual Reality: Concepts of Geometric Modeling, Kinematic Modeling, Physical modeling and Behavior modeling.		
Case Study	**Virtual reality in aviation and Space travel Training**	
Mapping of Course Outcomes for Unit VI	**CO5**	

Test Books

1. D. Hearn, M. Baker, "Computer Graphics – C Version", 2nd Edition, Pearson Education, 2002, ISBN81 – 7808 – 794 – 4
2. S. Harrington, "Computer Graphics", 2nd Edition, McGraw-Hill Publications, 1987, ISBN 0 – 07 –100472 – 6
3. Grigore C. Burdea, Philippe Coiffet, "Virtual Reality Technology", second edition, Wiley India Edition, ISBN 81-265-0789-6

Reference books

1. D. Rogers, "Procedural Elements for Computer Graphics", 2nd Edition, Tata McGraw-HillPublication, 2001, ISBN 0 – 07 – 047371 – 4.
2. J. Foley, V. Dam, S. Feiner, J. Hughes, "Computer Graphics Principles and Practice", 2nd Edition, Pearson Education, 2003, ISBN 81 – 7808 – 038 – 9.
3. Foley, "Computer Graphics: Principles & Practice in C", 2e, ISBN 9788131705056, Pearson Edu.
4. F.S. Hill JR, "Computer Graphics Using Open GL", Pearson Education

Home

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214454: Software Engineering

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory(TH) : 03 hrs/week	03	Mid_Semester: 30 Marks End_Semester: 70 Marks

Prerequisite Courses, if any: Fundamentals of Programming Languages

Course Objectives:

1. To learn the principles of Software Engineering.
2. To learn and understand methods of capturing, specifying, visualizing and analyzing software requirements.
3. To know design principles to software project development.
4. To learn basics of IT project management.
5. To understand software quality attributes and testing principles.
6. To introduce formal methods and recent trends in Software Engineering.

Course Outcomes:

On completion of the course, students will be able to --

CO1: Classify various software application domains.
CO2: Analyze software requirements by using various modeling techniques.
CO3: Translate the requirement models into design models.
CO4: Apply planning and estimation to any project.
CO5: Use quality attributes and testing principles in software development life cycle.
CO6: Discuss recent trends in Software engineering by using CASE and agile tools.

COURSE CONTENTS

Unit I	Introduction To Software Engineering	06 hrs

Software Engineering Fundamentals: Nature of Software, Software Engineering Practice, Software Process, Software Myths.
Process Models : A Generic Process Model, Linear Sequential Development Model, Iterative Development Model, The incremental Development Model
Agile software development: Agile manifesto, agility principles, Agile methods, myth of planned development, Introduction to Extreme programming and Scrum.
Agile Practices: test driven development, pair programming, continuous integration in DevOps , Refactoring

Case Study	An information system – Library Management system
Mapping of Course Outcomes for Unit I	CO1

Unit II	Requirements Engineering & Analysis	06 hrs

Requirements Engineering: User and system requirements, Functional and non-functional requirements, requirements engineering (elicitation, specification, validation, negotiation) prioritizing requirements (Kano diagram), requirement traceability matrix(RTM)
Software Requirements Specification (SRS): software requirements Specification document,

structure of SRS, writing a SRS, structured SRS for online shopping, **Requirements Analysis:** Analysis Model, data modeling, scenario based modeling, class based modeling, Flow oriented modeling, behavioral modeling-Introduction to UML diagrams		
Case Study : Library Management system		
Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**Design Engineering**	**06 hrs**
Design Engineering : Design Process & quality, Design Concepts, design Model, Pattern-based Software Design. Architectural Design :Design Decisions, Views, Patterns, Application Architectures, **Component level Design:** component, Designing class based components, conducting component-level design, User Interface Design: The golden rules, Interface Design steps& Analysis, Design Evaluation		
Case Study : Web App Design / Library Management System		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Project Planning, Management And Estimation**	**6 hrs**
Project Planning: Project initiation, Planning Scope Management, Creating the Work Breakdown Structure, scheduling: Importance of Project Schedules, Developing the Schedule using Gantt Charts, PERT/ CPM **Project Management:** The Management Spectrum, People, Product, Process, Project, The W5HH Principle, Metrics in the Process and Project Domains, Software Measurement: size &function-oriented metrics(FP & LOC), Metrics for Project **Project Estimation:** Software Project Estimation, Decomposition Techniques, Cost Estimation Tools and Techniques, Typical Problems with IT Cost Estimates.		
Case Study: Project Management tool like OpenProj or MS Project		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**Software Quality And Testing**	**06 hrs**
Quality Concepts: Quality, software quality, Quality Metrics, software quality dilemma, achieving software quality **Software Testing:** Introduction to Software Testing, Principles of Testing, Test plan, Test case, Types of Testing, Verification & Validation, Testing strategies, Defect Management, Defect Life Cycle, Bug Reporting, debugging.		
Case Study : Software testing tool like selenium		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**Formal Methods Recent Trends In Software Engineering**	**06 hrs**
Recent Trends in SE : SCM, Risk Management, Technology evolution, process trends, collaborative development, software reuse, test-driven development, global software development challenges, CASE – taxonomy, tool-kits, workbenches, environments, components of CASE, categories (upper, lower and integrated CASE tools), Introduction to agile tools Jira, Kanban		
Case Study : CASE software/ HP Quality Center (QC) / Jira		

Mapping of Course Outcomes for Unit VI	CO6

Text Books:

1. Roger Pressman, “Software Engineering:A Practitioner’s Approach”, McGraw Hill,ISBN 0-07-337597-7
2. Ian Sommerville, “Software Engineering”,Addison and Wesley, ISBN 0-13-703515-2

Reference Books:

1. 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
2. Pankaj Jalote, “Software Engineering: A Precise Approach”,Wiley India, ISBN: 9788-1265-2311-5
3. Marchewka, “Information Technology Project Management”,Willey India, ISBN: 9788-1265-4394-6
4. Rajib Mall, “Fundamentals of Software Engineering”,Prentice Hall India, ISBN-13:9788-1203-4898-1

Home

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214455: Programming Skill Development Lab

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory(TH) :02hrs/week	01	PR: 25Marks TW: 25Marks

Prerequisites: Computer Organization and Architecture

Course Objectives:

1. To learn embedded C programming and PIC18FXXXmicrocontrollers.
2. To learn interfacing of real-world input and output devices to PIC18FXXX microcontroller

Course Outcomes:

On completion of this course student will be able to --

CO1: Apply concepts related to embedded C programming.

CO2: Develop and Execute embedded C program to perform array addition, block transfer, sorting operations

CO3: Perform interfacing of real-world input and output devices to PIC18FXXX microcontroller.

CO4: Use source prototype platform like Raspberry-Pi/Beagle board/Arduino.

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 etc.

Guidelines for Student's Lab Journal

1. The laboratory assignments should be submitted by students in the form of journal. The Journal consists of Certificate, table of contents, and 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. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of program listing to journal may be avoided.
3. Use of Digital media like shared drive containing students' programs maintained by lab In-charge is highly encouraged.
4. Practical Examination will be based on the term work submitted by the student in the form of journal.
5. Candidate is expected to know the theory involved in the experiment.
6. 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.
7. 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 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 of PIC18FXXX microcontrollers and its interfacing kits should be checked by the concerned faculty members.

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.

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

Suggested List of Laboratory Assignments Group A (Any Three):

Mapping of Course Outcomes for Group A -- CO1 , CO2

1. Study of Embedded C programming language (Overview, syntax, One simple program like addition of two numbers).
2. Write an Embedded C program to add array of n numbers.
3. Write an Embedded C program to transfer elements from one location to another for following:
i) Internal to internal memory transfer
ii) Internal to external memory transfer
4. Write an Embedded C menu driven program for :
i) Multiply 8 bit number by 8 bit number
ii) Divide 8 bit number by 8 bit number
5. Write an Embedded C program for sorting the numbers in ascending and descending order.

Group B (Any Three):

Mapping of Course Outcomes for Group B -- CO3

6. Write an Embedded C program to interface PIC 18FXXX with LED & blinking it using specified delay.
7. Write an Embedded C program for Timer programming ISR based buzzer on/off.
8. Write an Embedded C program for External interrupt input switch press, output at relay.
9. Write an Embedded C program for LCD interfacing with PIC 18FXXX.

Group C (Any two):

Mapping of Course Outcomes for Group C -- CO3

10. Write an Embedded C program for Generating PWM signal for servo motor/DC motor.
11. Write an Embedded C program for PC to PC serial communication using UART.
12. Write an Embedded C program for Temperature sensor interfacing using ADC & display on LCD.

Group D:

Mapping of Course Outcomes for Group D -- CO4

13. Study of Arduino board and understand the OS installation process on Raspberry-pi.
14. Write simple program using Open source prototype platform like Raspberry-Pi/Beagle board/Arduino for digital read/write using LED and switch Analog read/write using sensor and actuators.

Reference Books :

1. Mazidi, Rolin McKinlay and Danny Causey, 'PIC Microcontroller and Embedded Systems using Assembly and C for PIC18", Pearson Education
2. "Raspberry Pi for Beginners", 2nd Edition book" e-book.
3. Peatman, John B, "Design with PIC Microcontroller", Pearson Education PTE,
4. Ramesh Gaonkar, "Fundamentals of Microcontrollers and Applications In Embedded Systems (with the PIC18 Microcontroller Family)"Thomson/Delmar Learning; 1 edition (January 8, 2007), ISBN:978-1401879143.

Home

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214456: Database Management System Lab

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR):04hrs/week	02	PR: 25 Marks TW: 25 Marks

Prerequisites: Data structures and 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 database system.
5. To learn and understand various Database Architectures and its use for application development.
6. To program PL/SQL including stored procedures, stored functions, cursors and packages.

Course Outcomes :

On completion of this course student will be able to --

CO1: Install and configure database systems.
CO2: Analyze database models & entity relationship models.
CO3 : Design and implement a database schema for a given problem-domain
CO4: Implement relational database systems.
CO5: Populate and query a database using SQL DDL / DML / DCL commands.
CO6 : Design a backend database of any one organization: CASE STUDY

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.

Guidelines for Student's Lab Journal

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

Guidelines for Oral /Practical Assessment

1. Examiners will assess the student 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.

Suggested List of Laboratory Assignments

Group A: Study of Databases

Mapping of Course Outcomes Group A -- CO1

1. Study of MySQL Open source software. Discuss the characteristics like efficiency, scalability, performance and transactional properties
2. Install and configure client and server of MySQL.(Show all commands and necessary steps for installation and configuration)
3. Study of SQLite: What is SQLite? Uses of Sqlite. Building and installing SQLite.

Group B: MySQL

Mapping of Course Outcomes Group B -- CO2, CO3, CO4, CO5

1. Design any database with at least 3 entities and relationships between them. Draw suitable ER/EER diagram for the system.
2. Design and implement a database (for assignment no 1) using DDL statements and apply normalization on them
3. Create Table with primary key and foreign key constraints.
   a. Alter table with add n modify b. Drop table
4. Perform following SQL queries on the database created in assignment 1.
   - Implementation of relational operators in SQL
   - Boolean operators and pattern matching
   - Arithmetic operations and built in functions
   - Group functions
   - Processing Date and Time functions
   - Complex queries and set operators
5. Execute DDL/DML statements which demonstrate the use of views. Update the base table using its corresponding view. Also consider restrictions on updatable views and perform view creation from multiple tables.

Group C: PL/SQL

Mapping of Course Outcomes Group C -- CO6

1. Write and execute PL/SQL stored procedure and function to perform a suitable task on the database. Demonstrate its use.
2. Write and execute suitable database triggers .Consider row level and statement level triggers.
3. Write a PL/SQL block to implement all types of cursor.

Group D: Relational Database Design

Mapping of Course Outcomes Group D -- CO5, CO6

Design and case study of any organization (back end only), Project Proposal and High Level SRS

To prepare for project, do the following:

1. Form teams of around 3 to 4 people
2. Create requirements document with the following information:-
   a. Give one or two paragraph description of your goals for the topic(s).
   b. List what all types of users will be accessing your application
   c. List the various functionalities that your application will support. Explain each in about a paragraph worth of detail.
   d. List the hardware and software requirements at the backend and at the front end.
   e. Give an estimate of the number of users of each type, the expected load (transactions per day), and the expected database size.

Project ER Diagram and Database Design

For ER diagram and Database design following guidelines can be used:

1. Draw an ER diagram of your project.
2. Reduce this ER diagram into the tables and complete database design.
3. Subsequently, list all the functional dependencies on each table that you expect will hold.
4. Check that the database schema is in 3NF/BCNF. If it is not, apply normalization. Use non-loss decomposition and bring the database schema in 3NF/BCNF.

Give the ER diagram and the data dictionary as part of the requirement specifications file which you created for the project proposal.

Reference Books:

1. Dr. P. S. Deshpande, “SQL and PL/SQL for Oracle 10g Black Book”, DreamTech
2. Ivan Bayross, “SQL, PL/SQL: The Programming Language of Oracle”, BPB Publication
3. 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
4. Eric Redmond, Jim Wilson, “Seven databases in seven weeks”, SPD, ISBN: 978-93-5023-91
5. Jay Kreibich, Using SQLite, SPD, ISBN: 978-93-5110-934-1, 1st edition

Home

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214457: Computer Graphics Lab

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR) :02hrs/week	02	PR : 25 Marks TW: 25 Marks

Prerequisites: Basic Geometry, Trigonometry, Vectors and Matrices, Data Structures and Algorithms

Course Objectives :

1. To acquaint the learners with the concepts of OpenGL.
2. To acquaint the learners with the basic concepts of Computer Graphics.
3. To implement the various algorithms for generating and rendering the objects.
4. To get familiar with mathematics behind the transformations.
5. To understand and apply various methods and techniques regarding animation.

Course Outcomes :

On completion of this course student will be able to --

CO1: Apply line& circle drawing algorithms to draw the objects.

CO2: Apply polygon filling methods for the object.

CO3: Apply polygon clipping algorithms for the object.

CO4: Apply the 2D transformations on the object.

CO5: Implement the curve generation algorithms.

CO6: Demonstrate the animation of any object using animation principles.

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.

Guidelines for Student's Lab Journal

1. Student should submit term work in the form of journal with write-ups based on specified list of assignments.
2. Practical and Oral Examination will be based on all the assignments in the lab manual
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 student 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 write-ups 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 related to respective laboratory should be checked by the concerned faculty member.

Guidelines for Laboratory Conduction

1. All the assignments should be implemented in C++ with OpenGL libraries.
2. Assignment 1 (week 1) should cover all the basic functions of openGL to get students familiar with Graphics Environment. Hence, this assignment is not included in Practical Exam.
3. The different objects/shapes/patterns should be drawn for implementation of drawing algorithm.
4. All the assignments should explore the conceptual understanding of students.
5. The keyboard/Mouse interfaces should be used wherever possible.

Guidelines for PRACTICAL EXAM conduction

1. There will be 2 problem statements options and student will have to perform any one.
2. All the problem statements carry equal weightage.

Virtual Laboratory

- https://cse18-iiith.vlabs.ac.in/
- http://vlabs.iitb.ac.in/vlabs-dev/labs/cglab/index.php

Suggested List of Laboratory Assignments

1. Install and explore the OpenGL -- **CO1**

2. Implement DDA and Bresenham line drawing algorithm to draw: i) Simple Line ii) Dotted Line iii) Dashed Line iv) Solid line ;using mouse interface Divide the screen in four quadrants with center as (0, 0). The line should work for all the slopes positive as well as negative.

3. Implement Bresenham circle drawing algorithm to draw any object. The object should be displayed in all the quadrants with respect to center and radius- **C02**

4. Implement the following polygon filling methods : i) Flood fill / Seed fill ii) Boundary fill ; using mouse click, keyboard interface and menu driven programming**- CO4**

5. Implement Cohen Sutherland polygon clipping method to clip the polygon with respect the viewport and window. Use mouse click, keyboard interface - **CO4**

6.Implement following 2D transformations on the object with respect to axis : – **CO5**

i) Scaling ii) Rotation about arbitrary point iii) Reflection

7. Generate fractal patterns using i) Bezier ii) Koch Curve - **CO5**

8. Implement animation principles for any object - **CO6**

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, McGraw-Hill Publications, 1987, ISBN 0-07-047371-4

3. F.S. Hill JR, "Computer Graphics Using OpenGL", Pearson Education

Reference Books

1. 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. D.P. Mukharjee, Debasish Jana, "Computer Graphics Algorithms and implementation", PHI Learning

7. Samuel R. Buss, "3D Computer Graphics", Cambridge University Press

8. Mario Zechner, Robert Green, "Beginning Android 4 Games Development", Apress, ISBN: 978-81-322-0575-3

9. Maurya, "Computer Graphics with Virtual Reality Systems, 2ed.", Wiley, ISBN-9788126550883

10. Foley, "Computer Graphics: Principles & Practice in C", 2e, ISBN 9788131705056, Pearson

Home

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214458: Project Based Learning

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR): 04hrs/week	02	TW : 50 Marks

Prerequisite Courses, if any:

Preamble:

Project Based Learning (PBL) is an instructional approach that emphasizes critical-thinking, collaboration and personalized learning. In PBL, student groups engage in meaningful inquiry that is of personal interest to them. These projects are based on problems, which are real-life oriented, curriculum-based and often interdisciplinary. Students decide how to approach a problem and what activities or processes they will perform. They collect information from a variety of sources, analyze, synthesize and derive understanding from it. The real-world focus of PBL activities is central to the process because it motivates students and adds value to their work. Their learning is connected to something real and involves life skills such as collaboration and reflection. The faculty assigned to the group is referred as mentor. Technology enables students and Mentor in various phases of the PBL process. At the end of the PBL, students demonstrate their newly acquired knowledge and are evaluated by how much they have learned and how well they communicate it. Students also conduct self-evaluation to assess their own growth and learning. Throughout this process, the mentor's role is to guide and advise students, rather than to direct and manage student work.

Companion Course: Online courses relevant to the project, along with expert lecture on Intellectual property rights, patents and software engineering.

Course Objectives :

1. To learn the various processes involved in project based learning.
2. To develop critical thinking and engineering problem solving skills amongst the students.
3. To explain the roles and responsibilities of IT engineers to the solution of engineering problems within the social, environmental and economic context.
4. To equip the students with knowledge and skills require to develop solutions for the problems coming from various Hackathon.

Course Outcomes

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

CO1: Design solution to real life problems and analyze its concerns through shared cognition.

CO2: Apply learning by doing approach in PBL to promote lifelong learning.

CO3: Tackle technical challenges for solving real world problems with team efforts.

CO4: Collaborate and engage in multi-disciplinary learning environments.

COURSE CONTENTS

Group Structure

Group structure should enable students to work in mentor–monitored groups. The students plan, manage and complete a task/project / activity which addresses the stated problem.

1. There should be a team of 3 to 6 students who will work cohesively.
2. A Mentor should be assigned to individual groups who will help them with learning and development process.

Selection of Project/Problem

1. The project scope/topic can be from any field/area, but selection related to IT technical aspect is desirous.
2. The project/problem done in first year engineering could be extended further, based on its potential and significance analysis.
3. Project/problem requiring solutions through conceptual model development and use of software tools should be preferred.
4. Different alternate approaches such as theoretical, practical, working model, demonstration or software analysis should be used in solving/implementing of project/problem.
5. The project/problem requiring multi-disciplinary approach to solve it, should be preferred.
6. Problem may require in depth study of specific practical, scientific or technical domain.
7. Hands-on activities, organizational and field visits, interacting with research institutes and expert consultation should be included in the approach to make students aware of latest technologies.

Assessment

The department should be committed to assess and evaluate both student performance and solution impact.

Progress of PBL will be monitored regularly on weekly basis. Weekly review of the work is necessary. During process of monitoring and continuous assessment and evaluation the individual and team performance is to be measured by mentor.

Students must maintain an institutional culture of authentic collaboration, self- motivation, peer-learning and personal responsiveness. The institution/department should support students in this regard through guidance/orientation programs and the provision of appropriate resources and services. Supervisor/mentor and students must actively participate in assessment and evaluation processes. Group may demonstrate their knowledge and skills by developing a public product and/or report and/or presentation.

1. Individual assessment for each student (Understanding individual capacity, role and involvement in the project).

2. Group assessment (roles defined, distribution of work, intra-team communication and togetherness.

3. Documentation and presentation.

Evaluation and Continuous Assessment

It is recommended that the all activities are to be recorded in PBL workbook, regular assessment of work to be done and proper documents are to be maintained at college end by both students as well as mentor.

The PBL workbook will reflect accountability, punctuality, technical writing ability and work flow of the task undertaken. Continuous Assessment Sheet (CAS) is to be maintained by all mentors/department.

Recommended parameters for assessment, evaluation and weightage:

1. Idea Inception (5%)
2. Outcomes of PBL/Problem Solving Skills/Solution provided/Final product**(40%)** (Individual assessment and team assessment)
3. Documentation (Gathering requirements, design & modeling, implementation/execution, use of technology and final report, other documents **(25 %)**
4. Potential for the patent**(10%)**
5. Demonstration (Presentation, User Interface, Usability etc.) **(10%)**
6. Contest Participation/ publication **(5%)**
7. Awareness /Consideration of Environment/ Social /Ethics/ Safety measures/Legal aspects **(5%).**

Design the rubrics based on the above parameters for evaluation of student performance

Faculty / Mentor is expected to perform following activities

Faculty/ Mentor is expected to perform following activities:

Revision of PBL concepts
Skill assessment of students
Formation of diversified and balanced groups
Share information about patent, copyright and publications to make students aware about it
Discussion of sample case studies
Design of the rubrics for evaluation of student performance
Discussion of the rubrics with students
Weekly Assessment of the deliverables such as Presentation, Report, Concept map, logbook
Scaffolding of the students
Summative and Formative assessment

Reference Books:

1. Project-Based Learning, Edutopia, March 14,2016.
2. What is PBL? Buck Institute forEducation.
3. www.schoology.com
4. www.wikipedia.org
5. www.howstuffworks.com

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019Course)
214459 (A) : Mandatory Audit course 4:
Water Supply and Management

Home

Teaching Scheme:	Credit Scheme:	Examination Scheme:
01hrs/week	Non Credit	Audit Course

Prerequisite Courses: Basic knowledge of environmental science and mathematics

Course Objectives:

1. Enable the student to understand the various components of environment in and around the earth crust and understand the effects of it over plants, animals, etc
2. Understand the important concepts of good water supply system to a city/town or a village
3. Understand the need of conservation of rain water and its applications
4. Understand the sources, effects, prevention and control measures of water pollution and its legislative aspects.

Course Outcomes:

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

CO1: Relate the relations between the environment and ecology, estimating water requirement for public water supply scheme.

CO2: Assess the quality of water as per BIS and select the appropriate treatment method required for the water source.

CO3: Analyze the suitable distribution system for a locality and know the appurtenances used.

CO4: Summarize the arrangement of water supply and fittings in a building.

CO5: Determine the need of conservation of water and rural water supply.

CO6: Identify the sources of water pollution and suitable control measures.

COURSE CONTENTS

Unit I	Introduction To Environment, Water Requirement And Water Sources	02 hrs

ENVIRONMENT AND ECOLOGY: Atmosphere, Lithosphere, Hydrosphere, Biosphere. Relation between Plant, Animals and Environment. Eco System, Man and Ecology.

WATER REQUIREMENT: Necessity of water supply, Methods of population forecasting (Arithmetical, Geometrical and Incremental Increase method), Water Requirements for a) Domestic Purpose b) Industrial Use c) Fire Fighting d) Public Purpose e) Losses. Per Capita Demand and Factors affecting it. Total Quantity of Water Required for a Town.

SOURCES OF WATER: Surface Sources - Lakes, Streams, Rivers. Impounded Reservoirs. Underground Sources - Infiltration Galleries, Infiltration Wells and Springs

Mapping of Course Outcomes for Unit I	CO1

Unit II	Quality And Treatment Of Water	02 hrs

QUALITY OF WATER: Impurities of water - organic and inorganic classification and examination of water. Physical - temperature, color, turbidity, taste and odour. Chemical - pH Value, Total Solids, Hardness, Chlorides, Iron and Manganese, Fluoride and Dissolved Oxygen. Bacteriological- E-coli, Most Probable Number (MPN), Quality Standards for Domestic purpose as perBIS.

TREATMENT OF WATER: Flow diagram of different units of treatment, brief description of constructional details, working and operation of the following units - plain sedimentation, sedimentation with coagulation, flocculation, filtration-Slow sand filters, Rapid sand filters and pressure filters (nodesign) Disinfection of water, Chlorination		
Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**Water Distribution System**	**02 hrs**
DISTRIBUTION SYSTEM: General Requirements, Systems of Distribution- Gravity System, Combined System, Direct Pumping. Maintenance of required pressure in Distribution Systems. Storage- Underground, Ground Level And OverheadServiceReservoirs– Sketch,NecessityandAccessories.Typesoflay- out : dead end, grid iron, radial and ring systems, their merits and demerits and their suitability **APPURTENANCES IN DISTRIBUTION SYSTEM:** Use of Sluice Valves, Check Valves, Air Valves, Scour Valves, Zero Velocity Valves, Fire Hydrants, Water Meter		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Water Supply In Buildings**	**02 hrs**
Water Supply arrangement in Buildings: General lay-outofwatersupplyarrangementforsingleandmulti-storiedbuildingsasperB.I.S code of practice. Pipe Materials- Plastic Pipes, High Density Polythene Pipes, Densified cast iron pipes, Merits and Demerits. Connections from water main to buildings. Water supply fittings - their description and uses, water main, service pipes, supply pipe, distribution pipe, domestic storage tank, stop cock, ferrule, goose neck, water tap, Modern systems of Potable water purification-(RO, UV, Activated carbon), Hot water supply - electric and solar waterheaters.		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**Water Conservation**	**02hrs**
WATER CONSERVATION: Conservation of rain water, roof water harvesting, recharging of ground water. RURAL WATER SUPPLY: Rural water supply systems, Disinfection of well water.		
Case Studies:	Refer suggested list of Case studies/ Students activities	
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**Water Pollution And Pollution control**	**02 hrs**
WATER POLLUTION AND CONTROL: Sources of water pollution, types and its effects, Prevention and control measures of water pollution, Legal aspects regarding water pollution control.		

Mapping of Course Outcomes for Unit V	CO6

Reference Books :

1. S.K.Garg, Water Supply Engineering Vol-I, Khanna Publishers
2. G.S.Birdie,Water Supply & Sanitary Engineering-including Environmental Engineering, water And air pollution and Ecology, Dhanpat RaiandSons publishers,ISBN:81-87433-31-0
3. Dr. P.N. Modi, Environmental Engg.-Vol-I, Standard BookHouse
4. A.K.Chatterji,WaterSupply,WasteDisposalandEnvironmentalPollution Engineering, Khanna publishers

SUGGESTED LIST OF CASE STUDIES/STUDENTACTIVITIES

1. Collect the information about biotic and a biotic component of surrounding environment and frame relation among them
2. Estimatethetotalquantityofwaterrequiredforatown/locality/Institute
3. Prepare map and written report for surface and underground sources of water in the neighborhood
4. Visit nearby Certified Water testing laboratories and identify various tests conducted on water
5. Visit Water Treatment Plant and collect details of unit operations and processes involved in it.
6. Study the distribution system of water supply of your locality
7. Visit a newly constructed building and study plumbing work
8. Study a rooftop rain water harvesting system of existing building
9. Study a Solar water heating system and collect necessary data
10. Collect a necessary data/information about issues related to water pollution and Prepare report/presentation

Evaluation:

Students should select any one of the above topic in a group of 3 to 5. Students should submit a written report and make a presentation on the topic. The task should not be repeated among students. Report will be evaluated by the faculty as per rubrics defined by him/her/them at start of course.

Home

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019Course)
214459 (B): Mandatory Audit course 4 :
Language Study Japanese : Module - II

Teaching Scheme:	Credit Scheme:	Examination Scheme:
01hrs/week	Non Credit	Audit Course

Prerequisite Courses: Audit Course 3**:** Language Study Japanese: Module-I

Course Objectives :

1. To develop the Japanese communicative competence of students with small sentence formation.to make primitive social conversation in Japanese.
2. To enable students with comprehension ability of Japanese grammar.
3. To enable students to translate simple conversations from English to Japanese and vice a versa.
4. To make students aware about Japanese Culture and Customs.

Course Outcomes :

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

CO1: Have Japanese Communicative competence for primitive Social conversation in Japanese
CO2: Comprehend Grammar of Japanese Script
CO3: Translate simple sentences from Japanese to English and vice a versa
CO4: Be aware about Japanese society and people

COURSE CONTENTS

Unit I	Japanese Conversation	(02 hrs +04hrs Self Study)

Oral practice of conversation in situations such as declining an invitation, reporting an event, narrating a story, short formal speeches on occasions such as welcoming, introducing and thanking a guest, talking about Japanese and Indian festivals, hostel life etc

Mapping of Course Outcomes for Unit I	CO1

Unit II	Japanese Text and Kanji	(02hrs +04 hrs Self Study)

Diverse texts based on Japanese culture, customs, history, food habits, and science etc, for the development of communicative competence of students; skimming, scanning of texts with emphasis on advanced sentence patterns, grammatical structures and idiomatic phrases, reading and writing of approximately 400 *kanji*.

Mapping of Course Outcomes for Unit II	CO2,CO3

Unit III	Japanese Grammar and Composition	(02 hrs +04 hrs Self Study)

Basic sentence patterns to be applied in self introduction, identifying things; time of the day; calendar; counting using Japanese numerical classifiers; describing things; making comparisons; talking of daily activities; kinship terms used for address and reference; seasons; giving and receiving; shopping; making requests; talking of one's likes and dislikes

Mapping of Course Outcomes for Unit III	**CO2, CO3**	
Unit IV	**Japanese – English Translation**	**(02hrs +04 hrs Self Study)**
Practice in English to Japanese and Japanese to English translation of short passages on various topics such as culture, society, religion and life style taken from books, newspapers, magazines, internet etc.		
Mapping of Course Outcomes for Unit IV	**CO3**	
Unit V	**Language and Literature of Japan**	**(02 hrs.)**
History of Japanese language, literary trends, religions, spread of Chinese influence, development of art and culture in Japan.		
Mapping of Course Outcomes for Unit V	**CO4**	

E-Resources for Learning Support:

1. **https://www.duolingo.com/course/ja/en/Learn-Japanese**
2. **https://www.freejapaneselessons.com/**
3. **https://minato-jf.jp/(Japan Foundation)**

Text Books:

1. EriBanno, Genki I: An Integrated Course in Elementary Japanese , 3rd Edition 2020, The Japan Times, (ISBN13: 9784789017305)
2. George Trombley , Yukari Takenaka, Japanese From Zero, 6th Edition, Learn From Zero Publishers (ISBN10- 0976998122, ISBN13-9780976998129)
3. Tae Kim, A Guide to Japanese Grammar, 2012, CreateSpace Publishing, (ISBN-1469968142, ISBN13- 9781469968148) http://www.guidetojapanese.org/learn/grammar

Reference Books:

1. Yukiko Ogata, Kana Sumitani, Yasuko Hidari, Yukiko Watanabe, Nihongo fun and Easy -II, Basic Grammar for Conversation
2. Nobuo Akiyama, Carol Akiyama, Japanese Grammar (Barron's Grammar), 3rd edition 2012, Barrons Educational Series
3. Storry Richard, A History Of Modern Japan, 1973, Penguin Books Ltd,
4. James W. Heisig, Remembering the Kanji 1 : A Complete Course on How Not To Forget the Meaning and Writing of Japanese Characters, 6h Edition, University of Hawai'i Press (ISBN10-0824835921, ISBN13-9780824835927)

Evaluation:

Students should select any one of the above topic in a group of 3 to 5. Students should submit a written report and make a presentation on the topic. The task should not be repeated among students. Report will be evaluated by the faculty as per rubrics defined by him/her/them at start of course.

Home

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019Course)
214459 (C): Mandatory Audit course 4 :
e-Waste Management and Pollution Control

Teaching Scheme:	Credit Scheme:	Examination Scheme:
01hrs/week	Non Credit course	Audit Course

Prerequisite Courses: if any: --

Course Objectives :

1. To make the students aware about importance of environmental study.
2. To study impact of professional engineering products in societal contexts.
3. To understand impact of professional engineering products in environmental contexts.
4. To learn e-waste management and e-waste recycling process.
5. To understand causes, effects and control measures of environment pollutions.
6. To learn impact of environment controlling methods on human health.

Course Outcomes :

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

CO1: Discuss various types of e-waste sources.
CO2: Understand impact of various e-wastes.
CO3: Identify characteristics of various e-Waste pollutants.
CO4: Understand process of e-Waste Recycling and relevant technologies.
CO5: Discuss causes, effects and control measures of different environment pollution.
CO6: Demonstrate Safe methods for disposal of e-waste and controlling the pollution.

COURSE CONTENTS

Unit I	E-Waste Overview and Sources	02 hrs

e-waste Overview: What is e-waste, E-waste growth- An overview, hazards of e-waste **Sources of e-wastes:** Discarded computers, televisions. VCRs. stereos, copiers, fax machines, electric lamps, cell phones, audio equipment and batteries if improperly disposed.

Mapping of Course Outcomes for Unit I	CO1

Unit II	Impact of various e-wastes	02 hrs

Solder in printed circuit boards, glass panels and monitors, Chip resistors and semiconductors, Relays and switches, Printed Circuit Boards, Cabling and computer housing, Plastic housing of electronic equipment and circuit boards, Front panel of CRTs, Motherboards.

Mapping of Course Outcomes for Unit II	CO2

Unit III	E- Waste pollutants and Characteristics	02 hrs

Digital dump yard, how to minimize e-waste, Hazardous substances waste Electrical and Electronic Equipment, characteristics of pollutants, batteries, electrical and electronic

components, plastic and flame retardants, circuit boards, pollutants in waste electrical and electronic equipment.		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**E-Waste Recycling**	**02 hrs**
Overview of e-Waste recycling, Technologies for recovery of resources from electronic waste, resource recovery potential of e-waste, steps in recycling and recovery of materials-mechanical processing, technologies for recovery of materials		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**Environmental Pollution**	**02 hrs**
Causes and effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, nuclear hazards, Role of an individual in prevention of pollution, Pollution case studies: Pollution caused because of electronic waste material and measures for controlling.		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**Impact on human health and Pollution Controlling**	**02 hrs**
Impact of products from e-waste in human health, Current disposal methods of e-waste, e-waste recycling technologies and methods recycling pose a risk to environmental and human health. Safe methods for disposal of e-waste and controlling relevant pollution.		
Mapping of Course Outcomes for Unit VI	**CO6**	
E-Resources from Learning Support		
1.https://nptel.ac.in/courses/105/105/105105169/ **2.https://www.ugc.ac.in/oldpdf/modelcurriculum/env.pdf**		
Text Books		
1. E-Waste Managing the Digital Dump Yard, Edited by Vishakha Munshi,ICFAI University Press,2007. 2. Text Book of Environmental Studies for undergraduate Courses by Bharucha Erach,University Press, II- Edition 2013 Available online free edition.		
Reference Books		
1. E-waste: Implications, Regulations and Management in India and Current Global Best Practices, Edited by Rakesh Johri, The Energy and Resources Institute, New Delhi,2008		
Evaluation:		
Students should select any one of the above topic in a group of 3 to 5. Students should submit a written report and make a presentation on the topic. The task should not be repeated among students. Report will be evaluated by the faculty as per rubrics defined by him/her/them at start of course.		

Home

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019Course)
214459 (D): Mandatory Audit course 4 :
Intellectual Property Rights

Teaching Scheme:	Credit Scheme:	Examination Scheme:
01hrs/week	Non Credit	Audit Course

Prerequisite Courses, if any: ---

Course Objectives

1. To introduce fundamental aspects of Intellectual property Rights (IPR)
2. To disseminate knowledge about types of IP like Patents, Copyrights, Trade Secrets
3. To make students aware about current trends in IPR and their importance
4. To motivate students for innovative thinking and making inventions

Course Outcomes

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

CO1: Exhibit the concepts of Intellectual Property Rights

CO2: Differentiate among different IPR

CO3: Formulate and characterize innovative ideas and inventions into IPR

CO4: Demonstrate knowledge of advances in patent law and IP regulations

COURSE CONTENTS

Unit I	Overview Of Intellectual Property	02 hrs

Introduction and the need for intellectual property right (IPR) - Types of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design – Genetic Resources and Traditional Knowledge – Trade Secret.

Mapping of Course Outcomes for Unit I	CO1, CO2

Unit II	Patents	04 hrs

What is invention? Patentability criteria: Novelty, Non-Obviousness (Inventive Steps), Industrial Application, Non- Patentable Subject Matter, Patent Search, Patent Registration Procedure, Rights and Duties of Patentee, Assignment and license, Infringement.

Mapping of Course Outcomes for Unit II	CO3, CO4

Unit III	Copyrights	02 hrs

Concept of Copyright –Copyright Subject matter: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and license of copyright - Infringement

Mapping of Course Outcomes for Unit III	CO3

Unit IV	Trademarks	02 hrs
Nature of Trademarks - Different kinds of trademarks (, logos, signatures, symbols, well known marks, brand names, certification and service marks) – Trademarks that can't be registered– Trademarks registration procedure - Rights of holder and assignment and licensing of marks - Infringement		
Mapping of Course Outcomes for Unit IV	**CO3**	
Unit V	**Advances in IP Laws and Government policies**	**02 hrs**
Amendments and India`s New National IP Policy, Promoting IPR policy for Start-ups, Career Opportunities in IP - IPR in current scenario		
Mapping of Course Outcomes for Unit V	**CO4**	

Text Books

1. Niraja Pandey, Khush deep Dharni (2014), "Intellectual Property Rights", PHI
2. Nithyananda K V. (2019). Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited

Reference Books

1. Mishra, "An introduction to Intellectual property Rights", Central Law Publications
2. Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis

Evaluation:

Students should select any one of the above topic in a group of 3 to 5. Students should submit a written report and make a presentation on the topic. The task should not be repeated among students. Report will be evaluated by the faculty as per rubrics defined by him/her/them at start of course.

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**					

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414453: Information and Cyber Security

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

Prerequisites:

1. Data Communication.
2. Computer Network.

Course Objectives:

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

Course Outcomes:

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

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

Unit I	SECURITY BASICS	7 Hrs

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

Unit II	SYMMETRIC AND ASYMMETRIC KEY CRYPTOGRAPHY	7Hrs

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

Unit III	DATA INTEGRITY ALGORITHMS AND SECURITY REQUIREMENTS	7 Hrs

Cryptographic Hash Functions, requirements and security, SHA-1, SHA-3, Digital Signatures, X.509 Certificate, Kerberos, IP Security: Architecture Protocols IPv4, IPv6, AH, EPS, ISAKMP, Web Security: SSL, HTTPS, Mail Security: PGP, S/MIME

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

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

Unit V	INTRODUCTION TO CYBER LAWS	7 Hrs

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

Unit VI	TOOLS AND METHODS USED IN CYBERCRIME	7 Hrs

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

Text Books

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

Reference Books

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

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

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

Prerequisites:

Linear Algebra and Calculus, Probability Basics

Course Objectives:

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

Course Outcomes:

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

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

Unit I	INTRODUCTION TO MACHINE LEARNING	8 Hrs

Introduction: What is Machine Learning, Examples of Machine Learning applications, Training versus Testing, Positive and Negative Class, Cross-validation.
Types of Learning: Supervised, Unsupervised and Semi-Supervised Learning.
Dimensionality Reduction: Introduction to Dimensionality Reduction, Subset Selection, Introduction to Principal Component Analysis.

Unit II	CLASSIFICATION	8 Hrs

Binary and Multiclass Classification: Assessing Classification Performance, Handling more than two classes, Multiclass Classification-One vs One, One vs Rest Linear Models: Perceptron, Support Vector Machines (SVM), Soft Margin SVM, Kernel methods for non-linearity

Unit III	REGRESSION AND GENERALIZATION	8 Hrs

Regression: Assessing performance of Regression – Error measures, Overfitting and Underfitting, Catalysts for Overfitting, VC Dimensions
Linear Models: Least Square method, Univariate Regression, Multivariate Linear Regression, Regularized Regression - Ridge Regression and Lasso
Theory of Generalization: Bias and Variance Dilemma, Training and Testing Curves Case Study of Polynomial Curve Fitting.

Unit IV	LOGIC BASED AND ALGEBRAIC MODELS	8 Hrs

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

Unit V	PROBABILISTIC MODELS	8 Hrs

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

Unit VI	TRENDS IN MACHINE LEARNING	8 Hrs

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

Text Books

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

Reference Books

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

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

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

Prerequisites:

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

Course Objectives:

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

Course Outcomes:

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

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

Unit I	OBJECT ORIENTED METHODOLOGIES, UML	7 Hrs

Views of Software Developments: Traditional System Development Methodology and Object Oriented Analysis and Design, Importance Object –Orientation

Some of the object Oriented Methodology:- Object Oriented Design –Booch, Object Modeling Techniques – Rumbaugh, Object – Oriented Analysis - Cood Yourdon, Object – Oriented Software Engineering – Ivar Jacobson

Unified Approach: Object Oriented Analysis, Object Oriented Design, Iterative Development & Continuous Testing, Modeling Based on UML, Layered Approach,

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

Unit II	OBJECT ORIENTED ANALYSIS	7 Hrs

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

Unit III	INTERACTION AND BEHAVIOR MODELING	7 Hrs

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

Unit IV	OBJECT ORIENTED DESIGN	7 Hrs

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

Unit V	DESIGN PRINCIPLES AND PATTERNS	7 Hrs

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

Unit VI	ARCHITECTURAL DESIGN	7 Hrs

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

Text Books

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

Reference Books

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

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

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

Prerequisites:

1. Foundations of Communication and Computer network.
2. Computer Network Technology.

Course Objectives:

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

Course Outcomes:

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

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

Unit I	INTRODUCTION TO WIRELESS COMMUNICATION SYSTEM	7 Hrs

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

Personal Area Networks		
Unit II	**THE CELLULAR CONCEPT- SYSTEM DESIGN FUNDAMENTALS**	**7 Hrs**
Cellular system, Hexagonal geometry cell and concept of frequency reuse, Channel Assignment Strategies Distance to frequency reuse ratio, Channel & co-channel interference reduction factor, S/I ratio consideration and calculation for Minimum Co-channel and adjacent interference, Handoff Strategies, Umbrella Cell Concept, Trunking and Grade of Service, Improving Coverage & Capacity in Cellular System-cell splitting, Cell sectorization, Repeaters, Micro cell zone concept, Channel antenna system design considerations.		
Unit III	**MOBILE RADIO PROPAGATION MODEL, SMALL SCALE FADING AND DIVERSITY**	**7 Hrs**
Large scale path loss: Free Space Propagation loss equation, Path-loss of NLOS and LOS systems, Reflection, Ray ground reflection model, Diffraction, Scattering, Link budget design, Max. Distance Coverage formula, Empirical formula for path loss, Indoor and outdoor propagation models, Small scale multipath propagation, Impulse model for multipath channel, Delay spread, Feher's delay spread, upper bound Small scale, Multipath Measurement parameters of multipath channels, Types of small scale Fading, Rayleigh and rician distribution, Statistical for models multipath fading channels and diversity techniques.		
Unit IV	**MULTIPLE ACCESS TECHNIQUES**	**7 Hrs**
Access Methods: TDMA (TDD and FDMA); Spread-Spectrum Frequency-Hopping; Direct-Sequence CDMA and CSMA. Comparison of Linearly Amplified BPSK, DQPS and DQPSK and Nonlinearly Amplified (NLA) GMSK, GFSK, 4-FM, and FQPSK Radio Equipment (Coherent and Noncoherent). Radio Link Design of Digital Wireless Cellular Systems. Spectrum Utilization in Digital Wireless Mobile Systems. Capacity and Throughput (Message Delay) Study and Comparison of GMSK, GFSK, and FQPSK Modulated Wireless Systems. Time Division Multiple Access Wireless Cellular Systems. Code Division Multiple Access Spread-Spectrum Digital Cellular IS-95 System.		
Unit V	**WIRELESS SYSTEMS**	**7 Hrs**
GSM system architecture, Radio interface, Protocols, Localization and calling, Handover, Authentication and security in GSM, GSM speech coding, Concept of spread spectrum, Architecture of IS-95 CDMA system, Air interface, CDMA forward channels, CDMA reverse channels, Soft handoff, CDMA features, Power control in CDMA, Performance of CDMA System, RAKE Receiver, CDMA2000 cellular technology, GPRS system architecture.		
Unit VI	**RECENT TRENDS**	**7 Hrs**
Introduction to Wi-Fi, WiMAX, ZigBee Networks, Software Defined Radio, UWB Radio, Wireless Adhoc Network and Mobile Portability, Security issues and challenges in a Wireless network.		
Text Books		

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

Reference Books

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

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

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

Prerequisites:

1. Basic understanding of probability theory.
2. Basic knowledge of finite automata.

Course Objectives:

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

Course Outcomes:

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

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

Unit I	INTRODUCTION	7 Hrs

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

Unit II	GRAMMARS	7 Hrs

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

Unit III	EFFICIENT PARSING	7 Hrs

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

Unit IV	AMBIGUITY RESOLUTION	7 Hrs

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

Unit V	LINKING SYNTAX AND SEMANTICS	7 Hrs
Semantic Interpretation and Compositionality, Prepositional Phrases and Verb Phrases, Lexicalized Semantic Interpretation and Semantic Roles, Handling Simple Questions, Semantic Interpretation Using Feature Unification, Semantic Filtering Using Selectional Restrictions, Semantic Networks, Statistical Word Sense Disambiguation		
Unit VI	**KNOWLEDGE REPRESENTATION**	**7 Hrs**
Handling Natural Language Quantification, Time and Aspectual Classes of Verbs, Automating Deduction in Logic-Based Representations, Procedural Semantics and Question Answering, Hybrid Knowledge Representations, Using World Knowledge, Establishing Coherence, Matching Against Expectations, Reference and Matching Expectations, Using Knowledge About Action and Casualty.		

Text Books

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

Reference Books

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

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

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

Prerequisites:

1. Human Computer Interaction.

Course Objectives:

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

Course Outcomes:

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

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

Unit I	INTRODUCTION	7 Hrs

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

Unit II	THE USABILITY ENGINEERING LIFECYCLE	7 Hrs

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

Unit III	USABILITY HEURISTICS	7 Hrs

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

Unit IV	USABILITY TESTING	7 Hrs
Usability Testing: Test Goals and Test Plans, Getting Test Users, Choosing Experimenters, Ethical Aspects of Tests with Human, Subjects, Test Tasks, Stages of a Test, Performance Measurement, Thinking Aloud, Usability Laboratories. Usability Assessment Methods beyond Testing: Observation, Questionnaires and Interviews, Focus Groups, Logging Actual Use, User Feedback, Choosing Usability Methods.		
Unit V	**INTERFACE STANDARDS**	**7 Hrs**
Interface Standards: National, International and Vendor Standards, Producing Usable In-House Standards. International User Interfaces: International Graphical Interfaces, International Usability Engineering Guidelines for Internationalization Resource Separation, Multi-locale Interfaces.		
Unit VI	**FUTURE DEVELOPMENTS**	**7 Hrs**
Future Developments: Theoretical Solutions, Technological Solutions, CAUSE Tools: Computer-Aided Usability Engineering, Technology Transfer, Ubiquitous Computing, Intelligent User-interfaces, Simulation and Virtual Reality. Case Study: Usability Issues in Organizations, Organizational Roles and Structures, Ethics of Usability, Web Analytics.		

Text Books

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

Reference Books

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

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

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

Prerequisites:

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

Course Objectives:

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

Course Outcomes:

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

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

Unit I	INTRODUCTION	7 Hrs

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

Unit II	MULTICORE AND CONCURRENT PROGRAM DESIGN	7 Hrs

The PCAM methodology, Decomposition patterns: Task parallelism, Divide-and-conquer decomposition.

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

Unit III	SHARED-MEMORY PROGRAMMING: THREADS	7 Hrs
Threads, Design concerns, Semaphores, Applying semaphores in classical problems, Monitors, Applying monitors in classical problems, Dynamic vs. static thread management, Debugging multithreaded applications, Higher-level constructs: multithreaded programming without threads: Concurrent Map, Map-Reduce, Concurrent filter, Filter-reduce.		
Unit IV	**SHARED-MEMORY PROGRAMMING: OPENMP**	**7 Hrs**
Introduction, OpenMP integration V.0: manual partitioning, OpenMP integration V.1: manual partitioning without a race condition, OpenMP integration V.2: implicit partitioning with locking, OpenMP integration V.3: implicit partitioning with reduction, Loop-level parallelism, Task parallelism, Synchronization constructs, Correctness and optimization issues.		
Unit V	**DISTRIBUTED MEMORY PROGRAMMING**	**7 Hrs**
Communicating processes, MPI, Core Concepts, Program architecture, Point-to-Point communication, Buffered communications, Non-blocking communications, Error reporting and handling, Collective communications, Communicating objects, Node management: communicators and groups, One-sided communications, I/O considerations, Combining MPI processes with threads, Timing and performance measurements, Debugging and proiling MPI programs, The Boost MPI library.		
Unit VI	**GPU PROGRAMMING**	**7 Hrs**
CUDA's programming model: threads, blocks, and grids, CUDA's execution model: streaming multiprocessors and warps, CUDA compilation process, Memory hierarchy, Optimization techniques, Dynamic parallelism, Debugging CUDA programs, Proiling CUDA programs, CUDA and MPI.		

Text Books

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

Reference Books

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

Hill, 2003.
7. Shameem Akhter and Jason Roberts, “Multi-core Programming”, Intel Press, 2006.
8. Roscoe A.W., “Understanding Concurrent Systems”, Springer-Verlag, 2010.

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

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

Prerequisites:

1. Fundamentals of Database Management System.
2. Fundamentals of Discrete mathematics.

Course Objectives:

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

Course Outcomes:

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

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

Unit I	Decision Making and Decision Support Systems	7 Hrs

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

Unit II	Business Intelligence Concepts and Platform Capabilities	7 Hrs

Definition of business intelligence (BI), BI architecture, and its components, and relation with DSS. The main components of BI platforms, their capabilities, and the competitive landscape of BI platforms. The building blocks of business reports, the types of business reports, and the components and structure of business reporting systems. Role of Mathematical model in BI, Factors Responsible for successful BI Project, Obstacle to Business Intelligence in an Organization Different types of OLAP and their applications, and the differences between OLAP and OLTP.

Unit III	Data Visualization and Dashboard Design	7 Hrs

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

Unit IV	Business Performance Management Systems	7 Hrs

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

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

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

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

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

Text Books

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

Reference Books

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

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

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

Prerequisites:

1. Prior knowledge of fundamentals of computer network.

Course Objectives:

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

Course Outcomes:

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

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

Unit I	INTRODUCTION TO SDN: AN OVERVIEW	7 Hrs

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

Unit II	OPEN FLOW PROTOCOLS	7 Hrs

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

Unit III	NETWORK VIRTUALIZATION (NV)	7 Hrs

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

Unit IV	CONTROL PLANE	7 Hrs
Control Plane: Overview, Existing SDN Controllers including Floodlight and Open Daylight projects. Customization of Control Plane: Switching and Firewall Implementation using SDN Concepts.		
Unit V	**DATA PLANE**	**7 Hrs**
Data Plane: Software-based and Hardware-based; Programmable Network, Hardware. Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs.		
Unit VI	**NETWORK FUNCTIONS VIRTUALIZATION (NFV)**	**7 Hrs**
Introduction: Concepts, Comparison of NFV and NV, Implementation and Applications. Data Center Networks: Packet, Optical and Wireless Architectures, Network Topologies.		

Text Books

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

Reference Books

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

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414457B: Elective-II
Soft Computing

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

Prerequisites:

1. Linear Algebra and Calculus.
2. Probability Theory.

Course Objectives:

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

Course Outcomes:

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

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

Unit I	INTRODUCTION	7 Hrs

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

Unit II	NEURAL NETWORKS OVERVIEW	7 Hrs

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

Unit III	NEURAL NETWORK ARCHITECTURES	7 Hrs

Complex Architectures Learning: Competitive Learning-Self Organizing Maps, Hebbian Learning-Hopfield Networks, Boltzmann Machines, Adaptive Resonance Theory (ART) Networks, Bayesian Neural Networks, Deep Learning Architecture of Neural Networks, Applications of Neural Networks.

Unit IV	FUZZY LOGIC AND FUZZY SYSTEMS	7 Hrs

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

Unit V	**GENETIC ALGORITHMS**	**7 Hrs**

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

Unit VI	**ADVANCES IN SOFT COMPUTING**	**7 Hrs**

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

Text Books

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

Reference Books

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

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

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

Prerequisites:

1. Software Engineering.

Course Objectives:

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

Course Outcomes:

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

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

Unit I	SOFTWARE TESTING BASICS	7 Hrs

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

Unit II	TESTING TECHNIQUES AND LEVELS OF TESTING	7 Hrs

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

Unit II	TESTING TECHNIQUES AND LEVELS OF TESTING	7 Hrs

Using White Box Approach to Test design - Static Testing Vs. Structural Testing, Code Functional Testing, Coverage and Control Flow Graphs, Using Black Box Approaches to Test Case Design,

Random Testing, Requirements based testing, Decision tables, State-based testing, Cause-effect graphing, Error guessing, Compatibility testing, Levels of Testing -Unit Testing, Integration Testing, Defect Bash Elimination. System Testing - Usability and Accessibility Testing, Configuration Testing, Compatibility Testing.

Unit III	SOFTWARE TEST AUTOMATION AND QUALITY METRICS	

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

Unit IV	FUNDAMENTALS OF SOFTWARE QUALITY ASSURANCE	7 Hrs

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

Unit V	QUALITY ASSURANCE MODELS	7 Hrs

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

Unit VI	SOFTWARE QUALITY ASSURANCE TRENDS	7 Hrs

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

Text Books

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

Reference Books

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

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

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

Prerequisites:

1. Fundamentals of System Programming.
2. Computer Organization and architecture.
3. Processor Architecture and Interfacing.
4. Fundamentals of Data Structures, Data Structures and Files.
5. Theory of Computation: DFA, NFA, Regular expressions, Grammars

Course Objectives:

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

Course Outcomes:

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

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

Unit I	FUNDAMENTALS OF COMPILATION	7 Hrs

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

Unit II	MEMORY UTILIZATION	7 Hrs

Intermediate representations, translation into trees, canonical trees, taming conditional branches, algorithms for instruction selection; Register allocation: coloring by simplification, coalescing, precolored nodes, graph coloring implementation, register allocation for trees;

Garbage collection: Mark-and-sweep collection, copying, generational collection, incremental collection, Baker's algorithm, Interface to the compiler.

Unit III	OBJECT ORIENTED AND FUNCTIONAL PROGRAMMING LANGUAGE	7 Hrs

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

Unit IV	POLYMORPHIC TYPES AND DATA FLOW ANALYSIS	7 Hrs

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

Unit V	STATIC SINGLE ASSIGNMENT FORM	7 Hrs

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

Unit VI	PIPELINING AND SCHEDULING	7 Hrs

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

Text Books

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

Reference Books

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

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

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

Prerequisites:

1. Discrete Structures.

Course Objectives:

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

Course Outcomes:

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

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

Unit I	Gaming Foundations	7 Hrs

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

Unit II	Developing Thinking	7 Hrs

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

Unit III	Opponent Moves in Gamification	7 Hrs

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

Unit IV	Game Design	7 Hrs

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

Unit V	Advanced tools, techniques	7 Hrs

Gamification case Studies, Coding basic game Mechanics

Unit VI	Applications	7 Hrs

Instant Gamification Platforms, Mambo.io (Ref:http://mambi.io), Installation and use of BigDoor (OpenSourcehttp://bigdoor.com),ngageoint/gamification-server(ref:https://github.com/ ngageoint/ gamification-server).
Text Books
1. Mathias Fuchs, Sonia Fizek, Paolo Ruffino, Niklas Schrape, Rethinking Gamification. 2. http://meson.press/books/rethinking-gamification, Meson Press, First Edition,ISBN:978-3-95796-001-6. 3. Gabe Zechermann, Christopher Cunningham Gamification by Design, Oreilly media, First, ISBN: 978-1-449-39767-8.
Reference Books
1. Susan Jacobs, Getting Gamification Right, The eLearning Guild, First.

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

Teaching Scheme:	Credits:02	Examination Scheme:
Practical:04 Hours/Week		TW:50 Marks PR: 50 Marks

Prerequisites:

Knowledge of Programming Languages

1. Java.
2. R.
3. Python.
4. C++.

Course Objectives:

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

Course Outcomes:

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

1. The students will be able to implement and port controlled and secured access to software systems and networks.
2. The students will be able to build learning software in various domains.

List of Laboratory Assignments
PART –A (ICS) – (All Mandatory)

Assignment 1

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

Assignment 2

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

Assignment 3

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

Assignment 4

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

PART –B (MLA) (Any Six)

Assignment 1

Study of platform for Implementation of Assignments

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

Assignment 2

Supervised Learning - Regression (Using R) Generate a proper 2-D data set of N points. Split the data set into Training Data set and Test Data set. i) Perform linear regression analysis with Least Squares Method. ii) Plot the graphs for Training MSE and Test MSE and comment on Curve Fitting and Generalization Error. iii) Verify the Effect of Data Set Size and Bias-Variance Tradeoff. iv) Apply Cross Validation and plot the graphs for errors. v) Apply Subset Selection Method and plot the graphs for errors. vi) Describe your findings in each case
Assignment 3
Create Association Rules for the Market Basket Analysis for the given Threshold. (Using R)
Assignment 4
Implement K-Means algorithm for clustering to create a Cluster on the given data.(Using Python)
Assignment 5
Implement SVM for performing classification and find its accuracy on the given data. (Using Python)
Assignment 6
Creating & Visualizing Neural Network for the given data. (Using Python)
Assignment 7
On the given data perform the performance measurements using Simple Naïve Bayes algorithm such as Accuracy, Error rate, precision, Recall, TPR,FPR,TNR,FPR etc. (Using Weka API through JAVA)
Assignment 8
Principal Component Analysis-Finding Principal Components, Variance and Standard Deviation calculations of principal components.(Using R)
Reference Books
1. Open source software-WEKA and R and Python. 2. JAVA 6.1 or more (for RJava Package). 3. Dr. Mark Gardener, Beginning R The Statistical Programming Language, ISBN: 978-81-2654120-1, Wiley India Pvt. Ltd. 4. Jason Bell, “Machine Learning for Big Data Hands-On for Developers and Technical Professionals”, ISBN: 978-81-265-5337-2-1, Wiley India Pvt. Ltd.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414459: Computer Laboratory VIII

Teaching Scheme:	Credits:02	Examination Scheme:
Practical:04 Hours/Week		TW:50 Marks OR: 50 Marks

Prerequisites:

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

Course Objectives:

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

Course Outcomes:

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

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

List of Laboratory Assignments

Assignment 1: Write Problem Statement for System / Project

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

Assignment 2: Prepare Use Case Model

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

Assignment 3: Prepare Activity Model

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

Assignment 4: Prepare Analysis Model-Class Model

Identify Analysis Classes and assign responsibilities.
Prepare Data Dictionary.

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

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

Teaching Scheme:	Credits:02	Examination Scheme:
TUT:02 Hours/Week		OR:50 Marks

Prerequisites:

1. Project Based Seminar.

Course Objectives:

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

Course Outcomes:

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

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

Contents

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

Guidelines for Students and Faculty

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

Review 1: Synopsis –

Deliverables:

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

Review 2: SRS –

Deliverables:

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

One paper should be published in reputed International conference/International journal based on project work done.

Project report contains the details as Follows:

Contents
List of Abbreviations
List of Figures
List of Graphs
List of Tables

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

Appendices

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

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

Term Work:

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

Reference Books

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

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

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

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

Criteria

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

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

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

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

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

Audit Course V Options

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

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

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

Course Objectives:

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

Course Outcomes:

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

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

Unit I	Introduction to Emotional Intelligence (EI)

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

Unit II	Know and manage your emotions

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

Unit III	Recognize Emotions in others

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

Unit IV	Relate to others

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

Books

1) Daniel Goleman,” Emotional Intelligence – Why It Matters More Than IQ,” Bantam Books.

2) ISBN-10: 055338371X13: 978-0553383713 2. Steven Stein, “The EQ Edge”, Jossey-Bass, ISBN: 978-0-470-68161-9.
3) Drew Bird, “The Leader’s Guide to Emotional Intelligence”, ISBN: 9781535176002.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414461B: Audit Course-V
Green Computing

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

Course Objectives:

1) To acquire knowledge to adopt green computing practices to minimize negative impacts on the environment.
2) To examine technology tools that can reduce paper waste and carbon footprint by user.
3) To understand how to minimize equipment disposal requirements.
4) To gain skill in energy saving practices in their use of hardware.

Course Outcomes:

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

1) Understand the concept of green IT and relate it to sustainable development.
2) Apply the green computing practices to save energy.
3) Discuss how the choice of hardware and software can facilitate a more sustainable operation.
4) Use methods and tools to measure energy consumption.

Unit I	Fundamentals of Green IT

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

Unit II	Green Assets and Power Problems

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

Unit III	Green Information Systems

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

Unit IV	Green Grid Framework

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

Reference Books

1. Woody Leonhard, Katherrine Murray, “Green Home computing for dummies”, August2009, ISBN: 978-0-470-46745-9
2. Alvin Galea, Michael Schaefer, Mike Ebbers, “Green Data Center: steps for the Journey”,

Shoff/IBM rebook, 2011. ISBN: 10: 1-933742-05-4; 13: 978-1-933742-05-2
3. John Lamb, "The Greening of IT", Pearson Education, 2009, ISBN 10: 0137150830
4. Jason Harris, "Green Computing and Green IT- Best Practices on regulations & industry",Lulu.com, 2008, ISBN: 1558604898.
5. Bud E. Smith, "Green Computing Tools and Techniques for Saving Energy, Money and Resources", CRC Press, 2014, 9781466503403

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

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

Course Objectives:

1) Critical thinking is considered among the most important "higher order cognitive skills" expected from students graduating with professional degrees (e.g. engineering, management, etc.)
2) This course will make you a better thinker; it will sharpen your mind, clarify your thoughts, and help you make smarter decisions (especially about your career). It will help you argue assertively and hence make you a forceful communicator – both in public speaking and in one-on-one situations.
3) Most employers complain that fresh graduates need too much of direction and they are incapable of "independent decision making". We intend to overcome this shortcoming

Course Outcomes:

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

1) If students whole-heartedly participate in the course, they can expect to be smarter, stronger and more confident thinkers.
2) They can embark on a life-long journey of "self-directed learning".

Unit I	**Introduction to Critical Thinking**

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

Unit II	**Importance of being logical**

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

Unit III	**Pattern in deductive logic**

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

Unit IV	**Argumentation – Foundation of Critical Thinking**

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

Reference Books

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

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

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

Course Objectives:

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

Course Outcomes:

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

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

Unit I	**Introduction to Statistical Learning**

What is Statistical Learning, Various issues to consider while "modeling"

Unit II	**Getting started with R programming**

Introduction to the R-Studio, user-interface, Basic commands, Data Structures in R, Graphics, Reading data into R.

Unit III	**Linear Regression models including Lab**

Instructor should select a problem statement and design the assignment for Linear Regression.

Unit IV	**Classification models (Logistic Regression and LDA) with Lab**

Instructor should select a problem statement and design the assignment for Logistic Regression and LDA.

Unit VI	**Tree based methods (regression trees, classification tree) with Lab**

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

Reference Books

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

SEMESTER-II

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

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

Prerequisites:

1. Web Technology.
2. Computer Network Technology.
3. Operating System.

Course Objectives :

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

Course Outcomes :

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

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

UNIT I	FUNDAMENTALS AND ARCHITECTURES	7 Hrs

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

Case Study: The World Wide Web

UNIT II	COMMUNICATION AND COORDINATION	7 Hrs

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

Case Study: IBM's Websphere Message-Queuing System

UNIT III	REPLICATION AND FAULT TOLERANCE	7 Hrs

Replication: Reasons for replication, Replica management, Failure masking and replication, Consistency protocols, Catching and replication in web,Fault Tolerance: Introduction, Failure models, Fault systems with arbitrary failures, Reliable client server communication, Reliable group communication, Distributed commit, Recovery, Checkpoints.

Case Study: Catching and Replication in Web

UNIT IV	DISTRIBUTED FILES AND MULTIMEDIA SYSTEMS	7 Hrs

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

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

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

Case Study: BitTorrent and End System Multicast.

UNIT V	DISTRIBUTED WEB BASED SYSTEM	7 Hrs

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

Case Study: HyperText Transfer Protocol (HTTP)

UNIT VI	SECURITY IN DISTRIBUTED SYSTEMS	7 Hrs

Introduction to Security: Security Threats, Policies, and Mechanisms, Design Issues, Cryptography.

Secure Channels: Authentication, Message Integrity and Confidentiality, Secure Group Communication,

Access Control: General Issues in Access Control, Firewalls, Secure Mobile Code, Denial of Service (DOS).

Security Management: Key Management, Secure Group Management, Authorization Management.

Emerging Trends In Distributed Systems: Grid Computing, Service Oriented Architectures (SOA).

Case Study: Kerberos.

Text Books

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

Reference Books

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

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

Teaching Scheme:	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, legal background, Interpersonal privacy, Ubicomp challenges to privacy: Collection scale, manner and motivation, data types, data accessibility; Case study of privacy solution such as Protecting RFID tags, ways of addressing privacy in Ubicomp.

UNIT VI	UBIQUITOUS COMMUNICATION AND MANAGEMENT	7 Hrs

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

Text Books

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

Reference Books

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

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414464A: Elective III
Internet of Things (IoT)

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

Prerequisites:

1. Fundamentals of Communication and Computer Network.
2. Computer Network Technology.

Course Objectives :

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

Course Outcomes:

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

1. Explain what is internet of things.
2. Explain architecture and design of IoT.
3. Describe the objects connected in IoT.
4. Understand the underlying Technologies.
5. Understand the platforms in IoT.
6. Understand cloud interface to IoT.

UNIT I	INTRODUCTION TO INTERNET OF THINGS	8 Hrs

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

UNIT II	IoT NETWORK ARCHITECTURE AND DESIGN	8 Hrs

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

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

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

UNIT IV	ADDRESSING TECHNIQUES FOR THE IoT	8 Hrs

Address Capabilities, IPv6 Protocol Overview, IPv6 Tunneling, IPsec in IPv6, Header Compression Schemes, Quality of Service in IPv6, Migration Strategies to IPv6, Mobile IPV6 technologies for the IoT: Protocol Details, IPv6 over low-power WPAN (6LoWPAN).		
UNIT V	**IoT PLATFORMS**	**8 Hrs**
What is an IoT Device, Exemplary Devices: Raspberry Pi, Raspberry Pi Interfaces, Other IoT Devices: pcDuino, Beagle Bone Black, CubieBoard, ARDUINO.		
UNIT VI	**IoT PHYSICAL SERVERS AND CLOUD OFFEREINGS**	**8 Hrs**
Introduction to cloud storage models and communication API's, WAMP-AutoBahn for IoT, Python web application framework, Designing a RESTful web API, AMAZON web services for IoT, SkyNet IoT messaging platform, IoT case studies: Home Automation, Cities, Environment.		

Text Books

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

Reference Books

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

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414464A: Elective III
Internet of Things Laboratory

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

Prerequisites:

1. Computer Network Technology.
2. Processor Architecture and Interfacing.

Course Objectives:

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

Course Outcomes:

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

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

Guidelines for Instructor

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

List of Assignments

Assignment 1

Study of Raspberry-Pi, Beagle board, Arduino.

Assignment 2

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

Assignment 3

Open source prototype platform- Raspberry-Pi/Beagle board/Arduino -Simple program digital read/write using LED and Switch -Analog read/write using sensor and actuators.
Assignment 4
Upload data from environmental sensor to cloud server (You can use any public cloud IBM Watson IoT cloud or Google or AWS etc.).
Assignment 5
Introduction to MQTT/ CoAP and sending sensor data to cloud using Raspberry-Pi/Beagle board/Arduino.
Assignment 6
Design a web interface to control connected LEDs remotely using Raspberry-Pi/Beagle board/Arduino.
Assignment 7
Install, configure XMPP server and deployed an application on Raspberry Pi/Beagle board/Arduino. Write client applications to get services from the server application.
Assignment 8
Install, configure APACHE server and deployed an application on Raspberry Pi/Beagle board/Arduino. Write client applications to get services from the server application.
Reference Books
1. The Internet of Things Key applications and protocols Olivier Hersent Willy Publications 2nd Edition 978-1-119- 99435-0. 2. The Internet of Things Connecting Objects to the Web Hakima Chaouchi, Willy Publications 978-1-84821- 140-7. 3. The Internet of Things Donald Norris TAB 4 Smart Internet of Things Projects Agus Kurniawan PACKT. 4. Getting Started with the Internet of Things Cuno Pfister SPD O'REILL Y IOT.

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

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

Prerequisites:

1. Data Structures and Files.
2. Database management systems.

Course Objectives :

1. To understand information retrieval process.
2. To understand concepts of clustering and how it is related to Information retrieval.
3. To deal Storage, Organization & Access to Information Items.
4. To evaluate the performance of IR system and understand user interfaces for searching.
5. To understand information sharing on semantic web.
6. To understand the various applications of Information Retrieval giving emphasis to multimedia and distributed IR, web Search.

Course Outcomes :

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

1. Understand the concept of Information retrieval.
2. Deal with storage and retrieval process of text and multimedia data.
3. Evaluate performance of any information retrieval system.
4. Design user interfaces.
5. Understand importance of recommender system.
6. Understand concept of multimedia and distributed information retrieval.

UNIT I	INTRODUCTION	8 Hrs

Basic Concepts of IR, Data Retrieval & Information Retrieval, text mining and IR relation, IR system block diagram.

Automatic Text Analysis: Luhn's ideas, Conflation Algorithm, Indexing and Index Term Weighing, Probabilistic Indexing

Inverted file, Suffix trees & suffix arrays, Signature Files, Scatter storage or hash addressing, Clustered files, Hypertext and XML data structures.

UNIT II	CLASSIFICATOIN AND RETRIEVAL SEARCH STRATEGIES	8 Hrs

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

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

UNIT III	RETRIEVAL PERFORMANCE EVALUATION AND VISUALISATION	8 Hrs

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

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

UNIT IV	DISTRIBUTED AND MULTIMEDIA IR	8 Hrs

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

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

UNIT – V	WEB SEARCHING	8 Hrs

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

UNIT VI	ADVANCED INFORMATION RETRIEVAL	8 Hrs

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

Recommendation system: Collaborative Filtering and Content Based Recommendation of Documents and Products.

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

Text Books

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

Reference Books

1. Christopher D. Manning, Prabhakar Raghavan and HinrichSchutzen, Introduction to Information Retrieval, Cambridge University Press, Online book, ISBN:978-0-521-86571-5
2. Robert Korfhage, Information Storage and Retrieval, John Wiley & Sons,1 Edition, ISBN:9788126507702.
3. Kowalski, Gerald, Maybury, Mark, Information Storage and Retrieval Systems :Theory and Implementation, Springer US, 2nd Edition,ISBN:978-0-7923-7924-9.
4. Zhang, Jin, Visualization for Information Retrieval, Springer-Verlag Berlin Heidelberg,1st Edition,ISBN:978-3-642-09442-2Mark leven, Introduction to search engines and web navigation, John Wiley and sons Inc, 2nd Edition,ISBN 9780-170-52684-2.
5. V. S. Subrahamanian, Satish K. Tripathi , Multimedia information System,Kulwer Academic Publisher.
6. ChabaneDjeraba, Multimedia mining A highway to intelligent multimedia documents, Kulwer Academic Publisher, ISBN:1-4020-7247-3.

7. Ricci, F, Rokach, L. Shapira, B.Kantor, Recommender Systems Handbook.
8. Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, Information Retrieval Implementing and Evaluating Search Engines, The MIT Press, Cambridge.

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

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

Prerequisites:

1. Data Structures and Files.
2. Database management systems.

Course Objectives:

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

Course Outcomes:

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

1. Understand the concept, data structure and preprocessing algorithms of Information retrieval.
2. Deal with storage and retrieval process of text and multimedia data.
3. Evaluate performance of any information retrieval system.
4. Design user interfaces.
5. Understand importance of recommender system (Take decision on design parameters of recommender system).
6. Understand concept of multimedia and distributed information retrieval.
7. Map the concepts of the subject on recent developments in the Information retrieval field.

Guidelines for Instructor

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

List of Assignments

Assignment 1

To implement Conflation Algorithm using File Handling.

Assignment 2

To implement single pass algorithm for clustering.

Assignment 3

To implement a program Retrieval of documents using inverted files.
Assignment 4
To implement a program for feature extraction in 2D colour images (any features like colour, texture etc
Assignment 5
To implement a simple Web Crawler in Java.
Assignment 6
Extract features from input image and plot histogram for the features.
Assignment 7
Write a program to recommend a product / learning course based on person preferences / education details.
Assignment 8
Consider set of 25 to 30 documents on 5 to 7 distinct topics. Define 5 queries and map the document that will be retrieved for every query. Write a program using any algorithm to retrieve documents. Evaluate the algorithm using all evaluation methods.
Assignment 9
Case study on Image retrieval for ADAS (Advanced Driver Assistance System) (Here students are expected to research the topics like Lane Change Assist (LCA), Driver Drowsiness and inattentiveness, Lane Change Assist, Automatic Parking, ACC etc.)
Reference Books
1. Yates & Neto, "Modern Information Retrieval", Pearson Education. 2. C.J. Rijsbergen, "Information Retrieval", (www.dcs.gla.ac.uk). 3. R. C. Gonzalez, R. E. Woods, “Digital Image Processing”, Pearson Education. 4. Zhang, Jin, “Visualization for Information Retrieval”, Springer-Verlag Berlin Heidelberg. 5. V. S. Subrahamanian, Satish K. Tripathi, “Multimedia information System”, Kulwer Academic Publisher. 6. Ricci, F, Rokach, L. Shapira, B.Kantor, “Recommender Systems Handbook”.

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

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

Prerequisites:

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

Course Objectives :

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

Course Outcomes :

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

1. To create own file formats for specific application.
2. To do some projects based on current trends in multimedia.
3. To use open sources for authoring tool for animation and presentations.
4. Understand some research areas of current multimedia techniques.

UNIT I	INTRODUCTION TO MULTIMEDIA	8 Hrs

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

UNIT II	TEXT AND IMAGE PROCESSING	8 Hrs

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

UNIT III	AUDIO AND VIDEO PROCESSING	8 Hrs

AUDIO: Nature of sound waves, characteristics of sound waves, psycho-acoustic, MIDI, digital audio, CD formats.
Audio file formats: WAV, AIFF, VOC, AVI, MPEG Audio File formats, RMF, WMA
Audio compression techniques: DM, ADPCM and MPEG
Video: Video signal formats, Video transmission standards: EDTV, CCIR, CIF, SIF, HDTV,

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

UNIT IV	ANIMATION AND VIRTUAL REALITY	8 Hrs

Animation: Basics of animation, types of animation, principles of animation, Methods of controlling animation, frame-by-frame animation techniques, real-time animation techniques, Programming aspects in creating simple animation,
OpenGL: Open GL over windows/Linux, Extension.
Virtual Reality: Concept, Forms of VR, VR applications, VR devices: Hand Gloves, Head mounted tracking system, VR chair, CCD, VCR, 3D Sound system, Head mounted display

UNIT – V	RENDERING	8 Hrs

Introduction, Basics of illumination and shading models, Transparency, Shadows and textures, Ray tracing from the light source, cone, beam and pencil tracing. Point based rendering, Mesh Simplification, Spatial partitioning, Solid Modeling

UNIT – VI	ADVANCES IN MULTIMEDIA	8 Hrs

Multimedia Communication and applications, Study of Multimedia networking, Quality of data transmission, Multimedia over IP, Media on Demand.
Multimedia in Android: Android Multimedia Framework Architecture
Gaming: Facial Recognition, Voice Recognition, Gesture Control, High-Def Displays, Augmented Reality, Mobile Gaming, Cloud Gaming, On-Demand Gaming.

Text Books

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

Reference Books

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

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

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

Prerequisites:

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

Course Objectives:

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

Course Outcomes:

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

1. To create own file formats for specific application.
2. To do some projects based on current trends in multimedia.
3. To use open sources for authoring tool for animation and presentations.

List of Assignments

Assignment 1

Write a program to open and display Images in Python or Java using OpenCV tool.

Assignment 2

Write a program for generating Huffman codes for a gray scale 8-bit image

Assignment 3

Write a program for implementation of ray-tracing algorithm in Java.

Assignment 4

Create a simple animation using OpenGL

Assignment 5

Study of any virtual reality tool/software. (3DS MAX, BLENDER, GOOGLE VR)

Assignment 6

Write a Program to compress image using Python

Assignment 7

Create a short movie clip using open source tool

Assignment 8

Build a Virtual Reality web application using open source tool

Assignment 9

Write a Program to implement basic game in Python

Reference Books

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

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

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

Prerequisites Courses :

1. Internet and Web Programming.

Course Objectives :

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

Course Outcomes :

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

1. Demonstrate static website using basic tools.
2. Develop client side programming skills.
3. Develop server side programming skills.
4. Understand web services and handle content management tools.
5. Develop mobile website using mobile web development tools.
6. Understand aspects of web security and cyber ethics.

UNIT I	INTERNET AND WEB PROGRAMMING ESSENTIALS	8 Hrs

The Internet, Introduction Basic Internet Protocol, The World Wide Web, Introduction to Web Programming, Web Clients, Web Servers, Browser and Search Engines.

Markup Languages : Introduction to HTML, Static and dynamic HTML, Structure of HTML documents, HTML Elements, Linking in HTML, Anchor Attributes, Image Maps, Meta Information, Image Preliminaries, Layouts, Backgrounds, Colors and Text, Fonts, Tables, Frames and layers, Audio and Video Support with HTML Database integration, , Forms Control, Form Elements, Applying Styles, values, selectors, class, ids, inheritance, layout, backgrounds, borders, margin, padding, lists, fonts, text formatting, positioning. HTML5. Introduction to Style Sheet, Inserting CSS in an HTML page, CSS selectors, Introduction to XML, XML key component, Transforming XML into XSLT, DTD: Schema, elements, attributes, Introduction to JSON.

UNIT II	CLIENT SIDE PROGRAMMING	8 Hrs

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

UNIT III	SERVER SIDE PROGRAMMING	8 Hrs

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

UNIT IV	WEB SERVICES AND CONTENT MANAGEMENT SYSTEMS	8 Hrs

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

UNIT V	MOBILE WEB DEVELOPMENT	8 Hrs

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

UNIT VI	WEB SECURITY AND CYBER ETHICS	8 Hrs

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

Text Books

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

Reference Books

1. Dr.Hiren Joshi, Web Technology and Application Development, DreamTech, First,ISBN:978-93- 5004-088-1.
2. Santosh Kumar K., DT Editorial Services,Black Book, JDBC 4.2, Servlet 3.1 & JSP 2.3,Dreamtech Press, Second Edition, ISBN:978-8177228700.
3. Steven M. Schafer, “HTML, XHTML and CSS”, Wiley India Edition, Fourth Edition, 978-81-265-1635-3.
4. B. V. Kumar, S. Sangeetha, S.V. Subrahmanya, J2EE Architecture, an illustrative gateway to enterprise solutions, Tata McGraw Hill Publishing Company, Second Edition, ISBN:978-0-070-621-633.
5. Ivan Bayross,”Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP,BPB Publications,4th Edition,ISBN:978-8183330084.
6. Brain Fling, Mobile Design and Development, O'REILLY, First Edition, ISBN: 13:978-81-8404-817-9.

7. Jason Hunter, Java Servlet Programming, O'reilly Publications, 2nd Edition, ISBN: 978-0-596-00040-0.
8. Adam Bretz & Colin J Ihrig, Full Stack Javascript Development with MEAN, SPD, First Edition, ISBN:978-0992461256.

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

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

Prerequisites:

1. Basic Programming Skills.

Course Objectives:

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

Course Outcomes:

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

1. Use fundamental skills to develop and maintain website and web application.
2. Apply scripting skills for Server side and Client-side Programming.
3. Develop web services to transfer data and add interactive components to website.
4. Combine multiple web technologies to create advanced web components.

Guidelines for Instructor's Manual

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

Guidelines for Student Journal

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

Guidelines for Assessment

Continuous assessment of laboratory work is done based on overall performance and laboratory assignments performance of student. Each laboratory assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters

for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness

Guidelines for Practical Examination

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

Guidelines for Laboratory Conduction

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

List of Assignments

Assignment 1

1.1 Using HTML5 layout tags develop informative page with sections which include various images, links to other pages for navigation, make use of all possible formatting (for example font, color etc.).

1.2 Apply CSS properties Border, margins, Padding, Navigation, dropdown list to page created in first assignment.

Assignment 2

Design an online registration form for any application and validate it using JQuery.

Assignment 3

Design Login Application using PHP and add essence of Ajax in it.

Assignment 4

Create any Java Web Service and integrate it with any suitable application.

Assignment 5

Create JSP login page and validate it. Make use of Servlets.

Assignment 6

Create an application for bill payment using Angular JS.

Assignment 7

Develop website using any CMS tool which falls into one of the categories blog, social networking, News updates, Wikipedia, E-commerce store. Website must include home page, and at least 3.

Assignment 8

Develop Mini Project using any front end tool with database connectivity.
Reference Books

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

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

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

Prerequisites Courses :

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

Course Objectives :

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

Course Outcomes :

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

1. Learn and implement various optimization techniques.
2. Learn model real-world problems in optimization framework.
3. Apply various optimization models to solve optimization problems in computer-science & IT Engineering.

UNIT I	INTRODUCTION	8 Hrs

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

UNIT II	NETWORK ANALYSIS	8 Hrs

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

UNIT III	INVENTORY CONTROL	8 Hrs

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

UNIT IV	GAME THEORY	8 Hrs

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

UNIT V	QUEUING THEORY	8 Hrs

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

UNIT VI	ADVANCED OPTIMIZATION TECHNIQUES	8 Hrs

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

Text Books

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

Reference Books

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

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414464E: Computational Optimization Laboratory

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

Prerequisites:

1. Optimization Algorithms.
2. Basics of Problem Solving.
3. Fundamentals of Design and Analysis of Algorithms.

Course Objectives:

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

Course Outcomes:

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

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

Guidelines for Instructor

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

List of Assignments

Assignment 1

Write a program to solve Transportation problem.

Assignment 2

Write a program to solve Assignment problem.

Assignment 3

Write a program to solve 0/1 knapsack problem using brute force method.

Assignment 4

Write a program to solve 0/1 knapsack problem using dynamic programming.

Assignment 5

Write a program to solve Duality problem.

Assignment 6

Write a program to solve optimization problem using Simplex method.

Assignment 7

Write a program to solve Dijkstra's and Floyd shortest path algorithm.

Assignment 8

Design and implement Maximal flow problem.

Assignment 9

Write a program to solve PERT/CPM problem.

Assignment 10

Design and implement Mini-Max and Maxi-Min theorem.
Study Assignments
Assignment 1
EOQ Models
Assignment 2
Safety stock and buffer stock
Assignment 3
M/M/1:∞/FIFO
Assignment 4
M/M/1:N/FIFO

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

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

Course Objectives :

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

Course Outcomes :

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

1. Understand rural development model.
2. Learn different measures in rural development and its impact on overall economy.
3. Understand and learn importance of technologies in rural and community development.
4. Understand challenges and opportunities in rural development.

UNIT I	INTRODUCTION	7 Hrs

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

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

UNIT II	RURAL DEVELOPMENT - MEASURES AND PARADIGMS	7 Hrs

MEASURES OF DEVELOPMENT - Introduction, Measures of level of rural development, Measures of income distribution, Measures of development simplified, Concepts and measures of rural poverty.

PARADIGMS OF RURAL DEVELOPMENT - Introduction, The modernization theory, The dependency theory of Marxist School, Rosenstein- Rodan's theory of 'Big Push', Lewis' model of economic development, The human capital model of development, The Gandhian Concept of Rural Development theories from other social sciences.

UNIT III	TECHNOLOGIES FOR RURAL DEVELOPMENT	7 Hrs

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

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

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

UNIT IV	COMMUNITY DEVELOPMENT	7 Hrs

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

UNIT V	COMMUNITY DEVELOPMENT - RURAL ENTREPRENEURSHIP	7 Hrs

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

UNIT VI	CASE STUDIES AND FIELD VISIT	7 Hrs

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

Text Books

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

Reference Books

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

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414465B: Elective IV
Parallel Computing

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

Prerequisites Courses :

1. System Programming.
2. Operating System.

Course Objectives :

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

Course Outcomes :

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

1. Understand fundamentals in parallel computing.
2. Understand and learn importance of technologies including different hardware structures used in parallel computing.
3. Understand challenges and opportunities in parallel computing.

UNIT I	FUNDAMENTALS OF PARALLEL COMPUTING	7 Hrs

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

UNIT II	PARALLEL HARDWARE AND LANGUAGES	7 Hrs

Introduction to parallel hardware: Multi-cores and multiprocessors; shared memory and message passing architectures; cache hierarchy and coherence; sequential consistency, Parallel languages and compilers: Language features for parallelism, parallel language constructs, optimizing compilers for parallelism, dependency analysis, code optimization and scheduling, loop parallelization and pipelining

UNIT III	CHALLENGES OF PARALLEL PROGRAMMING	7 Hrs

Identifying Potential Parallelism, Techniques for Parallelizing Programs, Issues, Cache Coherence issues, Memory Consistency Models, Maintaining Memory Consistency, Synchronization Issues, Performance Considerations.

UNIT IV	OPENMP PROGRAMMING	7 Hrs

OpenMP Execution Model, Memory Model and Consistency, Open MP Directives, Run Time Library Routines, Handling Data and Functional Parallelism.

UNIT V	MPI PROGRAMMING AND PROGRAMMING HETEROGENEOUS PROCESSORS	7 Hrs

The MPI Programming Model, Global Operations, Asynchronous Communication , Collective Communication , Other MPI Features ,Performance Issues , Combining OpenMP and MPI, GPU Architecture.

UNIT VI	GPU PROGRAMMING	7 Hrs

Introduction to GPU programming: GPU architecture; Introduction to CUDA programming, CUDA Threads and Memories, Concept of SIMD and SIMT computation; Thread blocks; Warps; Global memory; Shared memory; Thread divergence in control transfer; Example case studies, CUDA Threads and Memories , Application Development. Introduction to OpenCL.

Text Books

1. John L. Hennessey and David A. Patterson, “Computer Architecture, A quantitative approach”, Morgan Kaufmann / Elsevier Publishers, 5th. Edition, 2012.
2. Peter S. Pacheco, “An Introduction to Parallel Programming”, Morgan Kaufmann, 2011.
3. Michael J Quinn, “Parallel programming in C with MPI and OpenMP”, Tata McGraw Hill, 2003.
4. David B. Kirk and Wen,mei W. Hwu, “Programming Massively Parallel Processors”, Morgan Kaufmann, 2010.
5. David Culler: Parallel Computer Architecture: A Hardware/Software Approach, Morgan Kaufmann.
6. Jack Dongarra et al., Sourcebook of Parallel Computing, Morgan Kaufman Publishers, San Francisco, CA, 2003.

Reference Books

1. Ananth Grama, George Karypis, Vipin Kumar and Anshul Gupta, “Introduction to Parallel Computing”, Second Edition, Pearson Education Limited, 2003.
2. Shameem Akhter and Jason Roberts, “Multi,core Programming”, Intel Press, 2006.
3. Ian Foster, “Designing and Building Parallel Programs: Concepts and Tools for Parallel Software Engineering”, Addison Wesley Longman Publishing Co., USA, 1995.
4. David E. Culler, Jaswinder Pal Singh, “Parallel Computing Architecture: A hardware Software approach”, Morgan Kaufmann / Elsevier Publishers, 1999.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414464C: Elective IV
Computer Vision

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

Prerequisites Courses :

1. Students should know vectors, linear algebra (i.e., matrix operations, solution of linear equations).
2. Programming language (e.g., Matlab and/or C).

Course Objectives :

1. To review image processing techniques for computer vision.
2. To understand shape and region analysis.
3. To understand three-dimensional image analysis techniques.
4. To understand Object detection and tracking.
5. To study some applications of computer vision algorithms.

Course Outcomes :

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

1. Implement fundamental image processing techniques required for computer vision.
2. Implement boundary tracking techniques.
3. Apply Hough Transform for line, circle, and ellipse detections.
4. Implement motion related techniques.
5. Develop skills to develop applications using computer vision techniques.

UNIT I	FUNDAMENTALS OF DIGITAL IMAGE PROCESSING	7 Hrs

Review of image processing techniques, classical filtering operations, Thresholding techniques, edge detection techniques, corner and interest point detection, mathematical morphology and textures.

UNIT II	SHAPES AND REGIONS	7 Hrs

Binary shape analysis – connectedness – object labeling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments.

UNIT III	HOUGH TRANSFORM	7 Hrs

Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line localization – line fitting – RANSAC for straight line detection – HT based circular object detection – accurate center location – speed problem – ellipse detection –
Applications and case study: Human Iris location – hole detection – generalized Hough Transform – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation.

UNIT IV	3D VISION AND MOTION	7 Hrs

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations –

point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline based motion – optical flow – layered motion.

UNIT V	OBJECT DETECTION AND TRACKING	7 Hrs

Introduction to Motion Detection , Applications of Motion Detection and Tracking, Background Subtraction (BGS), Basic BGS Algorithms, Mixture of Gaussians (MoG), Block matching for object tracking. Single object and multi-object tracking.

UNIT VI	COMPUTER VISION APPLICATIONS	7 Hrs

Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians.

Text Books

1. Simon J. D. Prince, “Computer Vision: Models, Learning, and Inference”, Cambridge University Press, 2012.

Reference Books

1. R. Davies, “Computer & Machine Vision”, Fourth Edition, Academic Press, 2012.
2. R. Szeliski, “Computer Vision: Algorithms and Applications”, Springer 2011.
3. Mark Nixon and Alberto S. Aquado, “Feature Extraction & Image Processing for Computer Vision”, Third Edition, Academic Press, 2012.
4. D. L. Baggio et al., “Mastering OpenCV with Practical Computer Vision Projects”, Packt Publishing, 2012.
5. Jan Erik Solem, “Programming Computer Vision with Python: Tools and algorithms for analyzing images”, O'Reilly Media, 2012.
6. Sudha Challa, “Fundamentals of Object Tracking”, Cambridge University Press, 2011.

ONLINE REFERENCES

1. http://kercd.free.fr/linksKCD.html
2. http://www.cs.ubc.ca/spider/lowe/vision.html
3. http://www.teiath.gr/seyp/optics/Vision.htm
4. http://www.visionscience.com/

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414464D: Elective IV
Social Media Analytics

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

Prerequisites Courses :

1. Basic knowledge of Graphs.
2. Data mining.
3. Data Analysis.

Course Objectives :

1. To understand foundations of Social Media Analytics.
2. To Visualize and understand the data mining aspects in social networks.
3. To solve mining problems by different algorithms.
4. To understand network measures for social data.
5. To understand behavioral part of web applications for Analysis.
6. To analyze the data available on any social media applications.

Course Outcomes :

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

1. Understand the basics of Social Media Analytics.
2. Explain the significance of Data mining in Social media.
3. Demonstrate the algorithms used for text mining.
4. Apply network measures for social media data.
5. Explain Behavior Analytics techniques used for social media data.
6. Apply social media analytics for Face book and Twitter kind of applications.

UNIT I	ANALYTICS IN SOCIAL MEDIA AND TYPES OF ANALYTICS TOOLS	7 Hrs

The foundation for analytics, Social media data sources, Defining social media data, data sources in social media channels, Estimated Data sources and Factual Data Sources, Public and Private data, data gathering in social media analytics.

UNIT II	VISUALIZING SOCIAL NETWORKS	7 Hrs

Introduction, A Taxonomy of Visualization, The convergence of Visualization, Interaction and Analytics. Data mining in Social Media: Introduction, Motivations for Data mining in Social Media, Data mining methods for Social Media, Related Efforts.

UNIT III	TEXT MINING IN SOCIAL NETWORKS	7 Hrs

Introduction, Keyword search, Classification Algorithms, Clustering Algorithms-Greedy Clustering, Hierarchical clustering, k-means clustering, Transfer Learning in heterogeneous Networks, Sampling of online social networks, Comparison of different algorithms used for mining, tools for text mining.

UNIT IV	NETWORK MEASURES	7 Hrs

Centrality: Degree Centrality , Eigenvector Centrality, Katz Centrality , PageRank, Betweenness Centrality, Closeness Centrality ,Group Centrality ,Transitivity and Reciprocity, Balance and Status, Similarity: Structural Equivalence, Regular Equivalence

UNIT V	BEHAVIOR ANALYTICS	7 Hrs

Individual Behavior: Individual Behavior Analysis, Individual Behavior Modeling, Individual Behavior **Prediction Collective Behavior**: Collective Behavior Analysis, Collective Behavior Modeling, Collective Behavior Prediction		
UNIT VI	**CASE STUDY**	**7 Hrs**
Mining Twitter: Overview, Exploring Twitter's API, Analyzing 140 Characters **Mining Facebook:** Overview, Exploring Facebook's Social Graph API's, Analyzing Social Graph Connections.		

Text Books

1. Reza Zafarani Mohammad Ali Abbasi Huan Liu, Social Media Mining, Cambridge University Press, ISBN: 10: 1107018854.
2. Charu C. Aggarwal, Social Network Data Analytics, Springer, ISBN: 978-1-4419-8461-6.

Reference Books

1. Marshall Sponder, Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics, McGraw Hill Education, 978-0-07-176829-0.
2. Matthew A. Russell, Mining the Social Web, O'Reilly, 2nd Edition, ISBN:10: 1449367615.
3. Jiawei Han University of Illinois at Urbana-Champaign Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann, 2nd Edition, ISBN: 13: 978-1-55860-901-3 ISBN: 10: 1-55860-901-6.
4. Bing Liu, Web Data Mining : Exploring Hyperlinks, Contents and Usage Data, Springer, 2nd Edition, ISBN: 978-3-642-19459-7.

Savitribai Phule Pune University Fourth Year of Information Technology(2015 Course) 414465E: Elective IV Open Elective		
Teaching Scheme: **TH:03 Hours/Week**	**Credits:03**	**Examination Scheme:** **In-Sem (Paper): 30 Marks** **End-Sem (paper): 70 Marks**
In this subject, a student can opt from other branch of engineering (preferably *Computer Engineering* and *Electronics & Telecommunication*). An institution may design the syllabus of a subject in consultation with a reputed software company/industry. This syllabus should be approved by the University board of Studies (Information Technology) and academic council of SPPU authorities and then students can opt for the same as an open elective.		

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414466: COMPUTER LABORATORY-IX

Teaching Scheme:	Credits:02	Examination Scheme:
Practical:04 Hours/Week		TW:50Marks PR: 50Marks

Prerequisites:

1. Operating Systems.
2. Computer Network Technology.

Course Objectives :

1. The course aims to provide an understanding of the principles on which the distributed systems are based; their architecture, algorithms and how they meet the demands of Distributed applications.
2. The course covers the building blocks for a study related to the design and the implementation of distributed systems and applications.

Course Outcomes :

Upon successful completion of this course student will be able to

1. Demonstrate knowledge of the core concepts and techniques in distributed systems.
2. Learn how to apply principles of state-of-the-Art Distributed systems in practical application.
3. Design, build and test application programs on distributed systems.

Guidelines:

This Computer Laboratory-IX course has Distributed Systems as a core subject. The problem statements should be framed based on first six assignments mentioned in the syllabus. The teachers will frame the problem statements with due consideration that students have three hours to complete that. The practical examination will comprise of implementation and related theory. All assignments to be performed in Java 9.

Assignment 1

To develop any distributed application through implementing client-server communication programs based on Java Sockets and RMI techniques.

Assignment 2

To develop any distributed application using Message Passing Interface (MPI).

Assignment 3

To develop any distributed application with CORBA program using JAVA IDL.

Assignment 4

To develop any distributed algorithm for leader election.

Assignment 5

To create a simple web service and write any distributed application to consume the web service.

Assignment 6

To develop any distributed application using Messaging System in Publish-Subscribe paradigm.

Assignment 7

To develop Microservices framework based distributed application.

Term work:

Staff in-charge will suitably frame the above assignments and flexibility may be incorporated. Students will submit term work in the form of journal. Each assignment has to be well documented with problem definition, code documented with comments. Staff in-charge will assess the assignments continuously and grade or mark each assignment on completion date. All the assignments should be conducted on Latest version of Open Source Operating Systems, tools and Multi-core CPU supporting Virtualization and Multi-Threading.

Reference books:

1. George Coulouris, Jean Dollimore, Tim Kindberg & Gordon Blair,Distributed Systems – Concept and Design,Pearson,5th Edition ,ISBN:978-13-214301-1.
2. Nancy Ann Lynch, Distributed Algorithms, Morgan Kaufmann Publishers, illustrated, reprint, ISBN: 9781558603486.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414467: COMPUTER LABORATORY-X

Teaching Scheme:	Credits:01	Examination Scheme:
Practical:02 Hours/Week		TW:25Marks OR: 25Marks

Prerequisites:

1. Computer Network Technology.
2. Human Computer Interface.

Course Objectives :

1. To design and implement user interfaces for performing database operations.
2. To design applications for accessing smart devices and data generated through sensors and services.
3. To implement authentication protocols for providing security.

Course Outcomes :

Upon successful completion of this course student will be able to

1. Set up the Android environment and explain the Evolution of cellular networks.
2. Develop the User Interfaces using pre-built Android UI components.
3. Create applications for performing CURD SQLite database operations using Android.
4. Create the smart android applications using the data captured through sensors.
5. Implement the authentication protocols between two mobile devices for providing. Security.
6. Analyze the data collected through android sensors using any machine learning algorithm.

Guidelines:

This Computer Laboratory-X course has ubiquitous computing as a core subject. The problem statements should be framed based on first six assignments mentioned in the syllabus. The teachers will frame the problem statements with due consideration that students have three hours to complete that. The practical examination will comprise of implementation and related theory. All assignments to be performed in Java 9.

Tools Required: Android SDK / Android Studio, SQL Lite, Sensors, Ardunio kit.

Assignment 1

Android development environment. Installing and setting up the environment. Hello world application. Running the emulator. Inserting debug messages.

Assignment 2

Android UI Design: Design a User Interface using pre-built UI components such as structured layout objects, UI controls and special interfaces such as dialogs, notifications, and menus. Also make this UI attractive using Android graphics platform OpenGL.

Assignment 3

Android-database Connectivity: Create a SQLite Database for an Android Application and perform CRUD (Create, Read, Update and Delete) database operations.

Assignment 4

Sensors for building Smart Applications: Use any sensors on the device to add rich location and motion capabilities to your app, from GPS or network location to accelerometer, gyroscope, temperature, barometer, and more.
Assignment 5
Develop a Smart Light System (Light that automatically switched on in evening and gets off in morning) using open source Hardware platform like Arduino and some sensors (Light dependent resistor) and actuator (An LED).
Assignment 6
Design and Develop a GUI for FAN regulator that uses Android platform.
Assignment 7
Develop an Android based FAN regulator using open source Hardware platform like NodeMcu and actuator (a SERVO Motor).
Assignment 8
Android and Machine Learning: Mobile multimodal sensing- Draw inferences over the data coming from phone's sensing hardware (e.g. accelerometer, GPS, microphone), and processing these samples with the help of machine learning. (Any Application: Healthcare, Smart City, Agriculture, etc).
Assignment 9
Android API: Implement an application that uses Android APIs like Google Map, recording and playing audio and video, using the built-in camera as an input device.
Assignment 10
Wireless Network: Develop an app for a rolling display program of news on computer display. The input strings are supplied by the mobile phone/ by another computer connected through wireless networks.
Assignment 11
Android Security: Authentication of two mobile devices.
Assignment 12
Case Study: Evolution of cellular networks all the way up to 7G.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414468: Project Work

Teaching Scheme:	Credits:06	Examination Scheme:
TUT:06 Hours/Week		TW:50 Marks OR:100 Marks

Prerequisites:

1. BE-Project Phase I – Semester I.
2. Project Based Seminar.

Course Objectives:

1. The object of Project Work II & Dissertation is to enable the student to extend further the investigative study taken up under Project stage 1, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry.
2. To expose students to product development cycle using industrial experience, use of state of art technologies.
3. To encourage and expose students for participation in National/International paper presentation activities and funding agency for sponsored projects.
4. Exposure to Learning and knowledge access techniques using Conferences, Journal papers and anticipation in research activities.
5. Evaluate the various validation and verification methods.
6. Analyzing professional issues, including ethical, legal and security issues, related to computing projects.

Course Outcomes:

By the end of the course, Students will be able to

1. Learn teamwork.
2. Be well aware about Implementation phase.
3. Get exposure of various types of testing methods and tools.
4. Understand the importance of documentation.

Contents

Review 3:

Based on Implementation (50% implementation expected)

Review 4:

Complete Project and Testing

All the groups should try to overcome all the lacunas identified by the external examiner during Project Phase I exam

The group will submit following at the end of semester II.

1. The Workable project.
2. Project report (in Latex/Lyx/latest Word) in the form of bound journal complete in all respect – 1 copy for the Institute, 1 copy for guide and 1 copy of each student in the group for certification.

The project report contains the details.

1. Problem definition
2. Requirement specification
3. System design details (UML diagrams)
4. System implementation – code documentation – dataflow diagrams/ algorithm, protocols used.
5. Test result and procedure – test report as per ATP.
6. Conclusions.
7. Appendix
   a. Tools used
   b. References
   c. Papers published/certificates
   d. Plagiarism Report of paper and project report from any open source tool

One paper should be published in reputed International conference/International.

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

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

Criteria

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

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

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

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

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

Audit Course VI Options

Course Code	Audit Course Title
414469A	1. IoT – Application in Engineering Field
414469B	2. Entrepreneurship
414469C	3. Cognitive Computing
414469D	4. AI and Robotics

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414469A: Audit Course-VI
IoT Applications in Engineering Field.

IOT as a game changer in several fields of applications and poised for phenomenal growth. This course introduces Students to IOT applications in various Engineering disciplines: Civil, Chemical, Electrical, E&TC, Mechanical and Metallurgical Engineering This 20 hour course is aimed at covering various components involved in IOT, concepts, definitions and mainly Engineering Applications associated with IOT/IIOT.

Course Objectives:

1. To get the detailed insight of Internet of Things.
2. To learn the IoT terms in Engineering.
3. To understand how IoT concepts can be implement.
4. To know the protocols, Sensors and other elements for IoT implementation.

Course Outcomes:

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

1. Expand your knowledge of Internet of Things.
2. Discover how you can use IoT in your Engineering applications.
3. Build more effective hands on with IoT elements.
4. Expand the practical knowledge of using IoT components like sensors, processors.
5. Expand the understanding of using different protocols.

Unit I	**Basics of IOT – Difference between IOT and IIoT**

Overview of System Components of IOT.

Unit II	**Architecture**

Importance, Advantages & Disadvantages.

Unit III	**Sensors, Transducers, Special requirements for IIOT sensors, Actuators, Types of Sensors, Actuators**

Sensors, Transducers, Special requirements for IIOT sensors, Actuators, Types of Sensors, Actuators.

Unit IV	**Protocols - HART, MODBUS-Serial & Parallel, Ethernet, BACNet**

Protocols - HART, MODBUS-Serial & Parallel, Ethernet, BACNet.

Unit V	**Introduction to IIOT Cloud Platform and Security Aspects Importance and likely Risk Elements**

Introduction to IIOT Cloud Platform and Security Aspects Importance and likely Risk Elements.

Unit VI	**Quiz, Case Studies and Student Presentations**

Illustrative IIOT applications in Engineering Disciplines – Civil, Chemical, Electrical, E & TC, Mechanical and Metallurgical.

References

1. Internet of Things (A Hands-on-Approach) ISBN: 978-0996025515 - by ArshdeepBahga and Vijay Madisetti.
2. Inside the Internet of Things (IoT), Deloitte University Press.
3. Internet of Things- From Research and Innovation to Market Deployment; By Ovidiu& Peter; River Publishers Series.
4.Five thoughts from the Father of the Internet of Things; by By Phil Wainewright - Kevin Ashton, who coined the word IoT.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414469B: Audit Course-VI
Entrepreneurship

Today Entrepreneurship & Start -Ups are Key Words. Developing Entrepreneurs & Jobs is National Requirement. Separate PPT - presentation from our EEC Group can be Guideline as Reference Though reference books are available, it is best to see - Google Search videos and films that elaborate most of these concepts. You tube is a rich source of such content on each of these topics. This module also helps students get better prepared for interviews and group discussions.

Course Objectives:

1. To get the detailed about Entrepreneurship.
2. To understand the abilities to become an Entrepreneur.
3. To understand how Business Finance concepts can be implemented.

Course Outcomes:

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

1. Expand your knowledge of Entrepreneurship & Startups.
2. Discover how you can use Entrepreneur Qualities.
3. Expand the practical knowledge of Finance, Legal-Patents, Intellectual Property, and Business Associations.
4. Expand the understanding of Deliverables & Achieving Target.

Unit I	**Introduction To Entrepreneurship & Favorable Environment for Startups**

Overview of Entrepreneurship and its need.

Unit II	**Entrepreneur - Qualities, Strengths & Challenges - Govt. Regulations & Taxes**

Qualities and its strength, challenges as well as respective government originations.

Unit III	**Road Map - Goal Setting & Methodology, Case Studies**

Successful case studies and appropriate methodology.

Unit IV	**Skill Sets required- Communication, Linguistic, Analytical & Abstract Thinking Engineering etc.**

Soft skills and hard skills required to become a successful entrepreneur.

References

1. Burns, Paul, 1949- author. Title: Entrepreneurship and small business.
2. Hisrich R D and Peters M P; “Entrepreneurship”; 5th Edition Tata McGraw-Hill.

Savitribai Phule Pune University
Fourth Year of Information Technology(2015 Course)
414469C: Audit Course-VI
Cognitive computing

This course explores the area of cognitive computing and its implications for today's world of big data analytics and evidence-based decision making. Topics covered include: cognitive computing design principles, natural language processing, knowledge representation, Students will have an opportunity to build cognitive applications, as well as explore how knowledge-based artificial intelligence and deep learning are impacting the field of data science.
This course is open to students in Business Intelligence and Analytics, Information Systems, and Masters of Business Administration, or with the permission of the instructor

Course Objectives:

1. To develop algorithms that use AI and machine learning along with human interaction and feedback to help humans make choices/decisions.
2. To get the detailed about appealing new model for application development.
3. To understand how to evaluate patterns and complex relationships in large unstructured data sets.
4. To understand how Cognitive computing supports human reasoning by evaluating data in context and presenting relevant findings along with the evidence that justifies the answers.

Course Outcomes:

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

1. Understand and discuss what cognitive computing is, and how it differs from traditional approaches.
2. Plan and use the primary tools associated with cognitive computing.
3. Plan and execute a project that leverages cognitive computing.
4. Understand and discuss the business implications of cognitive computing.

Unit I	**Introduction to Cognitive Systems and computation, Knowledge based AI**

Cognitive systems, Different modes of Computing: Turning machine Lambda, Calculus, Hyper Computing, Super Computing, Pan Computing and Interactive Computing.

Unit II	**Cognitive Functioning**

Learning, Memorising, Adaptation, Self Origination, Control, Thinking, Reasoning, Decision Making & Judgement.

Unit III	**Mental States**

Belief Desire Intention (BDI) emotion and feeting. Computation of Cognitive Functioning in machines: Robotics, Human Robotics Interaction, Hepatic.

Unit IV	**Perception and sensing**

Hardware machines of vision and audition with reference to human and machine.

References

1. Hurwitz, Kaufman, and Bowles, Cognitive Computing and Big Data Analytics, Wiley, Indianapolis, IN, 2005, ISBN: 978-1-118-89662-4.

Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414469D: Audit Course-VI
AI and Robotics

Robotics is a branch of AI, which is composed of Electrical Engineering, Mechanical Engineering, and Computer Science for designing, construction, and application of robots. The robots have mechanical construction, form, or shape designed to accomplish a particular task. They have electrical components which power and control the machinery. They contain some level of computer program that determines what, when and how a robot does something.

Course Objectives:

1. To get the detailed robotics and rapid development.
2. To understand the robots functions.
3. To understand how mechanical devices converting into intelligent machines through a branch of computer science called artificial intelligence (AI).

Course Outcomes:

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

1. The goal of this course is to familiarize the students with the basic concepts of robotics, artificial intelligence and intelligent machines.
2. It will help students to understand and apply principles, methodology and techniques of intelligent systems to robotics.

Unit I	**Intelligent Robotics**

Automation and Robots, Robot Classification, Robot Specifications, Sensory perception, Robot control and Intelligence.

Unit II	**Direct Kinematics**

Coordinate Frames, Rotations, Homogeneous Coordinates, The arm Equation, (DK analysis of - 2 Axis and 3 Axis Planar robot, Four axis SCARA Robot, Five axis Articulated robot).

Unit III	**Inverse Kinematics**

General Properties of Solutions, Tool Configuration, (IK analysis of - 2 Axis and 3 Axis Planar robot, Four axis SCARA Robot, Five axis Articulated robot).

Unit IV	**Workspace Analysis and Trajectory Planning**

Workspace analysis, Work envelope of 4-axis SCARA Robot, Work envelope of 5-axis articulated Robot, Workspace Fixtures, The pick-and-place operation, Continuous-Path Motion, Interpolated Motion, Straight Line Motion.

References:

1. Robotics and AI", Andrew Staugaard, PHI.
2. Fundamentals of Robotics- Analysis and Control", Robert Schilling, Pearson Education.
3. Introduction to Robotics", J. J. Craig, Pearson Education.
4. "Robotics", Fu, Gonzales and Lee, McGraw Hill.
5. "Artificial Intelligence: Structures and Strategies for Complex Problem Solving", George F. Luger, Pearson Education.
6. "Industrial Robotics- Technology, programming, and applications", Groover, Weiss, Nagel and Odrey, McGraw Hill
7. Elaine Rich and Kevin Knight, "Artificial Intelligence", TMH.

Savitribai Phule Pune University
Faculty of Science & Technology

Curriculum/Syllabus
for
Second Year
Bachelor of Engineering
(Choice Based Credit System)
Mechanical Engineering and Automobile Engineering
(2019 Course)

Board of Studies - Automobile and Mechanical Engineering
(With Effect from Academic Year 2020-21)

Savitribai Phule Pune University

Board of Studies - Automobile and Mechanical Engineering

Undergraduate Program - Automobile Engineering & Mechanical Engineering (2019 pattern)

Course Code	Course Name	Teaching Scheme (Hours/ Week)			Examination Scheme and Marks						Credit			
		TH	PR	TUT	ISE	ESE	TW	PR	OR	TOTAL	TH	PR	TUT	TOTAL
Semester-III														
202041	Solid Mechanics	4	2	-	30	70	-	50	-	150	4	1	-	5
202042	Solid Modeling and Drafting	3	2	-	30	70	-	50	-	150	3	1	-	4
202043	Engineering Thermodynamics	3	2	-	30	70	-	-	25	125	3	1	-	4
202044	Engineering Materials and Metallurgy	3	2	-	30	70	25	-	-	125	3	1	-	4
203156	Electrical and Electronics Engineering	3	2	-	30	70	25	-	-	125	3	1	-	4
202045	Geometric Dimensioning and Tolerancing Lab	-	2	-	-	-	25	-	-	25	-	1	-	1
202046	Audit Course - III	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total	**16**	**12**	**-**	**150**	**350**	**75**	**100**	**25**	**700**	**16**	**6**	**-**	**22**
Semester-IV														
207002	Engineering Mathematics - III	3	-	1	30	70	25	-	-	125	3	-	1	4
202047	Kinematics of Machinery	3	2	-	30	70	-	-	25	125	3	1	-	4
202048	Applied Thermodynamics	3	2	-	30	70	-	-	25	125	3	1	-	4
202049	Fluid Mechanics	3	2	-	30	70	-	-	25	125	3	1	-	4
202050	Manufacturing Processes	3	-	-	30	70	-	-	-	100	3	-	-	3
202051	Machine Shop	-	2	-	-	-	50	-	-	50	-	1	-	1
202052	Project Based Learning - II	-	4	-	-	-	50	-	-	50	-	2		2
202053	Audit Course - IV	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total	**15**	**12**	**1**	**150**	**350**	**125**	**-**	**75**	**700**	**15**	**6**	**1**	**22**

Abbreviations: TH: Theory, **PR**: Practical, **TUT**: Tutorial, **ISE**: In-Semester Exam, **ESE**: End-Semester Exam,**TW**: Term Work, OR: Oral

Note: Interested students of SE (Automobile Engineering and Mechanical Engineering) can opt for any one of the audit course from the list of audit courses prescribed by BoS (Automobile and Mechanical Engineering)

Instructions

- Practical/Tutorial must be conducted in three batches per division only.
- Minimum number of required Experiments/Assignments in PR/ Tutorial shall be carried out as mentioned in the syllabi of respective subjects.
- Assessment of tutorial work has to be carried out as a term-work examination. Term-work Examination at second year of engineering course shall be internal continuous assessment only.
- Project based learning (PBL) requires continuous mentoring by faculty throughout the semester for successful completion of the tasks selected by the students per batch. While assigning the teaching workload of 2 Hrs/week/batch needs to be considered for the faculty involved. The Batch needs to be divided into sub-groups of 5 to 6 students. Assignments / activities / models/ projects etc. under project based learning is carried throughout semester and Credit for PBL has to be awarded on the basis of internal continuous assessment and evaluation at the end of semester.
- Audit course is mandatory but non-credit course. Examination has to be conducted at the end of Semesters for award of grade at institute level. Grade awarded for audit course shall not be calculated for grade point & CGPA.

SAVITRIBAI PHULE PUNE UNIVERSITY

FACULTY OF ENGINEERING

SYLLABUS FOR
T. E. (MECHANICAL ENGINEERING)
(2015 Course)

WITH EFFECT FROM YEAR 2017-2018

Savitribai Phule Pune University
T.E. Mechanical Engineering 2015 – Course
T. E. (Mechanical) (2015 Course) Semester – I

Code	Subject	Teaching Scheme Hrs / week			Examination Scheme					Total Marks	Credits	
		Lecture	Tut	Pract	In-Sem	ESE	TW	PR	OR		Th	TW / PR / OR
302041	Design of Machine Elements-I	4	-	2	30@	70@	50	-		150	4	1
302042	Heat Transfer*	4	-	2	30	70		50	-	150	4	1
302043	Theory of Machines-II$	3	1		30	70	25	-	25	150	3	1
302044	Turbo Machines	3	-	2	30	70	-	-	25	125	3	1
302045	Metrology and Quality Control$	3	-	2	30	70	-	-	25	125	3	1
302046	Skill Development	-	-	2	-	-	25	25	-	50	-	1
Total		17	1	10	150	350	100	75	75	750	17	6
											23	

T. E. (Mechanical) (2015 Course) Semester – II

Code	Subject	Teaching Scheme Hrs / week			Examination Scheme					Total Marks	Credits	
		Lecture	Tut	Pract	In-Sem	ESE	TW	PR	OR		Th	TW / PR / OR
302047	Numerical Methods and Optimization*	4	-	2	30	70	-	50	-	150	4	1
302048	Design of Machine Elements-II	4	-	2	30@	70@	25	-	25	150	4	1
302049	Refrigeration and Air Conditioning	3	-	2	30	70	-	-	25	125	3	1
302050	Mechatronics%	3	1		30	70	-	-	25	125	3	1
302051	Manufacturing - Process-II$	3	-	-	30	70	-	-	-	100	3	-
302052	Machine Shop-II$	-	-	2	-	-	50	-	-	50	-	1
302053	Seminar$	-	-	2	-	-	25	-	25#	50	-	1
302054	Audit Course*	--	--	--	--	--	-	-	-	-	-	-
Total		17	1	10	150	350	100	50	100	750	17	6
											23	

Though it is under Oral head Internal Panel to be appointed by Principal and HOD. Examination schedule will not be prepared at University level.
* Marked subjects are common with TE (Auto. Engg.) and TE Mech. Sandwich
$ Marked subjects are common with TE (Auto. Engg.) only
% Marked subjects are common with TE Mech. Sandwich only
@ Examination time for Insem examination 1 Hr 30 Min. and Endsem examination 3Hrs.

Savitribai Phule Pune University

Faculty of Science and Technology

Syllabus for Final Year of Mechanical Engineering

(Course 2015)

Savitribai Phule Pune University, Pune

BE (Mechanical Engineering) (2015 Course) Semester – VII

Code	Subject	Teaching Scheme Hrs / week			Examination Scheme					Total Marks	Credits		
		Lect	Tut	Pract	In-Sem	End-Sem	TW	PR	OR		TH	TW	OR/PR
402041	Hydraulics and Pneumatics	3	-	2	30	70	25	-	25	150	3	-	1
402042	CAD CAM Automation	3	-	2	30	70	25	50	-	175	3	-	1
402043	Dynamics of Machinery	4	-	2	30	70	25	-	25	150	4	-	1
402044	Elective-I	3	-	2	30	70	25	-	-	125	3	1	-
402045	Elective-II	3	-	-	30	70	-	-	-	100	3	-	-
402046	Project Stage-I	-	-	4	-	-	25	-	25	50	-	1	1
Total		16	-	12	150	350	125	50	75	750	16	2	4
											22		

B. E. (Mechanical Engineering) (2015 Course) Semester – VIII

Code	Subject	Teaching Scheme Hrs / week			Examination Scheme					Total Marks	Credits		
		Lect	Tut	Pract	In-Sem	End-Sem	TW	PR	OR		TH	TW	OR/PR
402047	Energy Engineering	3	-	2	30	70	25	-	25	150	3	-	1
402048	Mechanical System Design	4	-	2	30 (1.5 hrs)	70 (3 hrs)	25	-	50	175	4	-	1
402049	Elective-III	3		2	30	70	25	-	--	125	3	1	-
402050	Elective-IV	3	-	-	30	70	-	-	-	100	3	-	-
402051	Project Stage-II	-	-	12	-	-	100	-	100	200	-	3	3
Total		13	-	18	120	280	175	-	175	750	13	4	5
											22		

Elective – I		Elective – II	
Code	Subject	Code	Subject
402044 A	Finite Element Analysis	402045 A	Automobile Engineering
402044 B	Computational Fluid Dynamics	402045 B	Operation Research
402044 C	Heating Ventilation and Air Conditioning	402045 C	Energy Audit and Management
		402045 D	Open Elective**
Elective – III		Elective – IV	
402049 A	Tribology	402050 A	Advanced Manufacturing Processes
402049 B	Industrial Engineering	402050 B	Solar & Wind Energy
402049 C	Robotics	402050 C	Product Design and Development
		402050 D	Open Elective**

Savitribai Phule Pune University

FACULTY OF ENGINEERING

B.E. Electrical Engineering (2015 Course)
(w.e.f. 2018-2019)

SEMESTER-I													
Sr No	Subject Code	Subject Title	Teaching Scheme (Hrs/Week)			Examination Scheme (Marks)					Total Marks	Credit	
						PP		TW	PR	OR			
			TH	PR	TU	In Sem	End Sem					TH / TU	PR + OR
1	403141	Power System Operation and Control	03	02	--	30	70	25	--	25	150	03	01
2	403142	PLC and SCADA Applications	04	02	--	30	70	25	50	--	175	04	01
3	403143	Elective I	03	02	--	30	70	25	--	--	125	03	01
4	403144	Elective II	03	--	--	30	70	--	--	--	100	03	--
5	403145	Control System II	03	02	--	30	70	25	--	25	150	03	01
6	403146	Project I	--	--	02	--	--	--	--	50	50	02	--
	403152	Audit Course V											
TOTAL			16	08	02	150	350	100	50	100	750	18	04

SEMESTER-II													
Sr No	Subject Code	Subject Title	Teaching Scheme (Hrs/Week)			Examination Scheme (Marks)					Total Marks	Credit	
						PP		TW	PR	OR			
			TH	PR	TU	In Sem	End Sem					TH / TU	PR + OR
1	403147	Switchgear and Protection	03	02	--	30	70	50	--	25	175	03	01
2	403148	Power Electronic Controlled Drives	04	02	--	30	70	25	50	--	175	04	01
3	403149	Elective III	03	02	--	30	70	25	--	25	150	03	01
4	403150	Elective IV	03	--	--	30	70	--	--	--	100	03	--
5	403151	Project II	--	--	06	--	--	50	--	100	150	06	--
	403153	Audit Course VI											
TOTAL			13	06	06	120	280	150	50	150	750	19	03

Savitribai Phule Pune University
FACULTY OF ENGINEERING
T.E. Electrical Engineering (2015 Course)
(w.e.f. 2017-2018)

SEMESTER-I													
Sr. No	Subject Code	Subject Title	Teaching Scheme			Examination Scheme					Total Marks	Credit	
			Th.	Pr.	Tu.	PP		TW	PR	OR		TH/ TU	PR+OR
						In Sem	End Sem						
1	311121	Industrial and Technology Management	03	--	--	30	70	--	--	--	100	**03**	--
2	303141	Advance Microcontroller and its Applications	04	02	--	30	70	--	--	50	150	**04**	**01**
3	303142	Electrical Machines II	04	02	--	30	70	--	50	--	150	**04**	**01**
4	303143	Power Electronics	04	02	--	30	70	--	50	--	150	**04**	**01**
5	303144	Electrical Installation, Maintenance and Testing	03	02	--	30	70	50	--	--	150	**03**	**01**
6	303145	Seminar and Technical Communication	--	02	--	--	--	50	--	--	50	**--**	**01**
	303152	Audit Course III											
TOTAL			**18**	**10**	**--**	**150**	**350**	**100**	**100**	**50**	**750**	**18**	**05**

SEMESTER-II													
Sr. No.	Subject Code	Subject Title	Teaching Scheme			Examination Scheme					Total Marks	Credit	
			Th.	Pr.	Tu	PP		TW	PR	OR		TH/ TU	PR+OR
						In Sem	End Sem						
1.	303146	Power System II	04	02	--	30	70	--	50	--	150	**04**	**01**
2.	303147	Control System I	04	02	--	30	70	-	--	50	150	**04**	**01**
3.	303148	Utilization of Electrical Energy	03	--	--	30	70	--	--	--	100	**03**	--
4.	303149	Design of Electrical Machines	04	02	--	30	70	25	--	50	175	**04**	**01**
5.	303150	Energy Audit and Management	03	02	--	30	70	25	--	--	125	**03**	**01**
6.	303151	Electrical Workshop	--	02	--	--	--	50	--	--	50	--	**01**
	303153	Audit Course IV											
Total			**18**	**10**	**--**	**150**	**350**	**100**	**50**	**100**	**750**	**18**	**05**

Th: Theory lectures hours/week
Pr: Practical hours/week
Tu: Tutorial hours/week

TW: Term work
PR: Theory
OR: Oral
PP: Paper- In semester and End Semester

Savitribai Phule Pune University

Syllabus: Second Year (SE) Electrical Engineering (2019 Course) w.e.f. AY:2020-2021

SEMESTER-I

Course Code	Courses Name	Teaching Scheme			Examination Scheme and Marks						Credits			
		TH	PR	TUT	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
207006	Engineering Mathematics-III	03	--	--	30	70	--	--	--	**100**	03	--	--	**03**
203141	Power Generation Technologies	03	--	--	30	70	--	--	--	**100**	03	--	--	**03**
203142	Material Science	03	04#	--	30	70	25	--	25	**150**	03	02	--	**05**
203143	Analog and Digital Electronics	03	02	--	30	70	--	50	--	**150**	03	01	--	**04**
203144	Electrical Measurement & Instrumentation	03	04#	--	30	70	25	25	--	**150**	03	02	--	**05**
203150	Applications of Mathematics in Electrical Engineering	--	02*	--	--	--	25	--	--	**25**	--	01	--	**01**
203151	Soft Skill	--	02	--	--	--	25	--	--	**25**	--	01	--	**01**
203152	Audit Course-III	--	--	--	--	--	--	--	--	**--**	**Grade: PP/NP**			
Total		**15**	**14**	**--**	**150**	**350**	**100**	**75**	**25**	**700**	**15**	**07**	**--**	**22**

SEMESTER-II

Course Code	Courses Name	Teaching Scheme			Examination Scheme and Marks						Credits			
		TH	PR	TUT	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
203145	Power System-I	03	--	--	30	70	--	--	--	**100**	03	--	--	**03**
203146	Electrical Machines-I	03	02	--	30	70	--	50	--	**150**	03	01	--	**04**
203147	Network Analysis	03	02	--	30	70	25	--	--	**125**	03	01	--	**04**
203148	Numerical Methods & Computer Programming	03	02	--	30	70	--	25	--	**125**	03	01	--	**04**
203149	Fundamental of Microcontroller and Applications	03	04$	--	30	70	25	--	25	**150**	03	02	--	**05**
203152	Project Based Learning	--	04	--	--	--	50	--	--	**--**	--	02	--	**--**
203153	Audit Course-IV	--	--	--	--	--	--	--	--	**--**	**Grade: PP/NP**			
Total		**15**	**14**	**--**	**150**	**350**	**100**	**75**	**25**	**700**	**15**	**07**	**--**	**22**

* - Lab sessions on application of Mathematics in Electrical Engineering using professional software.

- Practical section will comprises of two Part : a) PART A : 2 hours per week : Regular curriculum listed practical total 12 numbers out of which conduction of 8 numbers will be mandatory b) PART B : 2 Hours a week :Practical/case studies/assignments to enable active learning based on advances related to subject to bridge gap between curriculum and enhance practical knowledge required in field .

$ - Practical section will comprises of two Part : a) PART A : 2 hours per week : Regular curriculum listed practical total 12 numbers out of which conduction of 8 numbers will be mandatory b) PART B : 2 Hours a week : IOT application in Electrical Engineering using microcontroller and GSM module to bridge gap between curriculum and enhance application knowledge.

Abbreviation: TH: Theory, PR: Practical, TUT:Tutorial, ISE: Insem Exam, ESE: End Sem Exam, TW: Term Work, OR: Oral

Savitribai Phule Pune University

Faculty of Science and Technology

Syllabus for

S.E (Electronics / Electronics & Telecommunication Engineering)

(Course 2019)

(w.e.f. June 2020)

Savitribai Phule Pune University, Pune
S.E. (Electronics / E&TC Engineering) 2019 Course
(With effect from Academic Year 2020-21)

Semester-III

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credit			
		Theory	Practical	Tutorial	In-Sem	End-Sem	TW	PR	OR	Total	TH	PR	TUT	Total
207005	Engineering Mathematics III	04	-	01	30	70	25	-	-	125	04	-	01	05
204181	Electronic Circuits	03	-	-	30	70	-	-	-	100	03	-	-	03
204182	Digital Circuits	03	-	-	30	70	-	-	-	100	03	-	-	03
204183	Electrical Circuits	03	-	-	30	70	-	-	-	100	03	-	-	03
204184	Data structures	03	-	-	30	70	-	-	-	100	03	-	-	03
204185	Electronic Circuit Lab	-	02	-	-	-	-	50	-	50	-	01	-	01
204186	Digital circuits Lab		02					50		50		01		01
204187	Electrical Circuit Lab	-	02	-	-	-	25	-	-	25	-	01	-	01
204188	Data Structures Lab	-	02	-	-	-	-	-	25	25	-	01	-	01
204189	Electronic Skill Development	-	02	-	-	-	25	-	-	25	-	01	-	01
204190	Mandatory Audit Course 3 &	-	-	-					-	-	-	-	-	-
Total		**16**	**10**	**01**	**150**	**350**	**75**	**100**	**25**	**700**	**16**	**05**	**01**	**22**

FACULTY OF ENGINEERING

Savitribai Phule Pune University

Syllabus for the

T.E (Electronics & Telecommunications Engineering)

(2015 Course)

(w.e.f . June 2017)

Savitribai Phule University of Pune, Pune

Third Year E&TC Engineering (2015 Course)

(With effect from Academic Year 2017-18)

Semester I

Course Code	Course	Teaching Scheme Hours / Week			Semester Examination Scheme of Marks						Credits	
		Theory	Tutorials	Practicals	In-Sem	End-Sem	TW	PR	OR	Total	Th+Tut	PR/OR/TW
304181	Digital Communication	3	--	--	30	70	--	--	--	100	3	--
304182	Digital Signal Processing	3	--	--	30	70	--	--	--	100	3	--
304183	Electromagnetics	3	1	--	30	70	--	--	--	100	4	--
304184	Microcontrollers	3	--	--	30	70	--	--	--	100	3	--
304185	Mechatronics	3	--	--	30	70	--	--	--	100	3	--
304191	Signal Processing and Communications Lab (DC/DSP)	--	--	4	--	--	50	50		100	--	2
304192	Microcontrollers and Mechatronics Lab	--	--	4	--	--	50	50		100	-	2
304193	Electronics System Design	2	--	2	--	--	-	--	50	50	2	1
	Audit Course 3	--	--	--	--	--	--	--	--	--	----	
	Total	17	01	10	150	350	100	100	50	750	18	5
										Total Credits	**23**	

Third Year E&TC Engineering (2015 Course)

(With effect from Academic Year 2017-18)

Semester II

Course Code	Course	Teaching Scheme Hours / Week			Semester Examination Scheme of Marks						Credit	
		Theory	Tutorials	Practicals	In-Sem	End-Sem	TW	PR	OR	Total	Th+Tut	PR/OR/TW
304186	Power Electronics	3	--	--	30	70	--	--	--	100	3	--
304187	Information Theory, Coding and Communication Networks	4	--	--	30	70	--	--	--	100	4	--
304188	Business Management	3	--	--	30	70	--	--	--	100	3	--
306189	Advanced Processors	3	--	--	30	70	--	--	--	100	3	--
304190	System Programming and Operating Systems	3	--	--	30	70		--	--	100	3	--
304194	Power and ITCT Lab	--	--	4	--	--	50	50	--	100	--	2
304195	Advanced Processors and System Programming Lab	--	--	4	--	--	50	50	--	100	--	2
304196	Employability Skills and Mini Project	2	--	2	--	--	--	--	50	50	2	1
	Audit Course 4	--	--	--	--	--	--	--	--	--		
	Total	18	---	10	150	350	100	100	50	750	18	5
										Total Credits	**23**	

Savitribai Phule Pune University

Faculty of Science &Technology

B.E. (Electronics & Telecommunication)
(2015 Pattern) Syllabus
(With effect from Academic Year 2018-19)

Savitribai PhulePune University
Final Year E&TC Engineering (2015 Course)
(With effect from Academic Year 2018-19)

Semester I												
Course Code	Course	Teaching Scheme Hours / Week			Semester Examination Scheme of Marks						Credits	
		Theory	Tut	Pract	In-Sem	End-Sem	TW	PR	OR	Total	TH/TW	PR+OR
404181	VLSI Design& Technology	3	--	--	30	70	--	--	--	100	3	--
404182	Computer Networks & Security	4	--	--	30	70	--	--	--	100	4	--
404183	Radiation & Microwave Techniques	3	--	--	30	70	--	--	--	100	3	--
404184	Elective I	3	--	--	30	70	--	--	--	100	3	--
404185	Elective II	3			30	70	--	--	--	100	3	--
404186	Lab Practice -I (CNS+ RMT)	--	--	4	--	--	50	--	50	100	--	2
404187	Lab Practice -II (VLSI + Elective I)	--	--	4	--	--	50	50		100	--	2
404188	Project Stage I	-	2	--	--	--	-	--	50	50	--	2
	Audit Course 5	--	--	--	--	--	--	--	--	--	----	
	Total	16	2	8	150	350	100	50	100	750	16	6
Total Credits											**22**	

Elective I

1 Digital Image and Video Processing
2. Industrial Drives and Control
3. Embedded Systems & RTOS
4. Internet of Things

Elective II

1. Wavelets
2. Electronics Product Design
3. Optimization Techniques
4. Artificial Intelligence
5. Electronics in agriculture

Audit Course 5

1. Green Energy
2. Human Behaviour

Final Year E&TC Engineering (2015 Course)

(With effect from Academic Year 2018-19)

Semester II

Course Code	Course	Teaching Scheme Hours / Week			Semester Examination Scheme of Marks						Credit	
		Theory	Tut	Pract	In-Sem	End-Sem	TW	PR	OR	Total	TH/TW	PR+OR
404189	Mobile Communication	3	--	--	30	70	--	--	--	100	3	--
404190	Broadband Communication Systems	4	--	--	30	70	--	--	--	100	4	--
404191	Elective III	3	--	--	30	70	--	--	--	100	3	--
404192	Elective IV	3	--	--	30	70	--	--	--	100	3	--
404193	Lab Practice –III (MC+BCS)	--	--	4	--	--	50	50	--	100	--	2
404194	Lab Practice –IV (Elective III)	--	--	2	--	--	--	--	50	50	--	1
404195	Project Stage II	--	6	-	--	--	150	--	50	200	--	6
	Audit Course 6	--	--	--	--	--	--	--	--	--		
Total		13	6	6	120	280	200	50	100	750	13	9
										Total Credits	**22**	

Elective III	**Elective-IV**	**Audit Course 6**
1. Machine Learning 2. PLC s and Automation 3. Audio and Speech Processing 4. Software Defined Radio 5. Audio Video Engineering	1. Robotics 2. Biomedical Electronics 3. Wireless Sensor Networks 4. Renewable Energy Systems 5. Open Elective*	1. Team Building, Leadership and Fitness 2. Environmental issues and Disaster Management

*Any one course from the list of Elective IV of computer/IT/Electrical/Instrumentation or Institute can offer elective IV based on any industry need with prior approval from BoS(Electronics & Telecommunication). Repetition of course or topics should be avoided.

Savitribai Phule Pune University
Fourth Year of Computer Engineering (2015 Course)
(with effect from 2018-19)

Semester I

Course Code	Course	Teaching Scheme Hours / Week		Examination Scheme and Marks						Credit	
		Theory	Practical	In-Sem	End-Sem	TW	PR	OR/ *PRE	Total	TH/ TUT	PR
410241	High Performance Computing	04	--	30	70	--	--	--	100	04	--
410242	Artificial Intelligence and Robotics	03	--	30	70	--	--	--	100	03	--
410243	Data Analytics	03	--	30	70	--	--	--	100	03	--
410244	Elective I	03	--	30	70	--	--	--	100	03	--
410245	Elective II	03	--	30	70	--	--	--	100	03	--
410246	Laboratory Practice I	--	04	--	--	50	50	--	100	--	02
410247	Laboratory Practice II	--	04	--	--	50	--	*50	100	--	02
410248	Project Work Stage I	--	02	--	--	--	--	*50	50	--	02
									Total Credit	**16**	**06**
Total		**16**	**10**	**150**	**350**	**100**	**50**	**100**	**750**	**22**	
410249	Audit Course 5									**Grade**	

Elective I	Elective II
410244 (A) Digital Signal Processing	**410245 (A)** Distributed Systems
410244 (B) Software Architecture and Design	**410245 (B)** Software Testing and Quality Assurance
410244 (C) Pervasive and Ubiquitous Computing	**410245 (C)** Operations Research
410244 (D) Data Mining and Warehousing	**410245 (D)** Mobile Communication

410249-Audit Course 5 (AC5) Options:

AC5-I Entrepreneurship Development

AC5-II: Botnet of Things

AC5-III: 3D Printing

AC5-IV: Industrial Safety and Environment Consciousness

AC5-V: Emotional Intelligence

AC5-VI: MOOC- Learn New Skills

Abbreviations:

TW: Term Work **TH:** Theory **OR:** Oral **PR:** Practical

Sem: Semester *__PRE__: Project/ Mini-Project Presentation

Savitribai Phule Pune University
Fourth Year of Computer Engineering (2015 Course)
(with effect from 2018-19)

Semester II

Course Code	Course	Teaching Scheme Hours / Week		Examination Scheme and Marks						Credit	
		Theory	Practical	In-Sem	End-Sem	TW	PR	OR/ *PRE	Total	TH/ TUT	PR
410250	Machine Learning	03	--	30	70	--	--	--	100	03	--
410251	Information and Cyber Security	03	--	30	70	--	--	--	100	03	--
410252	Elective III	03	--	30	70	--	--	--	100	03	--
410253	Elective IV	03	--	30	70	--	--	--	100	03	--
410254	Laboratory Practice III	--	04	--	--	50	50	--	100	--	02
410255	Laboratory Practice IV	--	04	--	--	50	--	*50	100	--	02
410256	Project Work Stage II	--	06	--	--	100	--	*50	150	--	06
								Total	Credit	12	10
Total		**12**	**14**	**120**	**280**	**200**	**50**	**100**	**750**	**22**	
410257	Audit Course 6									Grade	

Elective III	Elective IV
410252 (A) Advanced Digital Signal Processing	**410253 (A)** Software Defined Networks
410252 (B) Compilers	**410253 (B)** Human Computer Interface
410252 (C) Embedded and Real Time Operating Systems	**410253 (C)** Cloud Computing
410252 (D) Soft Computing and Optimization Algorithms	**410253 (D)** Open Elective

410259-Audit Course 6 (AC6) Options:

AC6-I: Business Intelligence
AC6-II: Gamification
AC6-III: Quantum Computing
AC6-IV: Usability Engineering
AC6-V: Conversational Interfaces
AC6-VI: MOOC- Learn New Skills

Abbreviations:

TW: Term Work **TH:** Theory **OR:** Oral **PR:** Practical
Sem: Semester *__PRE__: Project/ Mini-Project Presentation

Savitribai Phule University of Pune Third Year Computer Engineering (2015 Course) (with effect from 2017-18)												
Semester I												
Course Code	Course	Teaching Scheme Hours / Week			Examination Scheme and Marks						Credit	
		Theory	Tutorial	Practical	In-Sem	End-Sem	TW	PR	OR	Total	TH/TUT	PR
310241	Theory of Computation	03	--	--	30	70	--	--	--	100	03	--
310242	Database Management Systems (DBMS)	03	--	--	30	70	--	--	--	100	03	--
310243	Software Engineering & Project Management	03	--	--	30	70	--	--	--	100	03	--
310244	Information Systems & Engineering Economics	03	--	--	30	70	--	--	--	100	03	--
310245	Computer Networks (CN)	04	--	--	30	70	--	--	--	100	04	--
310246	Skills Development Lab	--	02	04	--	--	50	--	50	100	02	02
310247	DBMS Lab	--	--	04	--	--	25	50	--	75	--	02
310248	CN Lab	--	--	02	--	--	25	50	--	75	--	01
										Total Credit	18	05
	Total	16	02	10	150	350	100	100	50	750	23	
310249	Audit Course 3										Grade	

310249-Audit Course 3 (AC3) Options:

AC3-I: Cyber Security **AC3-II:** Professional Ethics and Etiquettes

AC3-III: Emotional Intelligence **AC3-IV:** MOOC- Learn New Skills

AC3-V: Foreign Language (Japanese- Module 3)

Abbreviations:

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

Savitribai Phule University of Pune
Third Year Computer Engineering (2015 Course)
(with effect from 2017-18)

Semester II

Course Code	Course	Teaching Scheme Hours / Week			Examination Scheme and Marks						Credit	
		Theory	Tutorial	Practical	In-Sem	End-Sem	TW	PR	OR	Total	TH/TUT	PR
310250	Design & Analysis of Algorithms	04	--	--	30	70	--	--	--	100	04	
310251	Systems Programming & Operating System (SP & OS)	04	--	--	30	70	--	--	--	100	04	--
310252	Embedded Systems & Internet of Things (ES & IoT)	04	--	--	30	70	--	--	--	100	04	--
310253	Software Modeling and Design	03	--	--	30	70	--	--	--	100	03	--
310254	Web Technology	03	--	--	30	70	--	--	--	100	03	--
310255	Seminar & Technical Communication	--	01	--	--	--	50	--	--	50	01	--
310256	Web Technology Lab	--	--	02	--	--	25	50	--	75	--	01
310257	SP & OS Lab	--	--	04	--	--	25	50	--	75	--	02
310258	ES & IoT Lab	--	--	02	--	--	50	--	--	50	--	01
										Total Credit	19	04
	Total	18	01	08	150	350	150	100	--	750	23	
310259	Audit Course 4										Grade	

310259-Audit Course 4(AC4) Options:

AC4-I: Digital and Social Media Marketing **AC4-II:** Green Computing
AC4-III: Sustainable Energy Systems **AC4-IV:** Leadership and Personality Development
AC4-V: Foreign Language (Japanese- Module 4)

Abbreviations:

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

Savitribai Phule Pune University, Pune
Master of Computer Engineering (2017 Course)
(with effect from June 2017)

Semester I

Course Code	Course	Teaching Scheme Hours / Week		Examination Scheme and Marks					Credit	
		Theory	Practical	In-Sem	End-Sem	TW	OR/ PRE	Total	TH	PR
510101	Research Methodology	04	--	50	50	--	--	100	04	--
510102	Bio-Inspired Optimization Algorithms	04	--	50	50	--	--	100	04	--
510103	Software Development and Version Control	04	--	50	50	--	--	100	04	--
510104	Embedded and Real Time Operating Systems	04	--	50	50	--	--	100	04	--
510105	Elective I	05	--	50	50	--	--	100	05	-
510106	Laboratory Proficiency I	--	08	--	--	50	50	100	--	04
								Total Credit	21	04
Total		**21**	**08**	**250**	**250**	**50**	**50**	**600**	**25**	
510107	Non-Credit Course I								Grade	

Elective I

510105A	Advanced Digital Signal Processing	510105B	Data Mining
510105C	Network Design and Analysis	510105D	Data Algorithms
510105E	Open Elective		

Semester II

Course Code	Course	Teaching Scheme Hours / Week		Examination Scheme and Marks					Credit	
		Theory	Practical	In-Sem	End-Sem	TW	OR/ PRE	Total	TH	PR
510108	Operations Research	04	--	50	50	--	--	100	04	--
510109	System Simulation and Modeling	04	--	50	50	--	--	100	04	--
510110	Machine Learning	04	--	50	50	--	--	100	04	--
510111	Elective II	05	--	50	50	--	--	100	05	--
510112	Seminar I		04	--	--	50	50	100	--	04
510113	Laboratory Proficiency II	--	08	--	--	50	50	100	--	04
								Total Credit	17	08
Total		**17**	**12**	**200**	**200**	**100**	**100**	**600**	**25**	
510114	Non-Credit Course II								Grade	

Elective II

510111A	Image Processing	510111B	Web Mining
510111C	Pervasive and Ubiquitous Computing	510111D	Network Security
510111E	Open Elective		

Abbreviations: TW: Term Work , **TH:** Theory, **OR:** Oral, **PRE**: Presentation, **Sem:** Semester

Savitribai Phule Pune University, Pune
Master of Computer Engineering (2017 Course)

Semester III

Course Code	Course	Teaching Scheme Hours / Week		Examination Scheme and Marks					Credit	
		Theory	Practical	In-Sem	End-Sem	TW	OR/PRE	Total	TH	PR
610101	Fault Tolerant Systems	04	--	50	50	--	--	100	04	--
610102	Information Retrieval	04	--	50	50	--	--	100	04	--
610103	Elective III	05	--	50	50	--	--	100	05	--
610104	Seminar II	--	04	--	--	50	50	100	--	04
610105	Dissertation Stage I	--	08	--	--	50	50	100	--	08
								Total Credit	13	12
Total		**13**	**12**	**150**	**150**	**100**	**100**	**500**	**25**	
610106	Non-Credit Course III								Grade	

Elective III

610103A	Cloud Security	610103B	Speech Signal Processing		
610103C	Mobile Ad-hoc Network	610103D	Pattern Recognition	610103E	Open Elective

Semester IV

Course Code	Course	Teaching Scheme Hours / Week	Examination Scheme and Marks			Credit
		Practical	TW	OR/PRE	Total	PR
610107	Seminar III	05	50	50	100	05
610108	Dissertation Stage II	20	150	50	200	20
Total		**25**	**200**	**100**	**300**	**25**

Non-Credit Courses

Typically curriculum is constituted by credit, non-credit and audit courses. These courses are offered as compulsory or elective. Non Credit Courses are compulsory. No grade points are associated with non-credit courses and are not accounted in the calculation of the performance indices SGPA & CGPA. However, the award of the degree is subject to obtain a PP grade for non credit courses. Conduction and assessment of performance in said course is to be done at institute level. The mode of the conduction and assessment can be decided by respective course instructor. Recommended but not limited to- (one or combination of) seminar, workshop, MOOC Course certification, mini project, lab assignments, lab/oral/written examination, field visit, field training. Examinee should submit report/journal of the same. Reports and documents of conduction and assessment in appropriate format are to be maintained at institute. Result of assessment will be PP or NP. Set of non-credit courses offered is provided. The Examinee has to select the relevant course from pool of courses offered. Course Instructor may offer beyond this list by seeking recommendation from SPPU authority. The selection of 3 distinct non-credit courses, one per semester (Semester I, II & III). The Contents of Non Credit Courses are Provided at page 63 onwards.

Open Elective: The open elective is to invite the attention to multidisciplinary, interdisciplinary, exotic, employability or update to technology course. The institute may design the syllabus accordingly. However such designed syllabus needs to be approved by SPPU authority before implementation.

Recommended Set of Non-Credit Courses(510107, 510114, 610106):

NCC1: Game Engineering
NCC2: Advanced Cognitive Computing
NCC3: Reconfigurable Systems
NCC4: Convergence Technology
NCC5: Machine Learning
NCC6: Storage Area Networks
NCC7: Search Engine Optimization
NCC8: Virtual Reality
NCC9: Machine Translation
NCC10: Infrastructure Management

Savitribai Phule Pune University

Second Year of Computer Engineering (2019 Course)

(With effect from Academic Year 2020-21)

Semester-III

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credit Scheme			
		Lecture	Practical	Tutorial	Mid-Sem	End-Sem	Term work	Practical	Oral	Total	Lecture	Practical	Tutorial	Total
210241	Discrete Mathematics	03	-	-	30	70	-	-	-	100	03	--	-	03
210242	Fundamentals of Data Structures	03	-	-	30	70	-	-	-	100	03	-	-	03
210243	Object Oriented Programming (OOP)	03	-	-	30	70	-	-	-	100	03	-	-	03
210244	Computer Graphics	03	-	-	30	70	-	-	-	100	03	-	-	03
210245	Digital Electronics and Logic Design	03	-	-	30	70	-	-	-	100	03	-	-	03
210246	Data Structures Laboratory	-	04	-	-	-	25	50	-	75	-	02	-	02
210247	OOP and Computer Graphics Laboratory	-	04	-	-	-	25	25	-	50	-	02	-	02
210248	Digital Electronics Laboratory	-	02	-	-	-	25	-	-	25	-	01	-	01
210249	Business Communication Skills	-	02	-	-	-	25	-	-	25	-	01	-	01
210250	Humanity and Social Science	-	-	01	-	-	25	-	-	25	-	-	01	01
210251	Audit Course 3													
										Total Credit	**15**	**06**	**01**	**22**
	Total	**15**	**12**	**01**	**150**	**350**	**125**	**75**	**-**	**700**	**-**	**-**	**-**	**-**

Semester-IV

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credit Scheme			
		Lecture	Practical	Tutorial	Mid-Sem	End-Sem	Term work	Practical	Oral	Total	Lecture	Practical	Tutorial	Total
207003	Engineering Mathematics III	03	-	01	30	70	25	-	-	125	03	--	01	04
210252	Data Structures and Algorithms	03	-	-	30	70	-	-	-	100	03	-	-	03
210253	Software Engineering	03	-	-	30	70	-	-	-	100	03	-	-	03
210254	Microprocessor	03	-	-	30	70	-	-	-	100	03	-	-	03
210255	Principles of Programming Languages	03	-	-	30	70	-	-	-	100	03	-	-	03
210256	Data Structures and Algorithms Laboratory	-	04	-	-	-	25	25	-	50	-	02	-	02
210257	Microprocessor Laboratory	-	02	-	-	-	25	-	25	50	-	01	-	01
210258	Project Based Learning II	-	04	-	-	-	50	-	-	50	-	02	-	02
210259	Code of Conduct	-	-	01	-	-	25	-	-	25	-	-	01	01
210260	Audit Course 4													
										Total Credit	**15**	**05**	**02**	**22**
	Total	**15**	**10**	**02**	**150**	**350**	**150**	**25**	**25**	**700**	**-**	**-**	**-**	**-**

M.E. (Electronics and Telecommunications-
VLSI and Embedded Systems)

2017 Pattern
Syllabus Structure

First Year – Semester I

Sr.No.	Subject Code	Subject	Examination Scheme					Total	Credits
				Paper					
			L/P	ISA	ESA	TW	OR		
1	504201	Digital CMOS Design	4	50	50	-	-	100	4
2	504202	Reconfigurable Computing	4	50	50	-	-	100	4
3	504203	Embedded System Design	4	50	50	-	-	100	4
4	504204	Research Methodology	4	50	50	-	-	100	4
5	504205	Elective I	5	50	50	-	-	100	5
6	504206	Lab. Practice I	4	-	-	50	50	100	4
		Total	**25**	**250**	**250**	**50**	**50**	**600**	**25**

Elective I:

1. Micro Electromechanical Systems
2. Nano Technology
3. Processor Design
4. Wireless Sensor Networks
5. MOS Device Modeling and Characterization

First Year – Semester II

Sr.No.	Subject Code	Subject	Examination Scheme					Total	Credits
				Paper					
			L/P	ISA	ESA	TW	OR		
1	504207	Analog CMOS Design	4	50	50	-	-	100	4
2	504208	System on Chip	4	50	50	-	-	100	4
3	504209	Embedded Automotive Systems	4	50	50	-	-	100	4
4	504210	Elective II	5	50	50	-	-	100	5
5	504211	Lab. Practice II	4	--	---	50	50	100	4
6	504212	Seminar I	4	-	-	50	50	100	4
		Total	**25**	**200**	**200**	**100**	**100**	**600**	**25**

Elective II :

1. Embedded Product Design
2. High Speed ICs
3. Mixed Signal IC Design
4. Embedded Signal Processor Architectures
5. Real Time Operating Systems

Second Year – Semester I

Sr.No.	Subject Code	Subject	Examination Scheme					Total	Credits
				Paper					
			L/P	ISA	ESA	TW	OR		
1	604201	Testing and Verification ofVLSI Circuits	4	50	50	-	-	100	4
2	604202	ASIC Design	4	50	50	-	-	100	4
3	604203	Elective III	5	50	50	-	-	100	5
4	604204	Seminar II	4	--	----	50	50	100	4
5	604205	Project Stage I	8	--	---	50	50	100	8
		Total	**25**	**150**	**150**	**100**	**100**	**500**	**25**

Elective III:

Elective III Topics for 3 Credits

1 Value Education, Human Rights and Legislative Procedures
2 Environmental Studies
3 Renewable Energy Studies
4 Disaster Management
5 Foreign language
6 Knowledge Management
7 Economics for Engineers
8 Engineering Risk – Benefit Analysis

Elective III Topics for 2 Credits

1 Optimization Techniques
2 Fuzzy Mathematics
3 Design and Analysis of Algorithms
4 CUDA

Second Year – Semester II

Sr.No.	Subject Code	Subject	Examination Scheme					Total	Credits
				Paper					
			L/P	ISA	ESA	TW	OR		
1	604206	Seminar III	5	--	----	50	50	100	5
2	604207	Project Stage II	20	--	---	150	50	200	20
		Total	**25**		**--**	**200**	**100**	**300**	**25**

Note: Seminar I, II & III reports should be prepared in Latex.