[PUNE DISTRICT EDUCATION ASSOCIATION,COLLEGE OF ENGINEERING

Syllabus of Department Information Technology

Under Savitribai Phule University

Year 2021-22

This document represents the syllabus of SE,TE,BE of Information Technology under sppu

Syllabus Second Year Engg

Sppu 2019 pattern

Faculty of Science & Technology
Savitribai Phule Pune University, Pune
Maharashtra, India

Curriculum
for
Second Year of Information Technology
(2019 Course)
(With effect from AY 2020-21)

I N D E X

Home

Savitribai Phule Pune University, Pune Bachelor of Information Technology	
Program Educational Objectives	
PEO1	**Possess strong fundamental concepts in mathematics, science, engineering and Technology to address technological challenges.**
PEO2	**Possess knowledge and skills in the field of Computer Science and Information Technology for analyzing, designing and implementing complex engineering problems of any domain with innovative approaches.**
PEO3	**Possess an attitude and aptitude for research, entrepreneurship and higher studies in the field of Computer Science and Information Technology.**
PEO4	**Have commitment to ethical practices, societal contributions through communities and life-long learning.**
PEO5	**Possess better communication, presentation, time management and teamwork skills leading to responsible & competent professionals and will be able to address challenges in the field of IT at global level.**

Home

Program Outcomes		
Students are expected to know and be able to–		
PO1	Engineering knowledge	An ability to apply knowledge of mathematics, computing, science, engineering and technology.
PO2	Problem analysis	An ability to define a problem and provide a systematic solution with the help of conducting experiments, analyzing the problem and interpreting the data.
PO3	Design / Development of Solutions	An ability to design, implement, and evaluate a software or a software/hardware system, component, or process to meet desired needs within realistic constraints.
PO4	Conduct Investigations of Complex Problems	An ability to identify, formulates, and provides systematic solutions to complex engineering/Technology problems.
PO5	Modern Tool Usage	An ability to use the techniques, skills, and modern engineering technology tools, standard processes necessary for practice as a IT professional.
PO6	The Engineer and Society	An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems with necessary constraints and assumptions.
PO7	Environment and Sustainability	An ability to analyze and provide solution for the local and global impact of information technology on individuals, organizations and society.
PO8	Ethics	An ability to understand professional, ethical, legal, security and social issues and responsibilities.
PO9	Individual and Team Work	An ability to function effectively as an individual or as a team member to accomplish a desired goal(s).
PO10	Communication Skills	An ability to engage in life-long learning and continuing professional development to cope up with fast changes in the technologies/tools with the help of electives, professional organizations and extra-curricular activities.
PO11	Project Management and Finance	An ability to communicate effectively in engineering community at large by means of effective presentations, report writing, paper publications, demonstrations.
PO12	Life-long Learning	An ability to understand engineering, management, financial aspects, performance, optimizations and time complexity necessary for professional practice.

Home

Program Specific Outcomes (PSO)	
A graduate of the Information Technology Program will demonstrate-	
PSO1	An ability to apply the theoretical concepts and practical knowledge of Information Technology in analysis, design, development and management of information processing systems and applications in the interdisciplinary domain.
PSO2	An ability to analyze a problem, and identify and define the computing infrastructure and operations requirements appropriate to its solution. IT graduates should be able to work on large-scale computing systems.
PSO3	An understanding of professional, business and business processes, ethical, legal, security and social issues and responsibilities.
PSO4	Practice communication and decision-making skills through the use of appropriate technology and be ready for professional responsibilities.

Home

Savitribai Phule Pune University
Second Year of Information Technology 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
214441	Discrete Mathematics	03	-	01	30	70	25	-	-	125	03	--	01	04
214442	Logic Design and Computer Organization	03	-	-	30	70	-	-	-	100	03	-	-	03
214443	Data Structures and Algorithms	03	-	-	30	70	-	-	-	100	03	-	-	03
214444	Object Oriented Programming	03	-	-	30	70	-	-	-	100	03	-	-	03
214445	Basics of Computer Network	03	-	-	30	70	-	-	-	100	03	-	-	03
214446	Logic Design Computer Organization Lab	-	02	-	-	-	25	25	-	50	-	01	-	01
214447	Data Structures and Algorithms Lab	-	04	-	-	-	25	25	-	50	-	02	-	02
214448	Object Oriented Programming Lab	-	04	-	-	-	25	25	-	50	-	02	-	02
214449	Soft Skill Lab	-	02	-	-	-	25	-	-	25	-	01	-	01
214450	Mandatory Audit Course 3	-	-	-	-	-	-	-	-	-	Non Credit			-
Total		15	12	01	150	350	125	75	--	700	15	06	01	22

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

Note: Students of S.E. (Information Technology) can opt any one of the audit course from the list of audit courses prescribed by BoS (Information Technology)

#Mandatory Audit Course 3:

214450A- Ethics and values in IT
214450B - Quantitative Aptitude and Logical Reasoning
214450C- Language Study- Japanese- Module
214450D-Cyber Security and Law

Home

Savitribai Phule Pune University, Pune
Second Year of Information Technology Engineering (2019 Course)
(With effect from Academic Year 2020-21)

Semester-IV

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
207003	Engineering Mathematics- III	03	-	01	30	70	25	-	-	125	03	--	01	04
214451	Processor Architecture	03	-	-	30	70	-	-	-	100	03	-	-	03
214452	Database Management System	03	-	-	30	70	-	-	-	100	03	-	-	03
214453	Computer Graphics	03	-	-	30	70	-	-	-	100	03	-	-	03
214454	Software Engineering	03	-	-	30	70	-	-	-	100	03	-	-	03
214455	Programming Skill Development Lab	-	02	-	-	-	25	25	-	50	-	01	-	01
214456	Database Management System Lab	-	04	-	-	-	25	25		50	-	02	-	02
214457	Computer Graphics Lab	-	02	-	-	-	-	25	-	25	-	01	-	01
214458	Project Based Learning	-	04	-	-	-	50	-	-	50	-	02	-	02
214459	Mandatory Audit Course 4	-	-	-	-	-	-	-	-	-	Non Credit			-
Total		15	12	01	150	350	125	75	-	700	15	06	01	22

Abbreviations:

TH: Theory TW: Term Work PR: Practical

OR: Oral TUT: Tutorial

Note: Students of S.E. (Information Technology) can opt any one of the audit course from the list of audit courses prescribed by BoS (Information Technology)

#Mandatory Audit Course 4:

- **214459A - Water Supply and Treatment**
- **214459B - Language Study- Japanese- Module II**
- **214459C - Waste Management and Pollution Control**
- **214459D - Intellectual Property Rights**

INSTRUCTIONS

- Practical or Tutorial must be conducted in batches and number of batches per division should be as per guidelines from regulatory bodies.
- Required minimum number of experiments/ assignments in practical/ tutorial shall be conducted as mentioned in the syllabi of respective subjects. The list of experiments/assignments is prescribed in the syllabi.
- In addition to the prescribed list, the instructor for practical/ tutorial may design one or two additional experiments/assignments relating to the subject covering some of the research/application areas of the concerned subject.
- For practical/tutorial subject, each experiment/assignment, the student must prepare a write-up consisting of assignment statement, objective(s)/outcome(s), algorithm(s), flow charts/UML diagram(s), important test cases, test case validation report etc.
- The faculty member/instructor should prepare a rubric for the assessment of practical and tutorial. Assessment of tutorial work is part of term-work examination. Term-work Examination at second year of engineering course shall be internal continuous assessment only**.**
- Project based learning (PBL) requires mentoring and internal continuous assessment by faculty throughout the semester for successful completion of the tasks assigned to the students. A teaching workload of 4 hours/week/batch is associated with PBL subject should be allocated to the faculty conducting PBL mentoring and internal continuous assessment. The students in a Batch may be divided into sub-groups of 5 to 6 students for easing the process of internal continuous assessment. Assignments/activities/models/ projects etc. completed under project-based learning will be considered for internal continuous assessment, evaluation, and award of credits for PBL subjects.
- Audit course is a mandatory non-credit course. The faculty member should prepare the rubric(s) for the assessment of audit course at the start of semester. The assessment should be carried out based on the said rubric(s) only and report should be prepared and submitted to the department at the end of semester.
- Case Studies may be assigned as a self-study to students and to be excluded from theory examinations.
- All the rules, regulations and guidelines issued by regulatory authorities from time to time for effective conduction of curriculum, assessment and evaluation are to be strictly followed.

SEMESTER – III

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 **<u>two</u>** of following , using virtual lab simulator

1. Design& simulate single bit RAM cell **<u>OR</u>** 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.

Syllabus Third Year Engg

Sppu 2019 pattern

Faculty of Science & Technology

Savitribai Phule Pune University,Pune,

Maharashtra, India

Curriculum For

Third Year of Information Technology

(2019 Course)

(With effect from AY 2021-22)

INDEX

Savitribai Phule Pune University, Pune Bachelor of Information Technology	
Program Educational Objectives	
PEO1	**Possess strong fundamental concepts in mathematics, science, engineering and Technology to address technological challenges.**
PEO2	**Possess knowledge and skills in the field of Computer Science and Information Technology for analyzing, designing and implementing complex engineering problems of any domain with innovative approaches.**
PEO3	**Possess an attitude and aptitude for research, entrepreneurship and higher studies in the field of Computer Science and Information Technology.**
PEO4	**Have commitment ethical practices, societal contributions through communities and life-long learning.**
PEO5	**Possess better communication, presentation, time management and team work skills leading to responsible & competent professional sand will be able to address challenges in the field of IT at global level.**

Program Outcomes		
Students are expected to know and be able to–		
PO1	Engineering knowledge	An ability to apply knowledge of mathematics, computing, science, engineering and technology.
PO2	Problem analysis	An ability to define a problem and provide a systematic solutionwith the help of conducting experiments, analyzing the problem and interpreting the data.
PO3	Design / Development ofSolutions	An ability to design, implement, and evaluate software or asoftware /hardware system ,component ,or process to meet desired need switch in realistic constraints.
PO4	Conduct Investigation of Complex Problems	An ability to identify, formulate, and provide essay schematicsolutions to complex engineering /Technology problems.
PO5	Modern Tool Usage	An ability to use the techniques, skills, and modern engineering technology tools, standard processes necessary for practice as a IT professional.
PO6	The Engineer and Society	An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems with necessary constraints andassumptions.
PO7	Environment and Sustainability	An ability to analyze and provide solution for the local and global impact of information technology on individuals, organizations and society.
PO8	Ethics	An ability to understand professional, ethical, legal, security andsocial issues and responsibilities.
PO9	Individual and Team Work	An ability to function effectively as an individual or a sate ammember to accomplish a desired goal(s).
PO10	Communication Skills	An ability to engage in life-long learning and continuing professional development to cope up with fast changes in the technologies /tools with the help of electives, profession along animations and extra-curricular activities.
PO11	Project Management and Finance	An ability to communicate effectively in engineering community at large by means of effective presentations, report writing, paper publications, demonstrations.
PO12	Life-long Learning	An ability to understand engineering, management, financial aspects, performance, optimizations and time complexity necessary for professional practice.

Program Specific Outcomes(PSO)	
A graduate of the Information Technology Program will demonstrate-	
PSO1	**An ability to apply the theoretical concepts and practical knowledge of Information Technology in analysis, design, development and management of information processing systems and applications in the interdisciplinary domain.**
PSO2	**An ability to analyze a problem, and identify and define the computing infrastructure and operations requirements appropriate to its solution. IT graduates should be able to work on large-scale computing systems.**
PSO3	**An understanding of professional, business and business processes, ethical,legal, security and social issues and responsibilities.**
PSO4	**Practice communication and decision-making skills through the use of appropriate technology and be ready for professional responsibilities.**

SEMESTER – V

Savitribai Phule Pune University
Third Year of Information Technology (2019 course)
(With effect from Academic Year 2021-22)

Semester-V

Course Code	Course Name	Teaching Scheme (Hours/ week)			Examination Scheme and Marks						Credit Scheme			
		Theory	Practical	Tutorial	Mid-Sem	End-Sem	Term work	Practical	Oral	Total	Lecture	Practical	Tutorial	Total
314441	Theory of Computation	03	-	-	30	70	-	-	-	100	3	-	-	3
314442	Operating Systems	03	-	-	30	70	-	-	-	100	3	-	-	3
314443	Machine Learning	03	-	-	30	70	-	-	-	100	3	-	-	3
314444	Human Computer Interaction	03	-	-	30	70	-	-	-	100	3	-	-	3
314445	Elective-I	03	-	-	30	70	-	-	-	100	3	-	-	3
314446	Operating Systems Lab	-	04	-	-	-	25	25	-	50	-	2	-	2
314447	Human Computer Interaction- Lab	-	02	-	-	-		-	50	50	-	1		1
314448	Laboratory Practice-I	-	04	-	-	-	25	25		50	-	2	-	2
314449	Seminar	-	01	-	-	-	50	-	-	50	-	1	-	1
314450	Audit Course 5	-	-	-	-	-	-	-	-	-	-	-	-	-
										Total Credit	15	06	-	21
	Total	15	11	-	150	350	100	50	50	700	15	06	-	21

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

Elective-I:
- 314445A- Design and Analysis of Algorithm
- 314445B- Advanced Database and Management System
- 314445C- Design Thinking
- 314445D- Internet of Things

Audit Course 5:
- 314450A-Banking and Insurance
- 314450B-Startup Ecosystems
- 314450C- Foreign Language–(Japanese Language- III)

Laboratory Practice-I:
Assignment from Machine Learning and Elective I

Note: Students of T.E. (Information Technology) can opt any one of the audit course from the list of audit courses prescribed by BoS (Information Technology)

Savitribai Phule Pune University
Third Year of Information Technology (2019 Course)
(With effect from Academic Year 2021-22)

Semester-VI

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
314451	Computer Networks& Security	03	-	-	30	70	-	-	-	100	03			03
314452	Data Science and Big Data Analytics	03	-	-	30	70	-	-	-	100	03			03
314453	Web Application Development	03	-	-	30	70	-	-	-	100	03			03
314454	Elective-II	03	-	-	30	70	-	-	-	100	03			03
314455	Internship	-	04	-	-	-	100	-	-	100		04		04
314456	Computer Networks& Security-Lab	-	04	-	-	-	25	-	50	75		02		02
314457	DS & BDA-Lab	-	02	-	-	-	25	25	-	50		01		01
314458	Laboratory Practice-II	-	04	-	-	-	50	25	-	75		02		02
314459	Audit Course 6	-	-	-	-	-	-	-	-	-	-	-	-	-
										Total	12	09	-	21
	Total	12	14	-	120	280	200	50	50	700	12	09	-	21

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

Elective-II:
314454A- Artificial Intelligence
314454B- Cyber Security
314454C -Cloud Computing
314454D- Software Modeling and Design

Audit Course 6:
314459A - Green and Unconventional Energy
314459B - Leadership and Personality Development
314459C- Foreign Language-(Japanese Language- IV)

Laboratory Practice-II:
Assignments from Web Application Development and Elective-II.

Note: Students of T.E. (Information Technology) can opt any one of the audit course from the list of audit courses prescribed by BoS (Information Technology)

Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)
314441: Theory of Computation

HOME

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

Prerequisite Courses:

1. Discrete Structures.
2. Data structures.

Companion Course, if any: NA

Course Objectives:

1. To know the applicability of the model of computation to different problems.
2. To understand in detail the relationship among formal languages, formal grammars and automata.
3. To learn the design of Finite Automata, Pushdown Automata and Turing Machine for processing offormal languages.
4. To study the theory of computability and complexity for algorithm design.

Course Outcomes:

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

CO1: Construct finite automata and its variants to solve computing problems.

CO2: Write regular expressions for the regular languages and finite automata.

CO3: Identify types of grammar, design and simplify Context Free Grammar.

CO4: Construct PushdownAutomata machine for the Context Free Language.

CO5: Design and analyze Turing machines for formallanguages.

CO6: Understand decidable and undecidable problems, analyze complexity classes.

COURSE CONTENTS

Unit I	FINITE AUTOMATA	(06 hrs)

Basic Concepts: Symbols, Strings, Language, Formal Language.

Finite Automata (FA): Formal definition and notations for FSM, Concept of state transition diagram and transition table for FA, Construction of DFA, NFA, NFA with epsilon moves. Conversion of NFA with epsilon moves to NFA, Conversion of NFA to DFA, and Conversion of NFA with epsilon moves to DFA, Minimization of FA, Equivalence of FAs, and Applications of FA.

Finite State Machine with output: Moore and Mealy machines - Definition, Construction, Inter-Conversion.

Mapping of Course Outcomes for Unit I	CO1

Unit II	REGULAR EXPRESSIONS AND LANGUAGES	(06 hrs)

Regular Expressions (RE) : Definition and Identities of RE, Operators of RE, Equivalence of two regular expressions, Equivalence of regular expressions and regular languages (RL), Conversion of RE to FA using direct method, Conversion of FA to RE using Arden's theorem, Pumping lemma for RLs, Closure properties of RLs, Applications of Regular Expressions.

Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**CONTEXT FREE GRAMMAR AND LANGUAGE**	**(06 hrs)**
Grammar: Introduction and representation, Chomsky Hierarchy, Formal definition of Regular **Grammar(RG), Conversions:** LRG to RLG, RLG to LRG, RG to FA, FA to RG. **Context Free Grammar (CFG):** Definition of CFG, Derivation tree, sentential forms, Leftmost and Rightmost derivations, Ambiguous Grammar and unambiguous grammar, Context Free Language (CFL). **Grammar Simplification, Normal forms:** Chomsky Normal Form, Greibach Normal Form. Closure properties of CFL, Pumping lemma for CFL.		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**PUSHDOWN AUTOMATA AND POST MACHINE**	**(06 hrs)**
Pushdown Automata(PDA) : Introduction and formal definition of PDA, Construction of Transition diagram and Transition table for PDA, Instantaneous Description of PDA, Equivalence of Acceptance by Final State & Empty stack, Deterministic PDA and Nondeterministic PDA, Context Free Language and PDA, Conversion of CFG to PDA and PDA to CFG. **Post Machine (PM):** Definition and construction of Post Machine.		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**TURING MACHINE**	**(06 hrs)**
Turing Machine (TM) : Formal definition of a Turing machine, Design of Turing machines, Variants of **Turing Machines:** Deterministic TM, Nondeterministic TM, Multi-tape TM, Universal Turing Machine, Halting problem of TM , Church-Turing thesis, Recursive Languages and Recursively Enumerable Languages, Post Correspondence Problem.		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**COMPUTATIONAL COMPLEXITY**	**(06 hrs)**
Decidability: Decidable problems concerning regular languages, Decidable problems concerning context free languages, Un-decidability. **Computational Complexity:** Measuring Complexity, The Class P, Examples of problems in P, The Class NP, and Examples of problems in NP, Reducibility, Mapping Reducibility, Polynomial Time Reduction and NP Completeness. Satisfiability Problem, NP Completeness of the SAT Problem, Normal Forms for Boolean Expressions, Cook's theorem, Node-C over Problem.		

Mapping of Course Outcomes for Unit VI	**CO6**

Text Books:

1. John C. Martin, Introduction to Language and Theory of Computation, TMH, 3rd Edition, ISBN: 978-0070660489.
2. Vivek Kulkarni, Theory of Computation, Oxford University Press,ISBN-13 : 978-0198084587.

Reference Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D.Ullman, Introduction to Automata Theory Languages and Computation, Addison-Wesley, ISBN 0-201-44124-1.
2. K.L.P Mishra, N. Chandrasekaran, Theory of Computer Science : Automata, Languages and Computation, Prentice Hall India, 2nd Edition.
3. Michael Sipser, Introduction to the Theory of Computation, CENGAGE Learning, 3rd Edition ISBN- 13:978-81-315-2529-6.
4. Daniel Cohen, "Introduction to Computer Theory", Wiley & Sons, ISBN 97881265133454.
5. Kavi Mahesh, "Theory of Computation: A Problem-Solving Approach", Wiley India, ISBN-1081265331106.

E- Books / E- Learning References :

1. https://cglab.ca/~michiel/TheoryOfComputation/TheoryOfComputation.pdf
2. https://theory.cs.princeton.edu/complexity/book.pdf

NPTEL video lecture link :

1. https://nptel.ac.in/courses/106/104/106104148/
2. https://nptel.ac.in/courses/106/104/106104028/

Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)
314442: Operating Systems

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

HOME

Prerequisite Courses:

1. Computer Organization and Architecture
2. Fundamentals of Data Structures

Companion Course, if any: NA

Course Objectives:

1. To introduce basic concepts and functions of modern operating systems.
2. To understand the concept of process, thread management and scheduling.
3. To learn the concept of concurrency control.
4. To study various Memory Management techniques.
5. To know the concept of I/O and File management.
6. To learn concept of system software.

Course Outcomes:

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

CO1: Understanding the role of Modern Operating Systems.

CO2: Apply the concepts of process and thread scheduling.

CO3: Apply the concept of process synchronization, mutual exclusion and the deadlock.

CO4: Understand and apply the concepts of various memory management techniques.

CO5: Make use of concept of I/O management and File system.

CO6: Understand Important of System software.

COURSE CONTENTS

Unit I	OVERVIEW OF OPERATING SYSTEM	(06 hrs)

Operating System Objectives and Functions, The Evolution of Operating Systems, Developments Leading to Modern Operating Systems, Virtual Machines, Introduction to Linux OS, BASH Shell scripting: Basic shell commands.

Mapping of Course Outcomes for Unit I	CO1

Unit II	PROCESS MANAGEMENT	(06 hrs)

Process: Concept of a Process, Process States, Process Description, Process Control

Threads: Processes and Threads, Concept of Multithreading, Types of Threads, Threadprogramming Using Pthreads.

Scheduling: Types of Scheduling, Scheduling Algorithms, First Come First Served, Shortest Job First, Priority, Round Robin

Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**CONCURRENCY CONTROL**	**(06 hrs)**
Process/thread Synchronization and Mutual Exclusion: Principles of Concurrency, Requirementsfor Mutual Exclusion, Mutual Exclusion: Operating System Support (Semaphores and Mutex). **Classical synchronization problems:** Readers/Writers Problem, Producer and Consumer problem, Inter-process communication (Pipes, Shared Memory). **Deadlock:** Principles of Deadlock, Deadlock Modeling, and Strategies to deal with deadlock: Prevention, Avoidance, Detection and Recovery. Example: Dining Philosophers Problem / Banker's Algorithm.		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**MEMORY MANAGEMENT**	**(06 hrs)**
Memory Management: Memory Management Requirements, **Memory Partitioning:** Fixed Partitioning, Dynamic Partitioning, Buddy System, Relocation, Paging, Page table structure, Segmentation **Virtual Memory:** Background, Demand Paging, Page Replacement (FIFO, LRU, Optimal), Allocation of frames, Thrashing		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**INPUT/OUTPUT AND FILE MANAGEMENT**	**(06 hrs)**
I/O Management and Disk Scheduling: I/O Devices, Organization of the I/O Function, I/O Buffering, Disk Scheduling (FIFO, SSTF, SCAN, C-SCAN, LOOK, C-LOOK). **File Management:** Overview-Files and File Systems, File structure. File Organization and Access, File Directories, File Sharing, Record Blocking, Secondary Storage Management.		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**SYSTEMS SOFTWARE AND ITS IMPORTANCE**	**(06 hrs)**
Need of System Software, study of various components of system software. **Assemblers:** Elements of Assembly Language Programming, A simple Assembly Scheme and pass structure of Assemblers. **Introduction to compilers:** Phase structure of Compiler and entire compilation process. Introduction to Macro processors, Macro Definition and call, Macro Expansion Loaders and Linkers. General Loader Scheme, Subroutine Linkages, Relocation and linking Linkages, Relocation and linking		
Mapping of Course Outcomes for Unit VI	**CO6**	

Text Books:

1. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, 8th Edition,2014, ISBN-10: 0133805913 • ISBN-13: 9780133805918
2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts,John Wiley & Sons ,Inc., 9th Edition,2012, ISBN 978-1-118-06333-0

Reference Books:

1. Tom Adelstein and Bill Lubanovic, Linux System Administration, O'Reilly Media, ISBN- 10: 0596009526, ISBN-13: 978-0596009526.
2. Harvey M. Deitel, Operating Systems, Prentice Hall, ISBN-10: 0131828274, ISBN-13: 978-0131828278.
3. Thomas W. Doeppner, Operating System in depth: Design and Programming, WILEY, ISBN:978-0-471-68723-8.
4. Mendel Cooper, Advanced Shell Scripting, Linux Documentation Project.
5. Andrew S. Tanenbaum & Herbert Bos, Modern Operating System, Pearson, ISBN-13: 9780133592221, 4th Edition.

E- Books / E- Learning References :

1. https://cglab.ca/~michiel/TheoryOfComputation/Theory Of Computation.pdf
2. https://theory.cs.princeton.edu/complexity/book.pdf

NPTEL video lecture link :

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2. https://nptel.ac.in/courses/106/104/106104028/

Savitribai Phule Pune University, Pune **Third Year Information Technology (2019 Course)** **314443: Machine Learning**		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory (TH) :3hrs/week	**03 Credits**	**Mid_Semester : 30 Marks** **End_Semester :70 Marks**

HOME

Prerequisite Courses:

1. Basics of Statistics ,2 Linear Algebra, Calculas 3.Probability

Companion Course:

1. Artificial Intelligence, Deep Learning

Course Objectives:

1. To understand the basic concepts of machine learning and apply them for the various problems.
2. To learn various machine learning types and use it for the various machine learning tasks.
3. To optimize the machine learning model and generalize it.

Course Outcomes:

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

CO1: Apply basic concepts of machine learning and different types of machine learning algorithms.

CO2: Differentiate various regression techniques and evaluate their performance.

CO3: Compare different types of classification models and their relevant application.

CO4: Illustrate the tree-based and probabilistic machine learning algorithms.

CO5: Identify different unsupervised learning algorithms for the related real world problems.

CO6: Apply fundamental concepts of ANN.

COURSE CONTENTS

Unit I	**INTRODUCTION TO MACHINE LEARNING**	**(06 hrs)**
Introduction: What is Machine Learning, Definitions and Real life applications, **Data and types:** Scales of Measurement. Data, **Features and Patterns:** Learning Tasks- Descriptive and Predictive Tasks. Learning Paradigms: Supervised, Unsupervised and Reinforced Learnings. **Learning Models. Data and Dimensionality:** Feature Sets, Feature Extraction and Subset Selection, Feature Transformation. Dimensionality reduction techniques- PCA and LDA		
Mapping of Course Outcomes for Unit I	**CO1**	
Unit II	**REGRESSION**	**(06 hrs)**
Introduction, Univariate Regression – Model Representation, Least-Square Method for finding values of the regression coefficients. Cost Functions: MSE, MAE, R-Square, Performance Evaluation, Optimizing Simple Linear Regression with Gradient Descent Algorithm. **Multivariate Regression** –Model Representation, Polynomial Regression. Performance enhancement with Regularization techniques. Generalization Issues- Overfitting Vs. Underfitting, Bias Vs. Variance		

Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**CLASSIFICATION**	**(06 hrs)**
Binary Classification: Linear Classification model , Performance Evaluation- Confusion Matrix, Accuracy and ROC curves. Logistic Regression – Model, Cost Function. Linear Support Vector Machines (SVM) – Introduction, Soft Margin SVM, Introduction to various SVM Kernel to handle non-linear data – RBF, Gaussian, Polynomial, Sigmoid. Multiclass Classification techniques -One vs One, One vs Rest. **Enhancing Performance of classification:** Cross-Validation, Sub-Sampling, HyperParameter Tuning Techniques.		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**TREE BASED AND PROBABILISTIC MODELS**	**(06 hrs)**
Tree Based Model : Decision Tree – Concepts and Terminologies, Impurity Measures -Gini Index, Information gain and Entropy. Random Forest and concept of Ensemble Learning. **Probabilistic Models:** Conditional Probability and Bayes Theorem, MLE and MAP estimations, Naïve Bayes Classifier, Bayesian networks for Learning and Inferencing.		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**DISTANCE AND RULE BASED MODELS**	**(06 hrs)**
Distance Based Models: Distance Metrics (Euclidean ,Manhattan, Hamming , Minkowski Distance Metric), K-Nearest Neighbour for Classification and Regression, **Clustering as Learning Task:** K-means clustering Algorithm with example, Hierarchical Clustering, Divisive Dendrogram for hierarchical clustering, Performance Measures. **Association Rule Mining:** Introduction, Rule learning for subgroup discovery, Apriori Algorithm, Performance Measures – Support and Confidence.		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**INTRODUCTION TO ARTIFICIAL NEURAL NETWORK**	**(06 hrs)**
Perceptron Learning : Biological Neuron, Introduction to ANN, McCulloch Pitts Neuron, Perceptron and its Learning Algorithm, Activation Functions and types: Soft and Hard limiting functions, Tanh and ReLu. **Multi-layer Perceptron Model**: Introduction, Learning parameters- Weights and Bias, Learning algorithm, Loss function- Mean Square Error. Concept of Deep Learning.		

Mapping of Course Outcomes for Unit VI	**CO6**

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.
3. Hastie, Tibshirani, Friedman: Introduction to Statistical Machine Learning with Applications in R, Springer, 2nd Edition 2012
4. Tom M. Mitchell , Machine Learning, 1997, McGraw-Hill, First Edition

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. Kevin P Murphy: Machine Learning – A Probabilistic Perspective, MIT Press, August 2012.
4. Parag Kulkarni : Reinforcement and Systematic Machine Learning for Decision Making, Wiley IEEE Press, Edition July 2012.
5. Shalev-Shwartz S., Ben-David S., Understanding Machine Learning: From Theory to Algorithms, CUP, 2014
6. Jack Zurada: Introduction to Artificial Neural Systems, PWS Publishing Co. Boston, 2002

E- Books / E- Learning References :

1. Introduction to Machine Learning : https://nptel.ac.in/courses/106/106/106106139/
2. Machine Learning: https://nptel.ac.in/courses/106/106/106106202/
3. Machine Learning for Science and Engineering applications: https://nptel.ac.in/courses/106/106/106106198/
4. Introduction to Machine Learning: https://nptel.ac.in/courses/106/105/106105152/
5. Deep Learning (Part-I) : https://nptel.ac.in/courses/106/106/106106184/
6. Deep Learning : https://onlinecourses.nptel.ac.in/noc19_cs54/preview
7. Naive Bayes from Scratch: https://courses.analyticsvidhya.com/courses/naive-bayes
8. Getting Started with Neural Networks: https://courses.analyticsvidhya.com/courses/getting-started-with-neural-networks
9. Machine Learning – Offered by Stanford Online - https://www.coursera.org/learn/machine-learning

Savitribai Phule Pune University, Pune

Third Year Information Technology (2019 Course)

314444: Human Computer Interaction

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

HOME

Prerequisite Courses:

1. Problem Solving and Object Oriented Technologies

Course Objectives:

1. To introduce to the field of human-computer-interaction study.
2. To gain an understanding of the human part of human-computer-interactions.
3. To learn to do design and evaluate effective human-computer-interactions.
4. To study HCI models and theories.
5. To understand HCI design processes.
6. To apply HCI to real life use cases.

Course Outcomes:

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

CO1: Explain importance of HCI study and principles of user-centered design (UCD) approach.

CO2: Develop understanding of human factors in HCI design.

CO3: Develop understanding of models, paradigms, and context of interactions.

CO4: Design effective user-interfaces following a structured and organized UCD process.

CO5: Evaluate usability of a user-interface design.

CO6: Apply cognitive models for predicting human-computer-interactions.

COURSE CONTENTS

Unit I	INTRODUCTION	(06 hrs)

What is HCI?, Disciplines involved in HCI, Why HCI study is important? The psychology of everydaythings Donald A. Norman, Principles of HCI, User-centered Design. Measurable Human factors.

Mapping of Course Outcomes for Unit I	CO1

Unit II	UNDERSTANDING THE HUMAN and HUMAN INTERACTION	(06 hrs)

Input-output channels, Human memory, Human emotions, Individual differences, Psychology. Ergonomics, Human errors, Models of interaction, Paradigms of Interactions, Interaction styles, Interactivity, Context of interaction, User experience.

Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**HCI MODELS AND THEORIES**	**(06 hrs)**
User Profiles, categorization of users, Goal and task hierarchy model, Linguistic model, Physical and device models, GOMS, Norman's 7 stage model, Cognitive architectures, Hierarchical task analysis (HTA), Uses of task analysis, Diagrammatic dialog design notations.		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**DESIGN PROCESS**	**(06 hrs)**
Design Rules : Principles that support usability, Design standards, Design Guidelines, What is interaction design?, The software design process, User focus, Scenarios, Navigation Design, Screen Design, Prototyping techniques, Wire-Framing, Understanding the UI Layer and Its Execution Framework, Model-View-Controller(MVC) Framework		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**HCI GUIDELINES AND EVALUATION TECHNIQUES**	**(06 hrs)**
Using toolkits, User interface management system (UIMS), Goals of evaluation, Categorization of Evaluation techniques, Choosing an Evaluation Method. DECIDE, Heuristic Evaluation, cognitive walk through, Usability testing		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**FUTURE TRENDS**	**(06 hrs)**
Ubiquitous Computing, Design thinking, Finding things on web, Augmented Reality, Virtual Reality , Challenges in designing interfaces for smart homes, smart devices, handheld devices, smart wristwatch, Future of HCI		
Mapping of Course Outcomes for Unit VI	**CO6**	

Text Books:

1. Alan Dix (2008). Human Computer Interaction. Pearson Education. ISBN 978-81-317-1703-5.
2. Ben Shneiderman; Catherine Plaisant; Maxine Cohen; Steven Jacobs (29 August 2013).
3. Designing The User Interface: Strategies for Effective Human-Computer Interaction. Pearson Education Limited. ISBN 978-1-292-03701-1.

Reference Books:

1. Gerard Jounghyun Kim (20 March 2015). Human–Computer Interaction: Fundamentals andPractice. CRC Press. ISBN 978-1-4822-3390-2.
2. Donald A. Norman (2013). The Design of Everyday Things Basic Books. ISBN 978-0-465-07299-6.
3. Jeff Johnson (17 December 2013). Designing with the Mind in Mind: Simple Guide to Understanding User Interface Design Guidelines. Elsevier. ISBN 978-0-12-411556-9.
4. Alan Cooper; Robert Reimann; David Cronin; Christopher Noessel (13 August 2014). About Face:The Essentials of Interaction Design. Wiley. ISBN 978-1-118-76658-3.
5. Alan Cooper (1 January 1999). The Inmates are running the Asylum, Sam's. ISBN 978-0-672-31649-4.
6. John M. Carroll (21 May 2003). HCI Models, Theories, and Frameworks: Toward aMultidisciplinary Science. Morgan Kaufmann. ISBN 978-0-08-049141-7.
7. Alan Cooper, Robert Reimann, David Cronin, Christopher Noessel, About Face: The Essentials of Interface Design, Wiley India, ISBN : 9788126559718,4th Ed
8. Rogers, Sharp, Preece, Interaction Design: Beyond Human Computer Interaction, Wiley India, ISBN:11. 9788126544912,3ed
9. Wilbert O.Galitz, The Essential Guide to user Interface Design, Wiley India, ISBN: 9788126502806

E- Books / E- Learning References :

1. http://hcibib.org/
2. Andriod Design Guidelines --- https://developer.android.com/guide/practices/ui_guidelines/index.html
3. iOS Human Interface Guidelines -- https://developer.apple.com/ios/human-interfaceguidelines/ overview/design-principles/
4. MacOS Human Interface Guidelines ---- https://developer.apple.com/library/content/documentation/UserExperience/Conceptual/OSX HIGuidelines/
5. www.baddesigns.com

Savitribai Phule Pune University, Pune

Third Year Information Technology (2019 Course)

314445(A) : Elective -I : Design and Analysis of Algorithm

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

HOME

Prerequisite Courses:

1. Data Structures and Algorithms.
2. Discrete Structures.
3. Basic mathematics: Induction, probability theory, logarithms.

Course Objectives:

1. To understand the problem solving and problem classification.
2. To know the basics of computational complexity analysis of various algorithms.
3. To provide students with foundations to deal with a variety of computational problems using different design strategies.
4. To select appropriate algorithm design strategies to solve real world problems.
5. To understand the concept of nondeterministic polynomial algorithms.

Course Outcomes:

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

CO1: Calculate computational complexity using asymptotic notations for various algorithms.

CO2: Apply Divide & Conquer as well as Greedy approach to design algorithms.

CO3: Understand and analyze optimization problems using dynamic programming.

CO4: Illustrate different problems using Backtracking.

CO5: Compare different methods of Branch and Bound strategy.

CO6: Classify P, NP, NP-complete, NP-Hard problems.

COURSE CONTENTS

Unit I	INTRODUCTION	(07 hrs)

Proof Techniques: Contradiction, Mathematical Induction, Direct proofs, Proof by counter example, Proof by contraposition.

Analysis of Algorithm: Efficiency- Analysis framework, asymptotic notations – big O, theta and omega.

Analysis of Non-recursive and recursive algorithms: Solving Recurrence Equations using Masters theorem and Substitution method.

Brute Force method: Introduction to Brute Force method & Exhaustive search, Brute Force solution to 8 queens' problem.

Mapping of Course Outcomes for Unit I	**CO1**	
Unit II	**DIVIDE AND CONQUER AND GREEDY METHOD**	**(06 hrs)**
Divide & Conquer: General method, Quick Sort – Worst, Best and average case. Binary search, Finding Max-Min, Large integer Multiplication (for all above algorithms analysis to be done with recurrence). **Greedy Method:** General method and characteristics, Kruskal's method for MST (using nlogn complexity), Dijkstra's Algorithm, Fractional Knapsack problem, Job Sequencing, Max flow problem and Ford-Fulkerson algorithm in transport network		
Mapping of Course Outcomes for Unit II	**CO1, CO2**	
Unit III	**DYNAMIC PROGRAMMING**	**(06 hrs)**
General strategy, Principle of optimality, 0/1 knapsack Problem, Coin change-making problem, Bellman-Ford Algorithm , Multistage Graph problem(using Forward computation), Travelling Salesman Problem		
Mapping of Course Outcomes for Unit III	**CO1, CO3**	
Unit IV	**BACKTRACKING**	**(06 hrs)**
General method, Recursive backtracking algorithm, Iterative backtracking method. n-Queen problem, Sum of subsets, Graph coloring, 0/1 Knapsack Problem.		
Mapping of Course Outcomes for Unit IV	**CO1, CO4**	
Unit V	**BRANCH AND BOUND**	**(06 hrs)**
The method, Control abstractions for Least Cost Search, Bounding, FIFO branch and bound, LC branch and bound, 0/1 Knapsack problem – LC branch and bound and FIFO branch and bound solution, Traveling salesperson problem- LC branch and bound		
Mapping of Course Outcomes for Unit V	**CO1, CO5**	
Unit VI	**COMPUTATIONAL COMPLEXITY**	**(05 hrs)**
Non Deterministic algorithms, The classes: P, NP, NP Complete, NP Hard, Satisfiability problem, Proofs for NP Complete Problems: Clique, Vertex Cover		
Mapping of Course Outcomes for Unit VI	**CO1, CO6**	
Text Books:		
1. Horowitz and Sahani, Fundamentals of computer Algorithms, Galgotia, ISBN 81-7371-612-9. **2.** Anany Levitin, Introduction to the Design & Analysis of Algorithm, Pearson, ISBN 81- 7758-835-4.		

Reference Books:

1. Jon Kleinberg, Algorithm Design, Pearson , ISBN : 0-321-29535-8

2. S. Sridhar, Design and Analysis of Algorithms, Oxford, ISBN 10 : 0-19-809369-1.

3. Thomas H Cormen and Charles E.L Leiserson, Introduction to Algorithm, PHI, ISBN: 9788120340077

4. Gilles Brassard, Paul Bratle, Fundamentals of Algorithms, Pearson, ISBN 978-81-317-1244-3.

5. R. C. T. Lee, SS Tseng, R C Chang, Y T Tsai, Introduction to Design and Analysis of Algorithms, A Strategic approach, Tata McGraw Hill, ISBN-13: 978-1-25-902582-2. ISBN-10: 1-25-902582-9.

6. Steven S Skiena, The Algorithm Design Manual, Springer, ISBN 978-81-8489-865-1.

7. George T. Heineman, Gary Pollice, Stanley Selkow, Algorithms in a Nutshell, A Desktop Quick Reference, O'Reilly, ISBN: 9789352133611.

8. Michael T. Goodrich, Roberto Tamassia, Algorithm Design: Foundations, Analysis and Internet

9. Examples, Wiley India, ISBN: 9788126509867

10. Rod Stephens, Essential Algorithms: A Practical Approach to Computer Algorithms, Wiley India,ISBN: 9788126546138

Savitribai Phule Pune University, Pune

Third Year Information Technology (2019 Course)

314445(B): Elective -I : Advanced Database Management System

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

HOME

Prerequisite Courses:

1. Database Management System

Course Objectives:

1. To understand the fundamental concepts of Relational and Object-oriented databases.
2. To learn and understand various Parallel and Distributed Database Architectures and Applications.
3. To understand and apply the basic concepts, categories and tools of NoSQL Database.
4. To learn and understand Data warehouse and OLAP Architectures and Applications.
5. To learn data mining architecture, algorithms, software tools and applications.
6. To learn enhanced data models for advanced database applications.

Course Outcomes:

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

CO1: Understand relational and object-oriented databases.

CO2: Learn and understand of parallel & distributed database architectures..

CO3: Learn the concepts of NoSQL Databases.

CO4: Understand data warehouse and OLAP technologies.

CO5: Apply data mining algorithms and to learn various software tools. CO6: Learn emerging and enhanced data models for advanced applications.

COURSE CONTENTS

Unit I	REVIEW OF RELATIONAL DATA MODEL AND RELATIONAL DATABASE CONSTRAINTS	(06 hrs)

Relational model concepts, Relational model constraints and relational database schemas, Update operations, anomalies, dealing with constraint violations, Types and violations. **Overview of Object-Oriented Concepts** – Objects, Basic properties. Advantages, examples, Abstract data types, Encapsulation, class hierarchies, polymorphism examples.

Mapping of Course Outcomes for Unit I	CO1

Unit II	PARALLEL AND DISTRIBUTED DATABASES	(06 hrs)

Introduction to Parallel Databases, Architectures for parallel databases, Parallel query evaluation, Parallelizing individual operations, Parallel query optimizations. **Introduction to distributed databases**, Distributed DBMS architectures, storing data in a Distributed DBMS, Distributed catalog management, Distributed Query processing, Updating distributed data, Distributed transactions, Distributed Concurrency control and Recovery.

Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**NOSQL DATABASES**	**(06 hrs)**
Introduction, **Overview, and History of NoSQL Databases**- The definition of Four Types of No SQL Databases. NoSQL Key/Value Database: MongoDB, **Column-Oriented Database:** Apache Cassandra, Comparison of Relational and NoSQL databases, NoSQL database Development Tools (Map Reduce/Hive) and Programming Languages (XML/JSON)		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**DATA WAREHOUSING**	**(06 hrs)**
Architectures and components of data warehouse, Characteristics and limitations of data warehouse, Data warehouse schema (Star, Snowflake), OLAP Architecture (ROLAP/MOLAP/HOLAP), Introduction to decision support system, Views and Decision support		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**DATA MINING**	**(06 hrs)**
Introduction to Data Mining, KDD seven step process, Architecture of data mining, Introduction to predictive and descriptive algorithms, Data mining software and applications		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**ENHANCED DATA MODELS FOR ADVANCED APPLICATIONS**	**(06 hrs)**
Active database concepts and triggers; Temporal, Spatial, and Deductive Databases – Basic concepts. More Recent Applications: Mobile databases; Multimedia databases; Geographical InformationSystems; Genome data management.		
Mapping of Course Outcomes for Unit VI	**CO6**	

Text Books:

1. Silberschatz A., Korth H., Sudarshan S, Database System Concepts, McGraw Hill Publication,ISBN-0-07-120413-X, Sixth Edition.
2. S. K. Singh, Database Systems: Concepts, Design and Application, Pearson Publication, ISBN-978-81-317-6092-5.

Reference Books:

1. Kristina Chodorow, Michael Dirolf, “MongoDB: The Definitive Guide”, O’Reilly Publications
2. Jiawei Han, Micheline Kamber, Jian Pei, “Data Mining: Concepts and Techniques”, Elsevier
3. Mario Piattini, Oscar Diaz “Advanced Database Technology and Design”- online book.
4. M. Tamer Özsu, Patrick Valduriez, “Principles of Distributed Database Systems” Prentice Hall, 1999.
5. Ramez Elmasri and Shamkant B. Navathe “Fundamentals of Database System”7th Edition

Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)
314445(C) : Elective -I : Design Thinking

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

HOME

Prerequisite Courses:
1. Software Engineering, 2. Problem Solving

Companion Course: Human Computer Interaction

Course Objectives:
1. To learn the Design thinking basic concepts.
2. To identify the opportunities and challenges for design thinking innovation.
3. To describe the define and ideate process of design thinking.
4. To summarize the prototyping techniques.
5. To enlist the activities carried out in Test and reflect phase of design thinking.
6. To Interpret Design Thinking case studies.

Course Outcomes:
On completion of the course, students will be able to–
CO1: Identify need and features of design thinking.
CO2: Identify the opportunities and challenges for design thinking innovation.
CO3: Learn the process of design thinking using various tools.
CO4: Summarize and learn the various prototyping techniques.
CO5: Enlist the activities carried out in Test and reflect phase of design thinking.
CO6: Interpret the design thinking disruptive innovations through case studies.

COURSE CONTENTS

Unit I	INTRODUCTION TO DESIGN THINKING	(06 hrs)

Introduction to Design and Design Thinking, Definition of Design Thinking, Need of Design Thinking, Features of Design Thinking, Problem Solving and Design, Design thinking as Strategy of Innovation, Use of Design Thinking, Design Thinking-Attributes, The Principles of Design Thinking, The Five-step Process of Design Thinking(Empathize, Define, Ideate, Prototype, Test),Design **Thinking-A Solution based thinking:** Design Thinking vs. Scientific Method, Problem Focused vs. Solution Focused, Analysis vs. Synthesis, Divergent Thinking vs. Convergent Thinking , Roots of Design Thinking in Human Centric Design Process.

Mapping of Course Outcomes for Unit I	CO1

Unit II	EXPLORE AND EMPATHIZE	(06 hrs)

Explore- STEEP Analysis, Activity Systems, Stakeholder Analysis, Framed Opportunities Empathise- Observation, Problem statement, User Interviews- Interview for Empathy, Explorative Interview, Ask 5x Why, 5W+H questions (Design Thinking Toolbox), Needs Finding, Empathy Map, Persona Development, Customer Journey Map		
Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**DEFINE AND IDEATE**	**(06 hrs)**
Define- Define Point of view, "How might we ..." question, Storytelling, Context Mapping Ideate-Brainstorming, 2x2 Matrix Ideate- Purpose, Methods & Tools, SCAMPER, SCAMPER for Ideation, SCAMPER template, Analogous Inspiration, IDEATION using Deconstruct & Reconstruct, User Experience Journey		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**PROTOTYPE**	**(06 hrs)**
Get Visual, Design Principals, Determine What to Prototype, Storyboard Prototype- How to carry out Prototyping? Frequently used kinds of prototypes, Focused experiments – Critical Experience Prototype (CEP) & Critical Function Prototype (CFP), Crazy experiments – Dark horse Prototype, Combined experiments – Funky prototype Prototyping -Paper Prototyping, Digital Prototyping- Wireframe vs Realistic Prototypes, HTML vs WYSIWYG Editors, Additional Tools for Prototyping, Working with a Developer, Prototype Examples		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**TEST AND REFLECT**	**(06 hrs)**
Test- Testing Sheet, Feedback Capture Grid, Powerful questions in experience testing, Solution interview, Structured Usability Testing, A/B Testing, Design Testing with Users, Exploring Visual Design Mock-Ups, Choosing a Design Testing, Usability Testing, Reflect- I like, I wish, I wonder, Create a pitch, lean canvas, lessons learned, Road map for implementation Evolve- Concept Synthesis, Viability Analysis(Impact Evaluation), Innovation Tool using user needs, CAP, 4s.		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**DISRUPTIVE INNOVATION**	**(06 hrs)**
Reimagining the Trade Show Experience at IBM, Redesigning the Customer Contact Center at Toyota, Social Networking at MeYou Health, Rethinking Subsidized Meals for the Elderly at The Good Kitchen THE SOCIAL PROBLEM Design Thinking in Healthcare with IDEO, Design Thinking Transformed Airbnb, IBM Design Thinking: A Framework To Help Teams Continuously Understand and Deliver, UberEATS.		
Mapping of Course Outcomes for Unit VI	**CO6**	
Text Books:		

1. Michael Lewrick, Patrick Link, Larry Leifer , "The Design Thinking Toolbox: A Guide to Masteringthe Most Popular and Valuable Innovation Methods", March 2020 edition, ISBN: 978-1-119- 62921-4, WILEY Publication.
2. Mr Lee Chong Hwa (Lead Facilitator), "The Design Thinking: Guidebook"

Reference Books:

1. IDEO (Firm), "The Field Guide to Human-centered Design: Design Kit", 1st edition, ISBN-978099140631-9, IDEO 2015.
2. Russ Unger, Carolyn Chandler, "A Project Guide to UX Design For user experience designers inthe field or in the making (Voices That Matter)", 2nd Edition, ISBN 13: 978-0-321-81538-5
3. Karl T Ulrich, "Design – Creation of Artifacts in Society", 1st edition, ISBN 978-0-9836487-0-3, University of Pennsylvania.
4. Tim Brown, "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", ISBN- 9780061937743, Harper Collins, 2009.
5. Eli Woolery, "Design Thinking Handbook", In-Vision publisher.
6. Jeanne Liedtka, Andrew King, Kevin Bennett, "Solving Problems with Design Thinking: TenStories of What Works", Columbia Business School Publishing, E-ISBN 978-0-231-53605-9
7. Jake Knapp, John Zeratsky, Braden Kowitz, "Sprint: How to Solve Big Problems and Test NewIdeas in Just Five Days", ISBN 9780593076118, Bantam Press, 2016.
8. Don Norman, "The Design of Everyday Things: Revised and Expanded Edition", ISBN9780465072996, Basic Books, 2013.
9. Tom Kelly, "Creative Confidence: Unleashing the Creative Potential Within Us All", October 2013 edition , ISBN: 978-0-385-34936-9

E -Books / E -Learning References :

1. Creating Customer Journey Maps - MODULE 4: Design Thinking and Customer Journey Maps Coursera
2. The IBM Story: https://www.coursera.org/lecture/uva-darden-design-thinking-innovation/the-ibm-story-iq0kE
3. Design Thinking - A Primer online course video lectures by IIT Madras (freevideolectures.com)
4. NPTEL :: Humanities and Social Sciences - NOC: Understanding Design Thinking & People Centered Design
5. NPTEL :: Management - NOC:Design Thinking - A Primer
6. Design Thinking Transformed Airbnb: https://review.firstround.com/How-design-thinking-transformed-Airbnb-from-failing-startup-to-billion-dollar-business
7. UberEATS: https://medium.com/uber-design/how-we-design-on-the-ubereats-team-ff7c41fffb76
8. IBM Design Thinking: A Framework To Help Teams Continuously Understand and Deliver: https://www.ibm.com/blogs/think/2016/01/ibm-design-thinking-a-framework-for-teams-to-continuously-understand-and-deliver/
9. https://www.tutorialspoint.com/design_thinking/index.htm
10. https://www.designkit.org/case-studies
11. https://www.innovationtraining.org/design-thinking-workshop-resources/

Savitribai Phule Pune University, Pune Third Year Information Technology (2019 Course) 314445(D) : Elective -I : Internet of Things		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory (TH) : 3 hrs/week	**03 Credits**	**Mid_Semester : 30 Marks** **End_Semester : 70 Marks**

HOME

Prerequisite Courses:

1. Basics of Computer Network
2. Processor Architecture

Course Objectives:

1. To know the IoT fundamentals and understanding the technologies.
2. To learn the concept of M2M (machine to machine) with necessary protocols.
3. To understand the Python Scripting Language and controlling hardware for IoT.
4. To learn the IoT Platforms widely used in IoT applications.
5. To understand the implementation of web-based services on IoT devices with cloud interface.
6. To introduce the IoT applications.

Course Outcomes:

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

CO1: Discuss fundamentals, architecture and framework of IoT.

CO2: Select suitable sensors and actuators for real time scenarios.

CO3: Justify the significance of protocol for wireless communication and IoT challenges

CO4: Understand the Python programming for development of IoT applications.

CO5: Understand the cloud interfacing technologies.

CO6: Design and Implement real time IoT applications.

COURSE CONTENTS

Unit I	**INTRODUCTION TO IOT**	**(06 hrs)**

Definition and Characteristics of IoT, IoT Framework and Architecture, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT Levels and Templates, **IoT Enabled Technologies** – Wireless Sensor Networks, Cloud Computing, Embedded Systems, Big Data Analysis, UAV, Web Services, IoT & M2M- Machine to Machine, Difference between IoT and M2M, Software Defined Network & NFV

Mapping of Course Outcomes for Unit I	**CO1**

Unit II	**THINGS IN IOT**	**(06 hrs)**

Introduction to Sensors - Light sensor, voltage sensor, Temperature and Humidity Sensor, Motion Detection Sensors, Wireless Sensors, Level Sensors, USB Sensors, Embedded Sensors, Distance Measurement with ultrasonic sensor Introduction to Actuators- Connecting LED, Buzzer, Controlling- AC Power devices, Servo motor, Speed DC Motor. Electronic Communication Protocols (Device Interfacing) Protocols: I2C,SPI,UART,USRT,CAN.

Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**COMMUNICATION PROTOCOLS AND IOT CHALLENGES**	**(06 hrs)**
Introduction to Non IP Based Protocol (IEEE 802.11, IEEE 802.15.4), BlueTooth, ZigBee, IP Based Protocol (IPV4, IPV6, 6LoWPAN), Application Layer Protocols (MQTT, AMQP) Wireless medium access issues, MAC protocol ,routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**IOT PLATFORMS AND ITS PROGRAMMING**	**(06 hrs)**
Introduction to Arduino and Raspberry Pi- Installation, Interfaces (Serial, SPI, I2C), Introduction to Python program with Raspberry Pi with focus on interfacing external gadgets (Bluetooth Speaker, CCTV Camera, Robotic Arm etc.), controlling output, and reading input from pins. Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino.		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**IOT PHYSICAL SERVERS AND CLOUD OFFERINGS**	**(06 hrs)**
Introduction to Cloud Storage models (SaaS, Paas, IaaS) and communication APIs Web server – Web server for IoT, Cloud for IoT (ThingSpeak, Ubidots), Python web application framework, Designing a RESTful web API. **IoT Security**: Vulnerabilities of IoT, Security Requirements, Challenges for Secure IoT, Threat Modelling, Key elements of IoT Security: Identity establishment, Access control, Data and message security, Non repudiation and availability, Security model for IoT.		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**DOMAIN SPECIFIC APPLICATIONS Of IOT**	**(06 hrs)**
Home Automation - Smart Appliances, Intrusion Detection, Smoke/Gas Detector, Smart City -Smart Parking, Smart Road, Structural Health Monitoring, Surveillance applications, Health - Fitness and Health Monitoring, Wearable Electronics, Agriculture - Smart Irrigation, Greenhouse Control, Environment - Weather Monitoring, Noise Pollution Monitoring, Logistic - Root Generation and Scheduling, Shipment Monitoring, Retail Management - Inventory Management, Smart Payments, **Industry Applications** - Machine Diagnosis and Prognosis, Indoor Air Quality Monitoring.		
Mapping of Course Outcomes for Unit VI	**CO6**	
Text Books:		

1. Vijay Madisetti, ArshdeepBahga, “Internet of Things: A Hands-On Approach” , 2014, Universities Press(India) Pvt Ltd., ISBN: 9788173719547
2. Matt Richardson & Shawn Wallac, “Getting Started with Raspberry Pi”, 2014, O'Reilly (SPD), ISBN:9789350239759
3. Pethuru Raj and Anupama C Raman, “The Internet of Things: Enabling Technologies, Platforms and Use Cases”, 2017, CRC Press, ISBN: 13:978-1-4987-6128-4.
4. Rushi Gajjar, “Raspberry Pi Sensors”, 2015, Packt Publishing, ISBN : 978-1-78439-361-8
5. Robert H. Bishop, “The Mechatronics Handbook”, 2002, CRC Press , ISBN: 0-8493-0066-5/02

Reference Books:
1. Peter Waher, “Learning Internet of Things”, 2015,Packt Publishing, ISBN: 978-1-78355-353-2
2. Peter Friess, “Internet of Things – From Research and Innovation to Market Deployment”, 2014, River Publishers, ISBN: 978-87-93102-94-1
3. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theoryand Practice", 2010 , Wiley Publication, ISBN: 978-0-470-99765-9
4. Simon Monk, “Raspberry Pi Cookbook, Software and Hardware Problems and solutions”, 2019, O'Reilly, ISBN 9781492043225
E- Books / E- Learning References :
1. Introduction to Arduino and its Setup : https://www.arduino.cc/en/software
2. Introduction to Raspberry Pi and its OS (Raspbian Lit) : https://www.raspberrypi.org/software/operating- systems/
3. Cloud for IoT– ThingSpeak : https://thingspeak.com/
4. Cloud for IoT - Ubidots : https://ubidots.com/stem/
5. Overall IoT Course Contents: https://onlinecourses.nptel.ac.in/noc21_cs17/preview

Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)
314446 : Operating Systems Lab

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR) : 4 hrs/week	02 Credits	PR: 25 Marks TW: 25 Marks

HOME

Prerequisites:

1. C Programming
2. Fundamentals of Data Structure

Course Objectives:

1. To introduce and learn Linux commands required for administration.
2. To learn shell programming concepts and applications.
3. To demonstrate the functioning of OS basic building blocks like processes, threads under the LINUX.
4. To demonstrate the functioning of OS concepts in user space like concurrency control (process synchronization, mutual exclusion), CPU Scheduling, Memory Management and Disk Scheduling in LINUX.
5. To demonstrate the functioning of Inter Process Communication under LINUX.
6. To study the functioning of OS concepts in kernel space like embedding the system call in any LINUX kernel.

Course Outcomes:

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

CO1: Apply the basics of Linux commands.

CO2: Build shell scripts for various applications.

CO3: Implement basic building blocks like processes, threads under the Linux.

CO4: Develop various system programs for the functioning of OS concepts in user space like concurrency control, CPU Scheduling, Memory Management and Disk Scheduling in Linux.

CO5: Develop system programs for Inter Process Communication in Linux.

Guidelines for Instructor's Manual

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

Guidelines for Student's Lab Journal

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

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 the theory & implementation of the 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.

Guidelines for Laboratory Conduction

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

List of Laboratory Assignments

Group A

Assignment No. 1 :

A. Study of Basic Linux Commands: echo, ls, read, cat, touch, test, loops, arithmetic comparison, conditional loops, grep, sed etc.

B. Write a program to implement an address book with options given below: a) Create address book. b) View address book. c) Insert a record. d) Delete a record. e) Modify a record. f) Exit

Assignment No. 2:

Process control system calls: The demonstration of FORK, EXECVE and WAIT system calls along with zombie and orphan states.

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

B. Implement the C program in which main program accepts an array. Main program uses the FORK system call to create a new process called a child process. Parent process sorts an array and passes the sorted array to child process through the command line arguments of EXECVE system call. The child process uses EXECVE system call to load new program which display array in reverse order.

Assignment No. 3:

Implement the C program for CPU Scheduling Algorithms: Shortest Job First (Preemptive) and Round Robin with different arrival time.

Assignment No. 4:

A. Thread synchronization using counting semaphores. Application to demonstrate: producer-consumer problem with counting semaphores and mutex.

B. Thread synchronization and mutual exclusion using mutex. Application to demonstrate: Reader-Writer problem with reader priority.

Assignment No. 5:

Implement the C program for Deadlock Avoidance Algorithm: Bankers Algorithm.

Assignment No. 6:

Implement the C program for Page Replacement Algorithms: FCFS, LRU, and Optimal for frame size as minimum three.

Assignment No. 7:

Inter process communication in Linux using following.

A. FIFOS: Full duplex communication between two independent processes. First process accepts sentences and writes on one pipe to be read by second process and second process counts number of characters, number of words and number of lines in accepted sentences, writes this output in a text file and writes the contents of the file on second pipe to be read by first process and displays onstandard output.

B. Inter-process Communication using Shared Memory using System V. Application to demonstrate: Client and Server Programs in which server process creates a shared memory segment and writes the message to the shared memory segment. Client process reads the message from the shared memory segment and displays it to the screen.

Assignment No. 8: Implement the C program for Disk Scheduling Algorithms: SSTF, SCAN, C-Look considering the initial head position moving away from the spindle.

Study Assignment: Implement a new system call in the kernel space, add this new system call in theLinux kernel by the compilation of this kernel (any kernel source, any architecture and any Linux kernel distribution) and demonstrate the use of this embedded system call using C program in user space.

Reference Books:

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

Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)
314447: Human Computer Interaction Laboratory

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR) : 2 hrs/week	01 Credits	OR: 50 Marks

HOME

Prerequisites:

1. Problem Solving and Object-Oriented Technologies

Course Objectives:

1. To study the field of human-computer-interaction.
2. To gain an understanding of the human part of human-computer-interactions.
3. To learn to do design and evaluate effective human-computer-interactions.
4. To study HCI models and theories.
5. To understand HCI design processes.
6. To apply HCI to real life use cases.

Course Outcomes:

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

CO1: Differentiate between good design and bad design.

CO2: Analyze creative design in the surrounding.

CO3: Assess design based on feedback and constraint.

CO4: Design paper-based prototypes and use wire frame.

CO5: Implement user-interface design using web technology.

CO6: Evaluate user-interface design using HCI evaluation techniques.

Guidelines for Instructor's Manual

The faculty member should prepare the laboratory manual for all the experiments, and it should bemade 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, references.

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, printouts of the code written using coding standards, sample test cases etc. To support Go-green, printouts should be asked to any 2 students from each batch. However, all students must submit the soft copy and should be maintained by batch teacher.
2. Oral Examination will be based on the HCI theory and HCI lab term work.
3. Candidate is expected to know the theory involved in the experiment.

4. The Oral 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 tags, coding standards, design flow 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 64-bit open-source software.

Guidelines for Oral Examination

Both internal and external examiners should jointly conduct Oral examination. During assessment, the examiners should give the maximum weightage to the satisfactory answer of the problem statement in question. 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.

List of Laboratory Assignments

Group A: CO1,2,3

1. Identify and observe bad designs

Students are expected to submit minimum of 3 to 5 photographs of bad designs in their surrounding or home or any product or neighborhood and create a report mentioning why is it bad? They can submit word/pdf file having photos and description, source of photos and place and mention why is it bad and discuss the outcome during lab session.

2. "The Jugad" :

Humans are very creative and often use it to get work done with available set up and resources. Students are expected to identify Jugad (things used creatively but not meant for that) things and submit minimum of 3 to 5 photographs of jugad in their surrounding or home or neighborhood. Prepare a report mentioning the Jugad and source of photos. Discuss the outcome during lab session.

3. Feedback and Constraint:

Products or interfaces should offer useful feedback to understand the state and have constraints to avoid mistakes while using them. Students are expected to identify and analyze minimum of 5

interfaces or products offering feedback and constraint. Prepare a report clearly showcasing feedback and constraint and support it with minimum of 5 photographs taken in their surrounding or home or neighborhood. Discuss the outcome during lab session

Group B: CO 4,5

4. Prototype and wire frame:

Students are expected to choose a problem statement and identify –

Types of users going to use (age, experience, environmental conditions during use etc..)Minimum 3 scenarios of use Create paper-based prototypes for scenarios.

Use any open-source tool to wire frame scenarios.

5. CSS:

Students are expected to design minimum of 5 web pages using CSS for the problem statement chosen in assignment no. 4. Apply CSS properties Border, margins, Padding, Navigation, dropdown list to page

Group C: CO 5,6

1. CMS tool:

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 5 forms. Use WordPress/ Joomla/ Drupal /PHP/ CSS/Bootstrap/ JavaScript.

2. Evaluation of Interface:

Students are expected to evaluate minimum of two products / software interface against known HCI evaluation.

Reference Books:

1. Alan Dix (2008). Human Computer Interaction. Pearson Education. ISBN 978-81-317-1703-5
2. Ben Shneiderman; Catherine Plaisant; Maxine Cohen; Steven Jacobs (29 August 2013). Designing the User Interface: Strategies for Effective Human-Computer Interaction. Pearson Education Limited.ISBN 978-1-292-03701-1.
3. https://www.w3schools.com

Savitribai Phule Pune University, Pune

Third Year Information Technology (2019 Course)

314448 : Laboratory Practice-I (Machine Learning)

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR) : 4 hrs/week	02 Credits	PR : 25 Marks TW: 25 Marks

HOME

Prerequisites:

1. Python programming language

Course Objectives:

1. The objective of this course is to provide students with the fundamental elements of machine learning for classification, regression, clustering.
2. Design and evaluate the performance of a different machine learning models.

Course Outcomes:

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

CO1: Implement different supervised and unsupervised learning algorithms.

CO2: Evaluate performance of machine learning algorithms for real-world applications.

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

Guidelines for Lab /TW Assessment

1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.
2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.
3. Appropriate knowledge of usage of software and hardware related to respective laboratories should be as a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers of the program in a journal may be avoided. There must be hand-written write-ups for every assignment in the journal. The DVD/CD containing student programs should be attached to the journal by every student and the same to be maintained by the department/lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

Guidelines for Laboratory Conduction

1. All the assignments should be implemented using python programming language
2. Implement any 4 assignments out of 6
3. Assignment number 4 is compulsory
4. The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic.
5. The instructor may frame multiple sets of assignments and distribute them among batches of students.
6. All the assignments should be conducted on multicore hardware and 64-bit open-sourcesoftware

Guidelines for Practical Examination

1. 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.
2. 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.
3. The evaluation should be done by both external and internal examiners.

List of Laboratory Assignments

Group A

1. **Assignment on Regression technique**

   Download temperature data from below link. https://www.kaggle.com/venky73/temperatures-of-india?select=temperatures.csv

   This data consists of temperatures of INDIA averaging the temperatures of all places month wise. Temperatures values are recorded in CELSIUS

   - **A.** Apply Linear Regression using suitable library function and predict the Month-wise temperature.
   - **B.** Assess the performance of regression models using MSE, MAE and R-Square metrics
   - **C.** Visualize simple regression model.

2. **Assignment on Classification technique**

   Every year many students give the GRE exam to get admission in foreign Universities. The data set contains GRE Scores (out of 340), TOEFL Scores (out of 120), University Rating (out of 5), Statement of Purpose strength (out of 5), Letter of Recommendation strength (out of 5), Undergraduate GPA (out of 10), Research Experience (0=no, 1=yes), Admitted (0=no, 1=yes). Admitted is the target variable.

   Data Set Available on kaggle (The last column of the dataset needs to be changed to 0 or 1)Data Set : https://www.kaggle.com/mohansacharya/graduate-admissions

   The counselor of the firm is supposed check whether the student will get an admission or not based on his/her GRE score and Academic Score. So to help the counselor to take appropriate decisions build a machine learning model classifier using Decision tree to predict whether a student will get admission or not.

   Apply Data pre-processing (Label Encoding, Data Transformation….) techniques if necessary.

Perform data-preparation (Train-Test Split)

C. Apply Machine Learning Algorithm
D. Evaluate Model.

3. Assignment on Improving Performance of Classifier Models

A SMS unsolicited mail (every now and then known as cell smartphone junk mail) is any junk message brought to a cellular phone as textual content messaging via the Short Message Service (SMS). Use probabilistic approach (Naive Bayes Classifier / Bayesian Network)to implement SMS Spam Filtering system. SMS messages are categorized as SPAM or HAM using features like length of message, word depend, unique keywords etc.

Download Data -Set from : http://archive.ics.uci.edu/ml/datasets/sms+spam+collection

This dataset is composed by just one text file, where each line has the correct class followed by the raw message.

- **A.** Apply Data pre-processing (Label Encoding, Data Transformation….) techniques if necessary
- **B.** Perform data-preparation (Train-Test Split)
- **C.** Apply at least two Machine Learning Algorithms and Evaluate Models
- **D.** Apply Cross-Validation and Evaluate Models and compare performance.
- **E.** Apply Hyper parameter tuning and evaluate models and compare performance.

4. Assignment on Clustering Techniques

Download the following customer dataset from below link:

Data Set: https://www.kaggle.com/shwetabh123/mall-customers

This dataset gives the data of Income and money spent by the customers visiting a Shopping Mall. The data set contains Customer ID, Gender, Age, Annual Income, Spending Score. Therefore, as a mall owner you need to find the group of people who are the profitable customers for the mall owner. Apply at least two clustering algorithms (based on Spending Score) to find the group of customers.

- **A.** Apply Data pre-processing (Label Encoding , Data Transformation….) techniques if necessary.
- **B.** Perform data-preparation(Train-Test Split)
- **C.** Apply Machine Learning Algorithm
- **D.** Evaluate Model.
- **E.** Apply Cross-Validation and Evaluate Model

5. Assignment on Association Rule Learning

Download Market Basket Optimization dataset from below link.

Data Set: https://www.kaggle.com/hemanthkumar05/market-basket-optimization

This dataset comprises the list of transactions of a retail company over the period of one week. It contains a total of 7501 transaction records where each record consists of the list of items sold in one transaction. Using this record of transactions and items in each transaction, find the association rules between items.

There is no header in the dataset and the first row contains the first transaction, so mentioned header = None here while loading dataset.

- **A.** Follow following steps :
- **B.** Data Preprocessing
- **C.** Generate the list of transactions from the dataset
- **D.** Train Apriori algorithm on the dataset
- **E.** Visualize the list of rules

F. Generated rules depend on the values of hyper parameters. By increasing the minimum confidence value and find the rules accordingly

6. **Assignment on Multilayer Neural Network Model**

Download the dataset of National Institute of Diabetes and Digestive and Kidney Diseases from below link :

Data Set: https://raw.githubusercontent.com/jbrownlee/Datasets/master/pima-indians-diabetes.data.csv

The dataset is has total 9 attributes where the last attribute is "Class attribute" having values 0 and 1. (1="Positive for Diabetes", 0="Negative")

- **A.** Load the dataset in the program. Define the ANN Model with Keras. Define at least two hidden layers. Specify the ReLU function as activation function for the hidden layer and Sigmoid for the output layer.
- **B.** Compile the model with necessary parameters. Set the number of epochs and batch size and fit the model.
- **C.** Evaluate the performance of the model for different values of epochs and batch sizes.
- **D.** Evaluate model performance using different activation functions Visualize the model using ANN Visualizer.

Reference 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.
3. Hastie, Tibshirani, Friedman: Introduction to Statistical Machine Learning with Applications in R, Springer, 2nd Edition 2012
4. Tom M. Mitchell , Machine Learning, 1997, McGraw-Hill, First EditionC. M. Bishop: Pattern Recognition and Machine Learning, Springer 1st Edition-2013.
5. Ian H Witten, Eibe Frank, Mark A Hall: Data Mining, Practical Machine Learning Tools and Techniques, Elsevier, 3rd Edition
6. Hastie, Tibshirani, Friedman: Introduction to Statistical Machine Learning with Applications in R, Springer, 2nd Edition 2012.
7. Kevin P Murphy: Machine Learning – A Probabilistic Perspective, MIT Press, August 2012.
8. Shalev-Shwartz S., Ben-David S., Understanding Machine Learning: From Theory to Algorithms, CUP, 2014
9. Jack Zurada: Introduction to Artificial Neural Systems, PWS Publishing Co. Boston, 2002

Virtual Laboratory :

1. http://vlabs.iitb.ac.in/vlabs-dev/labs/machine_learning/labs/index.php

Savitribai Phule Pune University, Pune

Third Year Information Technology (2019 Course)

314448 (A) : Laboratory Practice-I (Design of Analysis Algorithm)

Teaching Scheme:	Credit Scheme	Examination Scheme:
Practical (PR) : 4 hrs/week	02 Credits	PR: 25 Marks TW: 25 Marks

Prerequisites:

1. Data Structures and Algorithms.
2. Discrete Structures.
3. C/C++ programming

Course Objectives:

1. To learn the various algorithmic design strategies.
2. To apply efficiently in problem solving.

Course Outcomes:

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

CO1: Implement the various algorithmic design strategies and use it to solve real time problems/ applications

CO2: Apply Divide & Conquer as well as Greedy approach to design algorithms.

CO3: Understand and analyze optimization problems using dynamic programming.

Guidelines for Instructor's Manual

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

Guidelines for Student's Lab Journal

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

Guidelines for Lab /TW Assessment

1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.
2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.
3. Appropriate knowledge of usage of software and hardware related to respective laboratories should be As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers of the program in a journal may be avoided. There must be hand-written write-ups for every assignment in the journal. The DVD/CD containing student programs should be attached to the journal by every student and the same to be maintained by the department/lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

Guidelines for Laboratory Conduction
1. The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. **2.** The instructor may set multiple sets of assignments and distribute them among batches of students. It is appreciated if the assignments are based on real world problems/applications. **3.** All the assignments should be conducted on multicore hardware and 64-bit open-source software
Guidelines for Practical Examination
1. 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. **2.** 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. **3.** The evaluation should be done by both external and internal examiners.
List of Laboratory Assignments
1. Write a program to implement Fractional knapsack using Greedy algorithm and 0/1 knapsack using dynamic programming. Show that Greedy strategy does not necessarily yield an optimal solution over a dynamic programming approach. **2.** Write a program to implement Bellman-Ford Algorithm using Dynamic Programming and verify the time complexity **3.** Write a recursive program to find the solution of placing n queens on the chessboard so that no two queens attack each other using Backtracking. **4.** Write a program to solve the travelling salesman problem and to print the path and the cost using LC Branch and Bound.
Reference Books :
1. Horowitz and Sahani, Fundamentals of computer Algorithms, Galgotia.,ISBN : 81-7371-612-

Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)
314448 (B) : Laboratory Practice-I (ADBMS)

Teaching Scheme:	Credit Scheme	Examination Scheme:
Practical (PR) :4 hrs/week	02 Credits	PR : 25 Marks TW : 25 Marks

HOME

Prerequisites:

1. Database Management System

Course Objectives:

1. To learn and understand Database Modeling, Architectures.
2. To learn and understand Advanced Database Programming Frameworks.
3. To learn NoSQL Databases (Open source) such as MongoDB.
4. To design and develop application using NoSQL Database.
5. To design data warehouse schema for given system.

Course Outcomes:

On completion of the course, students will be able to

CO1: Understand Advanced Database Programming Languages.

CO2: Master the basic concepts of NoSQL Databases.

CO3: Install and configure database systems.

CO4: Populate and query a database using MongoDB commands.

CO5: Design data warehouse schema of any one real-time: CASE STUDYC

CO6: Develop small application with NoSQL Database for back-end.

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 handwritten journal based on specified list of assignments.
2. Practical 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 handwritten write-up along with results of implemented assignment, attendance etc.
2. Appropriate knowledge of usage of software and hardware related to respective laboratory should be checked by the concerned faculty member.
3. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers of the program in journal may be avoided. There must be hand-written write-ups for every assignment in the journal. The DVD/CD containing student's programs should be attached to the journal by every student and same to be maintained by department/lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

Guidelines for Laboratory Conduction

1. Group A assignments are compulsory and should be performed by individual student.
2. Group B case study may be performed in group of 3/4.
3. Mini project of Group C can be implemented using any suitable front-end. But back-end must be MongoDB.

Guidelines for Practical Examination

1. Practical Examination will be based on the all topics covered.
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.

List of Laboratory Assignments

Group A : MongoDB

1. Create a database with suitable example using MongoDB and implement

- Inserting and saving document (batch insert, insert validation)
- Removing document
- Updating document (document replacement, using modifiers, up inserts, updating multipledocuments, returning updated documents)
- Execute at least 10 queries on any suitable MongoDB database that demonstrates following:
  - Find and find One (specific values)
  - Query criteria (Query conditionals, OR queries, $not, Conditional semantics)
  - Type-specific queries (Null, Regular expression, Querying arrays)
  - $ where queries
  - Cursors (Limit, skip, sort, advanced query options)

2. Implement Map-reduce and aggregation, indexing with suitable example in MongoDB. Demonstrate the following:

- Aggregation framework
- Create and drop different types of indexes and explain () to show the advantage of the indexes.

3. Case Study: Design conceptual model using Star and Snowflake schema for any one database.

4. Mini Project

Pre-requisite: Build the mini project based on the requirement document and design prepared as a part of Database Management Lab in second year.

1. Form teams of around 3 to 4 people.

2. Develop the application:

Build a suitable GUI by using forms and placing the controls on it for any application. Proper data entry validations are expected.

Add the database connection with front end. Implement the basic CRUD operations.

3. Prepare and submit report to include: Title of the Project, Abstract, List the hardware and software requirements at the backend and at the front end, Source Code , Graphical User Interface, Conclusion.

Reference Books:

1. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", 6thEdition, McGraw Hill Publishers, ISBN 0-07-120413-X.

2. Kristina Chodorow, MongoDB The definitive guide, O'Reilly Publications, ISBN:978-93-5110-269-4,2nd Edition.

3. Jiawei Han, Micheline Kamber, Jian Pei "Data Mining: concepts and techniques", 2nd Edition, Publisher: Elsevier/Morgan Kaufmann.

4. http://nosql-database.org/.

Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)
314448 (C) : Laboratory Practice-I (Design Thinking)

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR) : 4 hrs/week	02 Credits	PR : 25 Marks TW: 25 Marks

Prerequisites: NA

Course Objectives:

1. To identify the opportunities and challenges for design thinking innovation and empathize And ideate for it.
2. To describe the solution by prototyping the design.

Course Outcomes:

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

CO1: Frame and Design Challenge by performing STEEP Analysis, Conduct Interviews, design and ask 5x Why and 5W+H questions.

CO2: Demonstrate the activities to empathize with the users by creation of Empathy Map, Persona Development, Customer Journey Map.

CO3: Define and ideate process of design thinking and perform brainstorming, selection of ideas, create a storyboard and design paper prototyping or digital prototyping for chosen design challenge.

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 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 inall 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 templates related to respective laboratory should be checked by the concerned faculty member.

HOME

Guidelines for Laboratory Conduction

1. Students should be asked to form a group of 3 to 4 students and identify design challenge to provide the solution to real life engineering problems within the social, environmental and economic context.
2. All the assignments should be conducted using the templates provided in the reference books.
3. The faculty member should help student to identify Online free or open source tools like diagrams.net, LucidChart, Draw.io, Creatly, Openboard, Microsoft whiteboard etc. which will help students to collaborate and draw diagram.
4. After every assignment, student group should be asked to demonstrate their design and discuss findings.

Guidelines for Practical Examination

1. Students will be provided with 2 problem statements options covering the detail design challenge statements and student will have to perform any one.
2. All the problem statements carry equal weightage.

List of Laboratory Assignments

Group A- CO1, C02,CO3

Assignment-I- Inspiration Phase:
Perform STEEP analysis by using MAKING SENSE OF STEEP ANALYSIS & STRATEGIC PRIORITIES TEMPLATE and Frame Your Design Challenge. Conduct Interviews, design and ask 5x Why and 5W+H questions

Assignment-II-Empathize Phase:
Observe the user and design Empathy Map, Generate persona/User profile and Customer Journey map

Assignment-III- Define and Ideate:
Share Stories and learning from research- Cluster Insights into themes, Create Insights statements, create 'How might we' questions

Assignment-IV Prototype Phase:
Brainstorm, select your ideas, create a storyboard, determine what to prototype, start prototyping, Design Paper Prototype/digital Prototype, test your prototype and get feedback, Create your Action plan, create pitch, share your solution, perform reflection

Reference Books:

1. Michael Lewrick, Patrick Link, Larry Leifer , "The Design Thinking Toolbox: A Guide to Mastering the Most Popular and Valuable Innovation Methods", March 2020 edition, ISBN: 978-1-119-62921-4, WILEY Publication.
2. Mr Lee Chong Hwa (Lead Facilitator), "The Design Thinking: Guidebook"
3. IDEO (Firm), "The Field Guide to Human-centered Design: Design Kit", 1st edition, ISBN-978099140631-9, IDEO 2015.
4. https://www.innovationtraining.org/

Savitribai Phule Pune University, Pune

Third Year Information Technology (2019 Course)

314448 (D) : Laboratory Practice-I (Internet of Things)

Teaching Scheme:	Credit Scheme	Examination Scheme:
Practical (PR) :4 hrs/week	02 Credits	TW: 25 Marks PR: 25 Marks

HOME

Prerequisites:

1. Programming Skill Development Lab.

Course Objectives :

1. To learn interfacing of sensor and actuators using Arduino Uno/Raspberry Pi
2. To learn and understand IoT platforms and its significance for real time applications
3. To learn and understand the steps involved in python programming for IoT applications

Course Outcomes:

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

CO1: Design and implement real time applications with sensors and actuators.

CO2: Design and develop real time IoT based application by cloud interfacing.

Guidelines for Instructor's Manual

Faculty Member should prepare lab manual by taking the review of latest IoT devices with specifications and made it available for students/Lab assistant.

Guidelines for Student's Lab Journal

1. Student should submit term work after the completion of entire assignment, only.
2. Practical Examination will be fully based on entire assignment set as per the given instructor manual.
3. Student should know the theory involved in the experiment.
4. Student will be eligible for practical examination only after the submission of term work in stipulated time.

Guidelines for Lab /TW Assessment

1. Instructor/Examiners will assess the student only based on performance of students considering the parameters such as timely submission of assignment, use of proper methodology for implementation of assignment.
2. Student must have appropriate basics and fundamental of software and hardware usage and its relevance with submitted assignment. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers of the program in journal andthe same will be submitted for future reference to Lab Instructor.

Guidelines for Laboratory Conduction

1. All assignments are compulsory and should be performed by individual student.

Guidelines for Practical Examination

1. Practical Examination will be fully based on entire laboratory assignments.
2. Examiners will judge the students based on practical performed in the examination and by asking some questions related to implementation of experiments, which he/she has carried out.

Group A

1. Design and implement IoT system using Arduino Uno/ Raspberry Pi using 'Ultrasonic sensor and Servo motor' such as 'Door opener in home automation'.
2. Design and implement parameter monitoring IoT system keeping records on Cloud such as 'environment humidity and temperature monitoring'.
3. Design and implement real time monitoring system using android phone (Blynk App.) such as'soil parameter monitoring'.
4. Design and implement IoT system for one of the applications like: Traffic Application, Medical/Health application, Social Application etc.

Text Books:

1. Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach" , 2014, Universities Press (India) Pvt Ltd., ISBN: 9788173719547
2. Matt Richardson & Shawn Wallac, "Getting Started with Raspberry Pi", 2014, O'Reilly (SPD), ISBN: 9789350239759
3. Rushi Gajjar, "Raspberry Pi Sensors", 2015, Packt Publishing, ISBN : 978-1-78439-361-8

Reference Books:

1. Peter Waher, "Learning Internet of Things", 2015, Packt Publishing, ISBN: 978-1-78355-353-2
2. Simon Monk, "Raspberry Pi Cookbook, Software and Hardware Problems and solutions", 2019, O'Reilly, ISBN 9781492043225
3. Simon Monk,"Programming Arduino-Getting Started with Sketches", 2012, ISBN: 978-0-07-178423-8, McGraw Hill

E- Books / E- Learning References :

1. Introduction to Arduino and its Setup : https://www.arduino.cc/en/software
2. Introduction to Raspberry Pi and its OS (Raspbian Lit) : https://www.raspberrypi.org/software/operating-systems/
3. Introduction to header files and support : https://github.com/
   Cloud for IoT - ThingSpeak : https://thingspeak.com/
4. Cloud for IoT - Ubidots : https://ubidots.com/stem/
5. Overall IoT Course Contents: https://onlinecourses.nptel.ac.in/noc21_cs17/preview

Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)
314449 : Seminar

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR) : 01 hrs/week	01 Credits	TW : 50 Marks

HOME

Prerequisites:

1. Project Based Learning
2. Software Engineering

Course Objectives:

Seminar should make the student attain skills like:

1. To gather the literature of specific area in a focused manner.
2. To summarize the literature to find state-of-the-art in proposed area.
3. To identify scope for future work.
4. To present the case for the intended work to be done as project.
5. To report literature review and proposed work in scientific way.

Course Outcomes:

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

CO1: Understand, interpret and summarize technical literature.

CO2: Demonstrate the techniques used in the paper.

CO3: Distinguish the various techniques required to accomplish the task. CO4: Identify intended future work based on the technical review.

CO5: Prepare and present the content through various presentation tools and techniques in effective manner.

CO6: Keep audience engaged through improved interpersonal skills.

Guidelines for Seminar Selection and Presentation

1) Student shall identify the area or topics in Information Technology referring to recent trends and developments in consultation with industry (for their requirement) and institute guide.
2) Student must review sufficient literature (reference books, journal articles, conference papers, white papers, magazines, web resources etc.) in relevant area on their topic as decided.
3) Seminar topics should be based on recent trends and developments. Guide should approve the topic by thoughtfully observing different techniques, comparative analysis of the earlier algorithms used or specific tools used by various researchers in the domain.
4) Research articles could be referred from IEEE, ACM, Science direct, Springer, Elsevier, IETE,CSI orfrom freely available digital libraries like Digital Library of India (dli.ernet.in), National Science Digital Library, JRD Tata Memorial Library, citeseerx.ist.psu.edu, getcited.org, arizona.openrepository.com, Open J-Gate, Research Gate, worldwidescience.org etc.
5) Student shall present the study as individual seminars in 20 – 25 minutes in English which is followed by Question Answer session.
6) Guide should ensure that students are doing literature survey and review in proper manner.
7) Guide should give appropriate instructions for effective presentation.
8) Attendance of all other students in the class for presentation is mandatory.

Timeline is suggested to follow throughout the semester:

1) **Week– 01:** Discussion to understand what is technical paper, how to search, where to search?
2) **Week– 02:** Download technical papers (minimum four), getting approved from Guide and Prepare abstract summary of all papers downloaded.
3) **Week– 03 & 04:** Read and understand in detail the decided research papers about the problem statement, techniques used, experimental details and results with conclusion from identified papers.
4) **Week– 05:** Review of the studied papers by Guide / Panel.
5) **Week – 06 & 07:** Search / Find equivalent techniques (other than the one proposed in technical paper) so performance / complexities can be improved (by amortized analysis, not actual implementation).
6) **Week – 08 & 09:** Prepare presentation with outline as The topic, its significance, The research problem, Studied solutions (through research papers) with strengths and weaknesses of each solution, comparison of the solutions to research problem, future directions of work, probable problem statement of project, tentative plan of project work
7) **Week – 10:** Write Seminar report.
8) **Week – 11:** Deliver Presentation to Guide/ Panel.
9) **Week –12:** Verification of Seminar report and Submission.

Guidelines for Seminar report

1. Each student shall submit two copies of the seminar report in appropriate text editing tool/software as per prescribed format duly signed by the guide and Head of the department/Principal.
2. Broad contents of review report (20-25 pages) shall be
   - **a)** Title Page with Title of the topic, Name of the candidate with Exam Seat Number / Roll Number, Name of the Guide, Name of the Department, Institution, Year & University.
   - **b)** Seminar Approval Sheet/Certificate.
   - **c)** Abstract and Keywords.
   - **d)** Acknowledgments.
   - **e)** Table of Contents, List of Figures, List of Tables and Nomenclature.
   - **f)** Chapters need to cover topic of discussion-
     - **i.** Introduction with section including organization of the report,
     - **ii.** Literature Survey
     - **iii.** Motivation, purpose and scope and objective of seminar
     - **iv.** Details of design/technology/Analytical and/or experimental work, if any/
     - **v.** Discussions and Conclusions,
     - **vi.** Bibliography/References (in IEEE Format),
     - **vii.** Plagiarism Check report,
3. Students are expected to use open source tools for writing seminar report, citing the references and plagiarism detection.

Guidelines for Lab /TW Assessment:

1. A panel of reviewers constituted by seminar coordinator (where guide is one of the member of the panel) will assess the seminar during the presentation.
2. Student's attendance for all seminars is advisable.
3. Rubric for evaluation of seminar activity:
   - **i.** Relevance of topic - 05 Marks
   - **ii.** Relevance + depth of literature reviewed - 10 Marks
   - **iii.** Seminar report (Technical Content) - 10 Marks
   - **iv.** Seminar report (Language) - 05 Marks
   - **v.** Presentation Slides - 05 Marks
   - **vi.** Presentation & Communication Skills - 05 Marks
   - **vii.** Question and Answers - 10 Marks

   TOTAL: **50 Marks**

Reference Book:

1. Andrea J. Rutherfoord, Basic Communication Skills for Technology, Pearson Education Asia, 2ndEdition.
2. Lesikar, Lesikar's Basic Business Communication, Tata McGraw, ISBN: 256083274, 1st Edition.

Text Book :

1. Sharon J. Gerson, Steven M. Gerson, Technical Writing: Process and Product, Pearson Education Asia, ISBN: 130981745, 4thEdition.

Savitribai Phule Pune University, Pune

Third Year Information Technology (2019 Course)

Mandatory Audit Course 5

314450 (A) : Banking and Insurance

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory (TH) : 1 hrs/week	No Credits	Audit Course

HOME

Prerequisite Courses : If any

Course Objectives: -

1. To understand banking system in India.

2. To understand negotiable instruments.

3. To learn attributes of different types of insurance policies.

4. To create awareness about nature and functioning of annuities.

Course Outcomes: -

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

CO1: Differentiate between types of banks and their working.

CO2: Carry out banking transactions on their own.

CO3: Decide which insurance policy they should buy.

CO4: Handle investing in annuities and claim settlements.

COURSE CONTENTS

Unit I	INTRODUCTION TO BANKING	(03 hrs)

Definition of Bank - Basic functions of Banker

Banking System in India : Banker and Customer: Relationship between Banker and Customer, Special Types of Customers, Retail & Wholesale Banking, Deposit Accounts – Savings Accounts, Current Accounts, Fixed Deposit Accounts, Opening and operation of Accounts, Nomination, KYC requirements, Pass Book, Minors, Partnerships & Companies.

Mapping of Course Outcomes for Unit I	CO1

Unit II	BANK FUNDS AND INSTRUMENTS	(03 hrs)

Employment of Bank Funds: Liquid Assets-Cash in Hand, Cash with RBI & Cash with other Banks, Investment in securities, Advances - Secured and Unsecured, Loans, Term Loans, Cash Credit, Overdraft, Discounting of Bills of Exchange, Modes of creating charge on Securities, Types of Securities.

Negotiable Instruments: Definition & Characteristics of Cheques, Bills of Exchange & Promissory Notes, Crossings, Endorsements, Collection and payment of Cheques, Liabilities of Parties.

Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**INTRODUCTION TO INSURANCE**	**(03 hrs)**

Concept of Insurance, Need for Insurance.

Brief history of Insurance industry in India: (a) Enactment of Insurance Act, 1938. (b) Nationalization of Life Insurance Companies in 1955. (c) Nationalization of General insurance Companies in 1972. (d) Malhotra Committee Report – Opening up of Insurance sector to Private Companies in 2000. (e) Setting up of Insurance Regulatory and Development Authority in 1999.

Life Insurance: Present Organizational set-up of Insurance Companies in India – L.I.C. and Private Companies with foreign joint ventures, selling Insurance through Agents and Banks.

Objectives of Life Insurance – Protection and Investment, Different types of Life Insurance Policies – Chief characteristics and similarity. Online vs Offline policies

Basic Pre-requites for Life Insurance – Insurable Interest and utmost Good Faith.

Procedure for taking a policy: (a) Selection of the Plan. (b) Consultation of Premium tables. (c) Filling up of Proposal Form. (d) Document regarding proof of age. (e) Important clauses of the Policy – eg. Suicide Clause. (f) Nomination

Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**ULIPs AND POLICY MATTERS**	**(03hrs)**

Annuities and Unit Linked Policies: Concept of Annuity, Objectives of Annuity, Procedure followed for obtaining Annuities, Meaning of Unit Linked Insurance Policies, Procedure for obtaining Unit linked insurance Policies.

General Insurance: General Insurance companies, types of general insurance

Post - Issue Matters: Lapse of the Policy due to Non-Payment of Premium, Revival of the Lapsed Policies, Surrender of the Policy – Payment of surrender value, Assignment of the Policies, Settlement of claims – Procedure to be followed.

Mapping of Course Outcomes for Unit IV	**CO4**

Text Books:

1. Sunil Kumar, Essentials of Banking and Insurance, JSR PUBLISHING HOUSE LLP; 2ndEd edition, ISBN-10 :938768461X.
2. D.D. Chaturvedi, Arun Mittal, Saumya Chaturvedi, Banking and Insurance, Scholar Tech Press, ASIN : B08S3H36K1

E- Books / E- Learning References:

1. https://onlinecourses.swayam2.ac.in/cec21_ge04/preview

Savitribai Phule Pune University, Pune

Third Year Information Technology (2019 Course)

Mandatory Audit Course 5

314450 (B) : Startup Ecosystems

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory (TH) : 1 hrs/week	No Credits	Audit Course

Prerequisite Courses: NA

Course Objectives:

To familiarize students-

1. New venture creation opportunities, its resources, and requirements for Enterprise Startup
2. Legal requirements for new ventures
3. Financial issues and strategies related to startups

Course Outcomes:

completion of the course, students will be able to–

CO1: Identify Startup opportunities

CO2: Explain legal and other requirements for new ventures

CO3: Analyze financial Issues of startups

COURSE CONTENTS

Unit I	STARTUP OPPORTUNITIES	(04 hrs)

Current industrial revolution, Idea Generation with brainstorming, Business Startup, ideation, choices of venture, the rise of Startup economy, forces of change, startup equation, the entrepreneurial ecosystem, Indian government initiatives, Entrepreneurship in India, Case Study: MEITY Startup Hub

Mapping of Course Outcomes for Unit I	CO1

Unit II	STARTUP ECOSYSTEM	(04 hrs)

Startups ecosystem: Support organizations, big companies, universities, funding organizations, service providers, research organizations, Startup development phases: Ideating, conception, committing, validating, scaling, establishing, Startup business partnering, Startup culture, Co-founders, FFF (Fools, friends and family), Angels

Mapping of Course Outcomes for Unit II	CO2

Unit III	STARTUP CAPITAL REQUIREMENTS AND LEGAL ENVIRONMENT	(04 hrs)

Identification of capital resource requirements of startup, estimating startup finance requirements, deciding a process map, Positioning the venture in the value chain – Framing risk reduction strategy, Startup financing metrics, Legal perspectives- New Ventures approval procedures- Taxes or duties payable for new ventures, Case Study: Technology Incubation and Development of Entrepreneurs (TIDE)

Mapping of Course Outcomes for Unit III	**CO3**

Text Books:

1. Kathleen R Allen, "Launching New Ventures, An Entrepreneurial Approach", Cengage Learning, 2016.
2. Anjan Raichaudhuri, Managing New Ventures Concepts and Cases, Prentice Hall International, 2010.
3. S.R. Bhowmik and M. Bhowmik, Entrepreneurship, New Age International, 2007.
4. Steven Fisher, Ja-nae Duane, The Startup Equation -A Visual Guidebook for Building Your Startup, Indian Edition, Mc Graw Hill Education India Pvt. Ltd, 2016.

Reference Books:

1. Donald F Kuratko, Jeffrey S. Hornsby, New Venture Management: The Entrepreneurs Road Map, 2e, Routledge, 2017.
2. Vijay Sathe, Corporate Entrepreneurship, 1e, Cambride, 2009.
3. Bruce R. Barringer, R.Duane Ireland, Entrepreneurship successfully, launching new ventures.Pearson,2019

Savitribai Phule Pune University, Pune

Third Year Information Technology (2019 Course)

Mandatory Audit Course 5

314450 (C) :Foreign Language- (Japanese Language-III)

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory (TH) :1 hrs/week	Non Credit	Audit Course

HOME

Prerequisite Courses, if any:

1. Students must have already studied can read/write Hiragana and Katakana script
2. Students must have studied Japanese for beginners that includes the syllabus of Audit course Module 1 and 2

Course Objectives:

To familiarize students with-

1. Japan Market needs: To meet the needs of ever growing industry with respect to the Japanese language support.
2. Japanese Culture and Mindset: To get introduced to Japanese society and culture through language.
3. Career opportunities: To know more about Higher studies, Career opportunities in Japan / Japanese companies across the world.
4. Soft skills and self-development: To learn the manners, business culture and develop the confidence by gaining the knowledge of global perspective and cross-cultural studies.

Course Outcomes:

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

CO1: Ability of basic communication.

CO2: Knowledge of Japanese script (reading, writing and listening skills).

CO3: Knowledge about Japanese culture, life style, manners and etiquettes.

CO4: Develop interest to pursue professional Japanese Language course.

COURSE CONTENTS

Unit I	JAPANESE-BEGINNERS LEVEL	(3 hrs Lecture + 3 hrs Self-study)

Greeting, Self-introduction, Nationality, Languages, Hiragana, Katakana rules, History of Kanji, Numbers, Days and Dates, Time, Age, Mobile number, Places, Relatives, Colors, Things, Vehicles. Introduction to grammar of basic particles, verbs and adjectives, Culture/Others: Business card exchange, Seasons and festivals in Japan, Kanjis: 1 to 10, Listening practice, Vocabulary and conversation practice.

Reference:

- **a.** Revision of beginner level studied in Module1-2
- **b.** Nihongo Challenge Kanji - Lesson 1

Mapping of Course Outcomes for Unit I	**CO1**	
Unit II	**JAPANESE SCRIPT**	
Introduction to Demonstrative pronouns (ko-so-a-do),Asking/requesting for something, Making sentences using various question words, Stating/asking age, nationality, profession ,Culture/Others: Information about Japanese standardized test (JLPT, NAT etc.),Kanjis:11 to 20,Listening practice Vocabulary and conversation practice. Reference: **a.** Minna no Nihongo I: Lesson 1 and 2 (Text book + Audio and Video) **b.** Nihongo Challenge Kanji - Lesson 2		
Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**BASIC JAPANESE GRAMMAR**	**(3 hrs Lecture + 3 hrs Self-study)**
Conversation at the shop, asking price, location, Telling time and scheduling tasks, Introduction to Verb groups (root, present, past, negative), Culture/Others: Conversation and Behavior at the shop, How to buy train tickets, Train manners, Introduction to social issues and Japanese society,Kanjis:21to 30,Listening practice Vocabulary and conversation practice. Reference: **a.** Minna no Nihongo I : Lesson 3 and 4 (Text book + Audio and Video) **b.** Nihongo Challenge Kanji - Lesson 3		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**JAPANESE FOR DAILY COMMUNICATION**	**(3 hrs Lecture + 3 hrs Self-study)**
Directions and heading towards (use of particle de, he and relevant vocabulary) , Actions (use of particle wo and relevant vocabulary),Types of adjectives (root, negative, past, past negative),Culture/Others: Party, gifts related conversation, Gifting culture in Japan, Introduction to Japanese economy and market needs ,Kanjis:31 to 40,Listening practice, Vocabulary and conversation practice. Reference: **a.** Minna no Nihongo I : Lesson 5 and 6 (Text book + Audio and Video) **b.** Nihongo Challenge Kanji - Lesson 4		

Mapping of Course Outcomes for Unit IV	**CO4**

Text Books:

1. Minna no Nihongo I –Main Text book with audio and video files (Books by Goyal Publishers - Available in shops / Online)
2. Minna no Nihongo - Translation and grammatical notes for self-study (Books by Goyal Publishers - Available in shops / Online)
3. Nihongo Challenge – Kanji (Available with Japanese Language schools/teachers)

Reference Books:

1. Nihongo Shoho: For better understanding and practice of Basic Japanese Grammar
2. Marugoto : For scenario based Japanese conversation practice

E -Books / E- Learning References :

1. nihongo ichiban
   a. https://nihongoichiban.com/home/jlpt-n5-study-material/
2. jlpt sensei
   a. https://jlptsensei.com/how-to-pass-jlpt-n5-study-guide/

SEMESTER – VI

Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)
314451: Computer Network and Security

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

HOME

Prerequisite Courses:

1. Basics of Computer Network

Companion Course:

1. Cyber Security

Course Objectives:

To familiarize students with-

1. The application layer services, responsibilities and protocol.
2. Fathom wireless network and different wireless standards
3. Differences in different wireless networks and to learn different mechanism used at layers of wireless network.
4. The concept of network security.
5. Basic cryptographic techniques in application development.
6. Cyber security vulnerabilities & study typical threats to modern digital systems.

Course Outcomes:

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

CO1: Know Responsibilities, services offered and protocol used at application layer of network

CO2: Understand wireless network and different wireless standards.

CO3: Recognize the Adhoc Network's MAC layer, routing protocol and Sensor networkarchitecture.

CO4: Define the principal concepts of network security and Understand network security threats,security services, and countermeasures

CO5: Apply basic cryptographic techniques in application development.

CO6: Gain a good comprehension of the landscape of cyber security Vulnerabilities & describe typical threats to modern digital systems.

COURSE CONTENTS

Unit I	APPLICATION LAYER	(06 hrs)

Client Server Paradigm: Communication using TCP and UDP, Peer to Peer Paradigm, Application Layer Protocols: DNS, FTP, TFTP, HTTP, SMTP, POP, IMAP, MIME, DHCP, TELNET.

Mapping of Course Outcomes for Unit I	**CO1**	
Unit II	**WIRELESS STANDARDS**	**(06 hrs)**
Wireless LANs: Fundamentals of WLAN, Design goals, Characteristics, Network Architecture, IEEE 802.11: components in IEEE 802.11 network, Physical Layer, **MAC Sub Layers :** DCF, PCF, Hidden and exposed station problem, Frame format, Addressing Mechanism, IEEE 802.15.1 **Bluetooth:** Architecture, Layers, operational states, **IEEE 802.16 WiMax:** Services, Architecture, Layers, comparisonbetween Bluetooth, IEEE 802.11 and IEEE 802.16.		
Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**ADHOC AND WSN**	**(06 hrs)**
Infrastructure Network and Infrastructure-less Wireless Networks, Issues in Adhoc Wireless Network, Adhoc Network MAC Layer: Design Issues, Design Goal, Classification, MACAW, **Adhoc Network Routing Layer:** Issues in Designing a Routing Protocol for Ad-hoc Wireless Networks – Classifications of Routing Protocols, DSDV, AODV, DSR, **Applications of Sensor Network**, Comparison with Ad Hoc Wireless Network, Sensor node architecture Issues and Challenges in Designing a Sensor Network, Classification of sensor network protocols, SENSOR NETWORK ARCHITECTURE: Layered Architecture, Clustered Architecture,		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**INTRODUCTION TO NETWORK SECURITY**	**(06 hrs)**
Importance and Need for Security, Network Attacks- Passive, Active Network Security Threats: Unauthorized access, Distributed Denial of Service (DDoS) attacks, Man in the middle attacks, **Concept of Security Principles:** Confidentiality and Privacy , Authentication, Authorization and Access Control, Integrity, Non- repudiation, Stream Ciphers: Substitution Cipher – Mono alphabetic Cipher, Polyalphabetic Substitution Cipher., Transposition Cipher: Rail-Fence **Block Ciphers modes:** Electronic Code Book (ECB) Mode., Cipher Block Chaining (CBC) Mode., Cipher Feedback Mode (CFB) , Output Feedback (OFB) Mode.		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**CRYPTOGRAPHIC ALGORITHM**	**(06 hrs)**
Mathematical preliminaries: Groups, Rings, Fields, Prime numbers, Symmetric key algorithms: Data Encryption Standards, Advanced Encryption Standard, **Public Key Encryption and Hash function:** RSA, Digital signatures, Digital Certificates and Public Key Infrastructure: Private Key Management, Diffie-Hellman key exchange, The PKIX Model		

Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**INTRODUCTION TO CYBER SECURITY**	**(06 hrs)**
Introduction to Cyber Security: Basic Cyber Security Concepts, Layers of security, Vulnerability,Threat, Harmful Acts-Malware, Phishing, MIM Attack, DOS Attack, SQL Injection, Internet Governance – Challenges and Constraints, Computer Criminals, Assets and Threat, Motive of Attackers, Software attacks, hardware attacks, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber Stalking, Cyber Terrorism, Cyber Espionage, Comprehensive Cyber Security Policy		
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. C. Siva Ram Murthy, B. S. Manoj, Adhoc Wireless Networks: Architecture and Protocols,Pearson Education, ISBN: 978-81-317-0688-6, 1st Edition.
3. Atul Kahate Cryptography and Network Security, 3e, McGraw Hill Education,
4. B. A. Forouzan Cryptography and Network Security McGraw Hill Education
5. William Stallings Cryptography and Network Security: Principles and Practice, 4th Edition.
6. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley

Reference Books:

1. Kazem Sohraby, Daniel Minoli, TaiebZnati, Wireless Sensor Networks: Technology, Protocolsand Applications, Wiley India, ISBN: 9788126527304
2. Schneir, Bruce, "Applied Cryptography: Protocols and Algorithms"
3. Charles E. Perkins, Adhoc Networking, Pearson Education, 978-81-317-2096-7
4. Andrew S. Tanenbaum, David J. Wethrall, Computer Network, Pearson Education, ISBN: 978-0-13-212695-3.
5. Kurose Ross, Computer Networking: A Top Down Approach Featuring the Internet, Pearson Education, ISBN: 978-81-7758-878-
6. Dr. V.K. Pachghare, Cryptography and Information security, PHI, Second edition, ISBN- 978-81-203-5082-3

E- Books / E- Learning References :

1. https://nptel.ac.in/courses/106/105/106105160/
2. https://nptel.ac.in/courses/106/105/106105031/
3. An Introduction to Cyber Security A Beginner's Guide

Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)
314452: Data Science and Big Data Analytics

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

HOME

Prerequisites:

1. Engineering and discrete mathematics.
2. Database Management Systems, Data warehousing and Data mining.
3. Programming skill.

Companion Course:

1. Machine Learning
2. Advance Database Management

Course Objectives:

1. To introduce basic need of Big Data and Data science to handle huge amount of data.
2. To understand the basic mathematics behind the Big data.
3. To understand the different Big data processing technologies.
4. To understand and apply the Analytical concept of Big data using Python.
5. To visualize the Big Data using different tools.
6. To understand the application and impact of Big Data.

Course Outcomes:

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

CO1: Understand Big Data primitives.
CO2: Learn and apply different mathematical models for Big Data.
CO3: Demonstrate Big Data learning skills by developing industry or research applications.
CO4: Analyze and apply each learning model comes from a different algorithmic approach and it will perform differently under different datasets.
CO5: Understand, apply and analyze needs, challenges and techniques for big data visualization.
CO6: Learn different programming platforms for big data analytics.

COURSE CONTENTS

Unit I	INTRODUCTION: DATA SCIENCE AND BIG DATA	(06 Hrs)

Introduction to Data science and Big Data, Defining Data science and Big Data, Big Data examples, **Data Explosion:** Data Volume, Data Variety, Data Velocity and Veracity. Big data infrastructure and challenges, **Big Data Processing Architectures:** Data Warehouse, Re-Engineering the Data Warehouse, shared everything and shared nothing architecture, Big data learning approaches. **Data Science** – The Big Picture: Relation between AI, Statistical Learning, Machine Learning , Data Mining and Big Data Analytics.

Mapping of Course Outcomes for Unit I	**CO1**	
Unit II	**MATHEMATICAL FOUNDATION OF BIG DATA**	**(07 Hrs)**
Probability: Random Variables and Joint Probability, Conditional Probability and concept of Markov chains, Tail bounds, Markov chains and random walks, Pair-wise independence and universal hashing, Approximate counting, Approximate median. **Data Streaming Models and Statistical Methods:** Flajolet Martin algorithm, Distance Sampling and Random Projections, Bloom filters, Mode, Variance, standard deviation, Correlation analysis and Analysis of Variance.		
Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**BIG DATA PROCESSING**	**(06 Hrs)**
Big Data Analytics- Ecosystem and Technologies, Introduction to Google file system, Hadoop Architecture, **Hadoop Storage:** HDFS, Common Hadoop Shell commands, Anatomy of File Write and Read, NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce paradigm, Map Reduce tasks, Job, Task trackers - Cluster Setup – SSH & Hadoop Configuration, Introduction to NOSQL, Textual ETL processing.		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**BIG DATA ANALYTICS**	**(06 Hrs)**
Big Data Analytics- Architecture and Life Cycle, Types of analysis, Analytical approaches, Data Analytics with Mathematical manipulations, Data Ingestion from different sources (CSV, JSON, html, Excel, mongoDB, mysql, sqlite), Data cleaning, Handling missing values, data imputation, Data transformation, Data Standardization, handling categorical data with 2 and more categories, statistical and graphical analysis methods, Hive Data Analytics.		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**BIG DATA VISUALIZATION**	**(06 Hrs)**
Introduction to Data visualization, Challenges to Big data visualization, Conventional datavisualization tools, Techniques for visual data representations, Types of data visualization, Visualizing Big Data, Tools used in data visualization, Propriety Data Visualization tools, Open – source data visualization tools, **Case Study:** Analysis of a business problem of Zomato using visualization, Analytical techniques used in Big data visualization, Data Visualization using Tableau Introduction to: Candela, D3.js, Google Chart API		

Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**BIG DATA TECHNOLOGIES APPLICATION AND IMPACT**	**(05 Hrs)**
Social media analytics, Text mining, Mobile analytics, Data analytics life cycle of case studies, Organizational impact, understanding decision theory, creating big data strategy, big data value creation drivers, Michael Porter's valuation creation models, Big data user experience ramifications, Identifying big data use cases, Big Data Analytics Challenges and Research directions.		
Mapping of Course Outcomes for Unit VI	**CO6**	

Text Books:

1. Krish Krishnan, Data warehousing in the age of Big Data, Elsevier, ISBN: 9780124058910, 1st Edition.
2. DT Editorial Services, Big Data, Black Book, DT Editorial Services, ISBN: 9789351197577, 2016Edition.

Reference Books:

1. Mitzenmacher and Upfal, Probability and Computing: Randomized Algorithms and ProbabilisticAnalysis, Cambridge University press, ISBN :521835402 .
2. Dana Ron, Algorithmic and Analysis Techniques in Property Testing, School of EE.
3. Graham Cormode, Minos Garofalakis, Peter J. Haas and Chris Jermaine, Synopses for Massive Data: Samples, Histograms, Wavelets, Sketches, Foundation and trends in databases, ISBN:10.1561/1900000004.
4. Alex Holmes, Hadoop in practice, Dreamtech press, ISBN:9781617292224.
5. AmbigaDhiraj, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends forToday's Business, Wiely CIO Series.
6. ArvindSathi, Big Data Analytics: Disruptive Technologies for Changing the Game, IBMCorporation, ISBN:978-1-58347-380-1.
7. EMC Education Services, Data Science and Big Data Analytics- Discovering, analyzing Visualizingand Presenting Data.
8. Li Chen, Zhixun Su, Bo Jiang, Mathematical Problems in Data Science, Springer, ISBN :978-3-319-25127-1.
9. Philip Kromer and Russell Jurney, Big Data for chips, O'Reilly, ISBN :9789352132447.
10. EMC Education services, Data Science and Big Data Analytics, EMC2 Wiley, ISBN :978812655653-
11. Mueller Massaron, Python for Data science, Wiley, ISBN :9788126557394.
12. EMC Education Services, Data Science and Big Data Analytics, Wiley India, ISBN:9788126556533
13. Benoy Antony, Konstantin Boudnik, Cheryl Adams,,Professional Hadoop, Wiley India,ISBN :9788126563029
14. Judith Hurwitz, Alan Nugent, Big Data For Dummies, Wiley India, ISBN : 9788126543281

E Books / E Learning References :
1. Zomato dataset Link: https://www.kaggle.com/shrutimehta/zomato-restaurants-data **2.** Link for dataset: https://www.kaggle.com/tanmoyie/us-graduate-schools-admission-parameters

Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)
314453: Web Application Development

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

HOME

Prerequisite Courses:

1. Programming languages C++, Java.

Companion Course:

1. Advanced Database Management system
2. Design Thinking

Course Objectives: -

1. To familiarize students with Web Programming basic concepts
2. To learn and understand Web scripting languages.
3. To explore the Front end& Back end web programming skills.
4. To understand and learn Mobile web development.
5. To understand and learn Web application deployment.

Course Outcomes: -

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

CO1: Develop Static and Dynamic website using technologies like HTML, CSS, Bootstrap.
CO2: Demonstrate the use of web scripting languages.
CO3: Develop web application with Front End & Back End Technologies.
CO4: Develop mobile website using JQuery Mobile.
CO5: Deploy web application on cloud using AWS.

COURSE CONTENTS

Unit I	INTRODUCTION TO WEB TECHNOLOGIES	(06 hrs)

HTML: Getting started with HTML, Why HTML, Tags and Elements, Attributes, Properties, Headings list, Links, Tables, Images, HTML Form, Media (Audio, Video), Semantic HTML5 Elements.

CSS: Why CSS, Types of CSS, How to use CSS, Properties, Classes, Child-Class (Nested CSS), Colors, Text, Background, Border, Margin, Padding, Positioning (flex, grid, inline, block), Animation, Transition.

BOOTSTRAP: Why Bootstrap, CSS over Bootstrap, How to Use Bootstrap, Bootstrap Grid System, Bootstrap Responsive, Bootstrap Classes, Bootstrap Components (i.e., Button, Table, List, etc.),Bootstrap as a Cross Platform.

W3C: What is W3C , How W3C handles/Supports Web Technologies.

Mapping of Course Outcomes for Unit I	**CO1**	
Unit II	**WEB SCRIPTING LANGUAGES**	**(06 hrs)**

JavaScript: Introduction to Scripting languages, Introduction to JavaScript (JS), JS Variables and Constants, JS Variable Scopes, JS Data Types, JS Functions, JS Array, JS Object, JS Events.

Advanced JavaScript: JSON - JSON Create, Key-Value Pair, JSON Access, JSON Array, JS Arrow Functions, JS Callback Functions, JS Promises, JS Async-Await Functions, JS Error Handling.

AJAX: Why AJAX, Call HTTP Methods Using AJAX, Data Sending, Data Receiving, AJAX Error Handling.

JQUERY : Why JQuery, How to Use, DOM Manipulation with JQuery, Dynamic Content Change with JQuery, UI Design Using JQuery.

Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**FRONT END TECHNOLOGIES**	**(06 hrs)**

Front-End Frameworks: What is web framework? Why Web Framework? Web Framework Types.

MVC: What is MVC, MVC Architecture, MVC in Practical, MVC in Web Frameworks.

TypeScript: Introduction to TypeScript (TS), Variables and Constants, Modules in TS.

AngularVersion 10+: Angular CLI, Angular Architecture, Angular Project Structure, Angular Lifecycle, Angular Modules, Angular Components, Angular Data Binding, Directives and Pipes, Angular Services and Dependency Injections (DI), Angular Routers, Angular Forms.

ReactJS: Introduction to ReactJS, React Components, Inter Components Communication, Components Styling, Routing, Redux- Architecture, Hooks- Basic hooks, useState() hook, useEffect() hook, useContext() hook.

Mapping of Course Outcomes For Unit III	**CO3**	
Unit IV	**BACK END TECHNOLOGIES**	**(06 hrs)**

Node.JS: Introduction to Node.JS, Environment Setup, Node.JS Events, Node.JS Functions, Node.JS Built-in Modules, File System, NPM, Install External Modules, Handling Data I/O in Node.JS, Create HTTP Server, Create Socket Server, Microservices- PM2.

ExpressJS: Introduction to ExpressJS, Configure Routes, Template Engines, ExpressJS as Middleware, Serving Static Files, REST HTTP Method APIs, Applying Basic HTTP Authentication, Implement Session Authentication.

MongoDB: NoSQL and MongoDB Basics, MongoDB-Node.JS Communication, CURD Operations using Node.JS, Mongoose ODM for Middleware, Advanced MongoDB.

Mapping of Course Outcomes for Unit IV	**CO3**	
Unit V	**MOBILE WEB DEVELOPMENT**	**(06 hrs)**
Mobile-First: What is Mobile-First? What is Mobile Web? Understanding Mobile Devices and Desktop. **JQuery Mobile:** Introduction to the jQuery Mobile Framework, Set-up jQuery Mobile, Pages, Icons, Transitions, Layouts Widgets, Events, Forms, Themes, Formatting Lists, Header and Footer, CSS Classes, Data Attributes, Building a Simple Mobile Webpage.		
Mapping of Course Outcomes for Unit V	**CO4**	
Unit VI	**WEB APPLICATION DEPLOYMENT**	**(06 hrs)**
Cloud: AWS Cloud, AWS Elastic Compute, AWS Elastic Load Balancer and its types, AWS VPC and Component of VPC, AWS storage, Deploy Website or Web Application on AWS, Launch an Application with AWS Elastic Beanstalk.		
Mapping of Course Outcomes for Unit VI	**CO5**	

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.

Reference Books:

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

2. Dr.HirenJoshi, Web Technology and Application Development, DreamTech, First,ISBN:978-93-5004-088-1

3. Steven M. Schafer, “HTML, XHTML and CSS”, Wiley India Edition, Fourth Edition,978- 81-265-1635-3

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

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

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

7. JavaScript: The Definitive Guide - Master The World's Most-Used Programming Language, Seventh Edition

8. Java Script, D.Flanagan, O’Reilly, SPD.

9. Programming Typescript: Making Your JavaScript Applications Scale, Boris Cherny

E- Books / E- Learning References :

1. Learning Amazon Web Services AWS - A Hands-on Guide to the Fundamentals of AWS Cloud Author: Mark Wilkins.
2. https://www.meanacademy.in/web-technologies
3. https://www.meanacademy.in/angular
4. https://www.meanacademy.in/ mongodb
5. https://www.meanacademy.in/ nodejs
6. https://www.meanacademy.in/ aws
7. https://www.w3schools.com/Css
8. https://www.javatpoint.com/angularjs-tutorial
9. https://www.tutorialspoint.com/reactjs/index.htm
10. https://www.tutorialspoint.com/web_development_tutorials.htm
11. https://www.tutorialspoint.com/angular_material/index.htm
12. https://www.javaguides.net/2020/07/angular-10-example-tutorial.html
13. https://www.javatpoint.com/reactjs-tutorial
14. https://www.tutorialspoint.com/jquery_mobile/index.htm
15. https://www.tutorialspoint.com/nodejs/index.htm
16. https://www.tutorialspoint.com/expressjs/index.htm
17. https://www.tutorialspoint.com/mongodb/index.htm
18. https://www.tutorialspoint.com/mongodb/mongodb_tutorial.pdf
19. https://www.tutorialspoint.com/ajax/index.htm.
20. https://www.udemy.com/ajax/online-course.

Savitribai Phule Pune Universisty, Pune
Third Year Information Technology (2019 Course)
314454 (A): Elective-II (Artificial Intelligence)

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

HOME

Prerequisite Courses:

1. Discrete Mathematics, 2. Machine Learning, 3. Data Structures and Algorithms 4. Any Programming Knowledge (Java, Python)

Companion Course:

1. Lab Practice - II

Course Objectives:

1. To understand Fundamental concepts of Artificial Intelligence and different search strategies.
2. To explore Various knowledge representations and reasoning schemes.
3. To understand Fundamentals of NLP and Game Theory.
4. To explore of AI applications.

Course Outcomes:

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

CO1: Understand the fundamental concepts of Artificial Intelligence

CO2: Identify and apply appropriate search strategies for any AI problem

CO3: Explore knowledge reasoning and knowledge representation methods (for solving real world problems)

CO4: Analyze the suitable techniques of NLP to develop AI applications

CO5: Correlate the appropriate methods of Game Theory to design AI applications

CO6: Understand the concept of deep learning and AI applications

COURSE CONTENTS

Unit I	INTRODUCTION TO AI And SEARCH	(06 hrs)

Artificial Intelligence: Introduction, Components of Artificial Intelligence, Characteristics of Artificial Intelligence Systems, Intelligent Agents, Types of Intelligent Agents

Statistical Analysis: Correlation coefficient, Rank Correlation, Residual Error, Mean Square Error, RMSE, Probability Distributions, Concept of Discrete PD and Continuous PD

Search Strategies: Problem spaces (states, goals and operators), problem solving by search, Uninformed search (breadth-first, depth-first, depth first with iterative deepening)

Mapping of Course Outcomes for Unit I	**CO1**	
Unit II	**PROBLEM SOLVING**	**(06 hrs)**
Heuristic Search Techniques: Generate-and-Test; Hill Climbing; Properties of A* algorithm, Best-first Search; Problem Reduction. **Constraint Satisfaction problem:** Interference in CSPs; Backtracking search for CSPs; Local Search for CSPs; structure of CSP Problem. **Beyond Classical Search:** Local search algorithms and optimization problem, local search in continuous spaces, searching with nondeterministic action and partial observation, online search agent and unknown environments.		
Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**KNOWLEDGE REPRESENTATION AND REASONING**	**(06 hrs)**
Knowledge Representation: Introduction to Knowledge Representation, Knowledge agent, Predicate logic, WFF, Inference rule & theorem proving: forward chaining, backward chaining, resolution; Propositional knowledge, Boolean circuit agents. Rule Based Systems, **Knowledge Reasoning:** Forward reasoning: Conflict resolution, backward reasoning: Use of backtracking, **Structured Knowledge Reasoning:** Semantic Net - slots, inheritance, Frames- exceptions and defaults attached predicates, Conceptual Dependency formalism, **Reasoning Under Uncertainty:** Source of Uncertainty, Probabilistic Reasoning and Uncertainty; Probability theory; Bayes Theorem and Bayesian networks, Certainty Factor, Dempster-Shafer theory, Non Monotonic Reasoning, Truth maintenance Systems, Overview of Fuzzy Logic.		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**UNDERSTANDING Of NLP**	**(06 hrs)**
Introduction: What is NLP, Steps in Natural Language Processing, Syntactic Analysis(Parsing): Grammars and Parsers, Augmented Transition Networks, Unification grammars **Semantic Analysis:** Semantic grammar, Case grammars, Conceptual parsing, Approximately Compositional Semantic Interpretation. **Discourse and Pragmatic Processing:** Using focus in Understanding, Modeling Beliefs, Using Goals and Plans for Understanding, Speech Acts, Conversational Postulates Text classification (Spell Checking), Probabilistic Language Models, Implementation aspects of Syntactic Analysis(Parsing)		

Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**INTRODUCTION TO GAME THEORY**	**(06 hrs)**
Game Playing: Overview and Examples. **Domain: Overview**, MiniMax, Alpha-Beta Cut-off, Refinements, Iterative deepening, The Blocks World, Components of A Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive Systems.		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**RECENT AND FUTURE TRENDS IN AI**	**(06 hrs)**
Deep Learning: Introduction, Why to go deep? Architecture of Deep Network, Restricted Boltzmann Machines, Deep belief Network, Tensor Flow, Deep Learning libraries, Deep Learning platform, The no, Caffe, Deep Learning Use Cases. **Applications:** Overview of Artificial Intelligence Domains, AI-Robotics, AI-Neural Networks, AI-IOT, Computer Vision in AI **Case Studies:** Automatic Bird Identification using Deep Learning, Tukmur monitoring using Computer VIsion, Text to Speech Conversion using APIs		
Mapping of Course Outcomes for Unit VI	**CO6**	

Text Books:

1. Stuart Russel, Peter Norvig, “AI – A Modern Approach”, Third Edition, Pearson Education, 2009
2. Elaine Rich, Kevin Knight and Shivashankar B Nair, ”Artificial Intelligence “, Tata McGraw Hill Edition 3rd Edition, 2009
3. James Allen, Natural Language Understanding. Benjamin/Cummings, 2ed, 1995

Reference Books:

1. Algorithmic Game theory Edited by N Nishan, T Roughgarden; Cambridge University Press
2. Allen B. Downey, "Think Stats", Second Edition, O’Reilly Media, ISBN: 978-1-491-90733-7
3. Game Theory - D Fudenberg& J Tirole; MIT Press
4. K. Boyer, L. Stark, H. Bunke, “Applications of AI, Machine Vision and Robotics, World Scientific PubCo, 1995

E- Books / E- Learning References :

1. http://onlinestatbook.com/Online_Statistics_Education.pdf
2. https://london.ac.uk/sites/default/files/study-guides/introduction-to-natural-language-processing.pdf
3. https://www.deeplearningbook.org/contents/TOC.html
4. https://cvlesalfabegues.com/search/natural-language-understanding-2nd-edition/

SavitribaiPhule Pune University, Pune
Third Year Information Technology (2019 Course)
314454 (B): Elective-II (Cyber Security)

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory (TH): 3 hrs/week	03 Credit	Mid_ Semester: 30 Marks End_ Semester: 70 Marks

HOME

Prerequisite Courses: if Any

Companion Course:

1. Computer Networks & Security

Course Objectives:

1. To learn fundamental concepts of cyber security
2. To learn different types of threats and cyber-crimes.
3. To understand the basics cyber forensics, network forensics, Email forensics, web forensicsand crypto currency forensics.
4. To understand the basic digital forensics concepts and techniques for conducting the forensic examination on different digital devices.
5. To analyze how particular social engineering attacks take advantage of specific features ofthe Internet and of human nature.
6. To learn the IT laws and cyber-crime basics.

Course Outcomes:

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

CO1: To develop basic understanding of cyber security.

CO2: Differentiate among different types of cyber threats and cyber-crimes.

CO3: Illustrate cyber forensic techniques to identify the criminal activities.

CO4: Apply forensic analysis tools to recover important evidence for identifying computercrime

CO5: Distinguish and classify the forms of cybercriminal activity and the technological and social engineering' methods used to undertake such crimes

CO6: Evaluate the effectiveness of cyber-security, cyber-laws and other countermeasures against cybercrime

COURSE CONTENTS

Unit I	INTRODUCTION TO CYBER SECURITY	(06 hrs.)

Introduction: Introduction to Cyber Security, Need, Importance and challenges in Cyber Security, Cyberspace, Cyber threats, Cyber-warfare, CIA Triad, Cyber Terrorism, Cyber Security of Critical Infrastructure, Cyber security - Organizational Implications.

Mapping of Course Outcomes for Unit I	**CO1**	
Unit II	**CYBER CRIMES AND HACKING**	**(06 hrs)**
Overview of Cyber-Attacks and Vulnerabilities, **Types of Threats** – Malware, spyware, Sniffing, Gaining Access, Escalating Privileges, Executing Applications, Hiding Files, Covering Tracks, Worms, Trojans, Viruses, Backdoors. **Types of Cyber Crime -** cyber stalking, forgery, software piracy, cyber terrorism, phishing, computer vandalism, computer hacking, creating and distributing viruses over internet, spamming, cross site scripting, online auction fraud, cyber-squatting, logic bombs, web jacking, internet time thefts, DoS attack, salami attack, data diddling, email spoofing. **Types of Hacker** Hacking and Cracking, Hacking: Ethical issues, Ethical Hacking.		
Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**CYBER FORENSICS**	**(06 hrs)**
Introduction to Cyber Forensics: What are cyber forensics, cyber forensics investigation process,digital evidence, challenges in cyber forensics; **Web Attack Forensics:** Intrusion forensics, database forensics, preventive forensics; Anti-forensics practices, Anti-forensics detection techniques, Network forensics analysis tools; **Malware Forensics:** Malware types, Malware Analysis, Tools for analysis; **Email Forensics:** e-mail Protocols, e-mail crimes, email forensics; Bitcoin **Forensics:** crypto currency, crimes related to bitcoin; **Case Study:** A detailed case study on cyber forensics and its Investigation Reports.		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**DIGITAL FORENSICS**	**(06 hrs)**
Introduction to Digital Forensics, Cyber Forensics vs Digital Forensics, the role of digital forensics and its environment, Forensic Software and Hardware, properties of digital evidence, recovering and preserving digital evidence, Advanced forensic Tools, selecting and analyzing digital evidence, validating the evidence, Forensic Technology and Practices, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition, Audio Video Analysis **Case Study:** A detailed case study on Digital Forensics		
Mapping of Course Outcomes for Unit IV	**CO3, CO4**	
Unit V	**SOCIAL ENGINEERING**	**(06 hrs)**
Introduction of social engineering and cyber security, social engineering conceptual evolution, defining social engineering-categories, Phases, attack spiral model, Attack Vendors-social approach, socio-technical approach. Advanced social engineering attack, Phishing Attack, Insider Attack, Identity Theft, Preventing Insider Threats, Social Engineering Targets and Defense Strategies. Case Study: Phishing and Identity Theft Online Scams		

Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**CYBER ETHICS AND LAWS**	**(06 hrs.)**
Introduction to Cyber Laws, E-Commerce and E-Governance, Certifying Authority and Controller, Offences under IT Act, Computer Offences and its penalty under ISO 27001, IT Act 2000, Positive Aspects and weak areas of ITA 2000, **Digital signatures and the Indian ITA act**, ITA 2008, and International Standards maintained for Cyber Security, Security Audit, Investigation by Investing Agency, Intellectual Property Rights in Cyberspace.		
Mapping of Course Outcomes for Unit VI	**CO6**	

Text Books:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA. ISBN 978-81-265-2179-1
2. Practical Cyber Forensics an Incident-Based Approach to Forensic Investigations, Niranjan Reddy, Apress, ISBN-13: 978-1-4842-4459-3
3. Practical Digital forensics – Richard Boddingtion, PACKT Publishing ISBN 978-1-78588-710-9

Reference Books:

1. William Stallings, Computer Security: Principles and Practices, Pearson 6th Ed, ISBN: 978-0-13-335469-0
2. Bernard Menezes, Network Security and Cryptography, Cengage Learning, ISBN-978-81- 315-1349-1
3. Dr. V.K. Pachghare, Cryptography and Information security, PHI, Second edition, ISBN- 978-81-203-5082-3

E- Books / E- Learning References:

1. Z. Wang, L. Sun and H. Zhu, "Defining Social Engineering in Cyber security," in IEEE Access, vol.8, pp. 85094-85115, 2020, Doi: 10.1109/ACCESS.2020.2992807.
2. Eoghan Casey, “Digital Evidence and Computer Crime: Forensic Science, Computers, and the Internet”, ELSVIER, May 2011, ISBN 978-0-12-374268-1

Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)
314454 (C): Elective-II-(Cloud Computing)

HOME

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

Prerequisite Courses:

1. Basics of Computer Networks
2. Operating Systems

Course Objectives:

1. To provide students with the fundamentals and essentials of cloud computing
2. To learn basics of virtualization and its importance
3. To provide students a sound foundation of the cloud computing so that they are able to startusing and adopting cloud computing services and tools in their real life scenarios
4. To enable students exploring some important cloud computing driven commercial systems and applications
5. To understand cloud storage technologies and relevant file systems
6. To be exposed to Ubiquitous Cloud and Internet of Things

Course Outcomes:

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

CO1: Articulate the main concepts, key technologies and fundamentals of cloud computing.

CO2: Understand cloud enabling technologies and virtualization.

CO3: Analyze various cloud programming models and apply them to solve problems on the cloud.

CO4: Explain data storage and major security issues in the cloud.

CO5: Understand trends in ubiquitous cloud and internet of things.

CO6: Explore future trends of cloud computing.

COURSE CONTENTS

Unit I	FUNDAMENTALS Of CLOUD COMPUTING	(06 hrs)

Origins and Influences, Basic Concepts and Terminology, Goals and Benefits, Risks and Challenges, Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models, Federated Cloud/Intercloud, Types of Clouds.

Mapping of Course Outcomes for Unit I	CO1

Unit II	CLOUD-ENABLING TECHNOLOGY AND VIRTUALIZATION	(06 hrs)

Cloud-Enabling Technology: Broadband Networks and Internet Architecture, Data Center Technology, Virtualization Technology, Web Technology, Multitenant Technology, Service Technology.

Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Types of Hypervisors, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation.

Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**COMMON STANDARDS AND CLOUD PLATFORMS**	**(06 hrs)**

Common Standards: The Open Cloud Consortium, Open Virtualization Format, Standards for Application **Developers:** Browsers (Ajax), Data (XML, JSON), Solution Stacks (LAMP and LAPP), Syndication (Atom, Atom Publishing Protocol, and RSS), Standards for Security.

Amazon web services: Compute services Storage Services Communication Services Additional services **Google AppEngine:** Architecture and core concepts, Application life cycle, Cost model

Microsoft Azure: Azure core concepts, SQL Azure, Windows Azure platform appliance

Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**DATA STORAGE AND SECURITY IN CLOUD**	**(06 hrs)**

Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo Cloud data stores: Datastore and Simple DB Gautam Shrauf, Cloud Storage-Overview, Cloud Storage Providers.
Securing the Cloud- General Security Advantages of Cloud-Based Solutions, Introducing Business Continuity and Disaster Recovery. Disaster Recovery- Understanding the Threats.

Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**UBIQUITOUS CLOUDS AND THE INTERNET Of THINGS**	**(06 hrs)**

Cloud Trends in Supporting Ubiquitous Computing, Performance of Distributed Systems and the Cloud, Enabling Technologies for the Internet of Things (RFID, Sensor Networks and ZigBee Technology, GPS), Innovative Applications of the Internet of Things (Smart Buildings and Smart Power Grid, Retailing and Supply-Chain Management, Cyber-Physical System), Online Social and Professional Networking.

Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**FUTURE OF CLOUD COMPUTING**	**(06 hrs)**

How the Cloud Will Change Operating Systems, Location-Aware Applications, Intelligent Fabrics, Paints, and More, The Future of Cloud TV, Future of Cloud-Based Smart Devices, Faster Time to Market for Software Applications, Home-Based Cloud Computing, Mobile Cloud, Autonomic Cloud Engine, Multimedia Cloud, Energy Aware Cloud Computing, Jungle Computing. **Docker at a Glance:** Process Simplification, Broad Support and Adoption, Architecture, Getting the Most from Docker, The Docker Workflow

Mapping of Course Outcomes for Unit VI	**CO6**

Text Books:

1. Thomas Erl, ZaighamMahmood and Ricardo Puttini, Cloud Computing: Concepts, Technology & Architecture, Pearson, ISBN :978 9332535923, 9332535922, 1 st Edition
2. Anthony T. Velte Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", 2010, The McGraw-Hill.

Reference Books:

1. RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi, Mastering Cloud Computing: Foundations and Applications Programming, McGraw Hill, ISBN: 978 1259029950, 1259029956.
2. GautamShrof, "ENTERPRISE CLOUD COMPUTING Technology Architecture, Applications, Cambridge University Press, ISBN: 9780511778476
3. Srinivasan, J. Suresh, Cloud Computing: A practical approach for learning and implementation, Pearson, ISBN :9788131776513.
4. Jack J. Dongarra, Kai Hwang, Geoffrey C. Fox, Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, Elsevier, ISBN :9789381269237, 9381269238, 1st Edition.
5. Brian J.S. Chee and Curtis Franklin, Jr., Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center, CRC Press, ISBN :9781439806128.
6. Kris Jamsa, Cloud Computing: Saas, Paas, Iaas, Virtualization, Business Models, Mobile, Security, and More, Jones and Bartlett, ISBN :9789380853772.
7. John W. Ritting house, James F. Ransome, Cloud Computing Implementation, Management, and Security, CRC Press, ISBN : 978 1439806807, 1439806802.
8. Karl Matthias, Sean P. Kane, Docker: Up and Running, OReilly, ISBN:9781491917572,1491917571.
9. Barrie Sosinsky, Cloud Computing Bible, Wiley, ISBN: 978 8126529803.
10. Ronald L. Krutz and Russell D. Vines, Cloud Security: A Comprehensive guide to Secure Cloud Computing, Wiley, ISBN: 9788126528097.
11. Scott Adkins, John Belamaric, Vincent Giersch, Denys Makogon, Jason E. Robinson, OpenStack:Cloud Application Development, Wrox, ISBN :9781119194316.
12. KailashJayaswal, JagannathKallakurchi, Donald J. Houde, Cloud Computing Black Book ,Wiley Dreamtech,ISBN:9789351194187

SavitribaiPhule Pune University, Pune

Third Year Information Technology (2019 Course)

314454 (D): Elective –II (Software Modeling and Design)

HOME

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

Prerequisite Courses:

1. Basic Knowledge of Object-oriented Programming
2. Software Engineering
3. DatabaseManagement System

Course Objectives:

1. To understand and use of UML to arrive at a design solution for real world problems.
2. To understand basics of object-oriented Modeling.
3. To learn Design concepts to Model for real world problems using object modeling.
4. To explore Interaction and behavior modeling.
5. To understand Software design principles and patterns.
6. To explore the architectural design guidelines in various type of application development.

Course Outcomes:

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

CO1: Understand basics of object oriented methodologies and Unified Modeling Language (UML).

CO2: Understand and apply analysis process, use case modeling, domain/class modeling

CO3: Design and apply interaction and behavior modeling on a given system.

CO4: Comprehend OO design process and business, access and view layer class design.

CO5: Recognize the software design principles and patterns to be applied on system.

CO6: Get started on study of architectural design principles and guidelines in the various type of application development.

COURSE CONTENTS

Unit I	INTRODUCTION TO OOM AND UML	(06 hrs)

Introduction to Object Oriented Methodology- Study of various design methodologies like Object Oriented Design by Booch, Object Modelling Techniques by Rumbaugh, Object-Oriented Analysis by Codd Yourdon and Object-Oriented Software Engineering by Ivar Jacobson

Unified Approach – Unification of Booch, Rumbaugh and Jacobson methodologies, Object - Oriented Analysis, Object Oriented Design, Iterative Development & Continuous Testing, Modellingbased on UML , Layered Approach

Unified Modeling Language – Introduction to Modeling and UML2.0, MDA, UML2.0 Structure, UML Building Blocks, UML common Mechanisms, Introduction to all UML2.0 Diagram notational Techniques, 4+1View

Mapping of Course	**CO1**	
Outcomes for Unit I		
Unit II	**OBJECT ORIENTED ANALYSIS**	**(06 hrs)**
Object Oriented Analysis Process : Use Case Modeling: Actor Identification, Actor Classification, Actor Generalization, Use Case Identification, Uses/Include/Extend Association, Writing a formal use case, Forward Engineering (Use case realization) **Class Modeling:** Approach for identifying class, Approaches for identifying classes, Class pattern approach, Class Responsibilities, Collaboration Approach, Naming Classes, Class associations Generalization specialization relationship, Aggregation and Composition Relationships		
Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**INTERACTION AND BEHAVIOR MODELING**	**(06 hrs)**
Activity Diagram: Activity and Actions, Activity Edge, Decision and Merge Points, Fork-Join, Control Flow, Constraints on Action, Swim Lanes. **Sequence Diagram:** Context, Objects and Roles, Links, Object Life Line, Message or stimulus, Activation/Focus of Control, delete object, Modelling 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 and conditions, Initial and Final State, nestedstate, Composite States, Submachine States.		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**OBJECT ORIENTED DESIGN PROCESS**	**(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: create mirror classes, identify access layer class relationships, eliminate redundant classes, create method classes. **Designing View Layer:** View Layer Classes Design, Identifying View Classes by Analyzing Use Cases, Macro-Level Design Process – identify view layer objects, and build prototype for view layer Interface. **Test Usability and User satisfaction:** Component and Deployment Design using Component and Deployment Diagram.		

Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**SOFTWARE DESIGN PRINCIPLES AND PATTERNS**	**(06 hrs)**
Introduction and need of Design Principles: General Responsibility Assignment Software Patterns (GRASP): Introduction, Creator, Information Expert, Low coupling, Controller, High Cohesion, Polymorphism, Pure fabrication, Indirection, Protected Variations. **Introduction to GOF design patterns :** Types of design patterns: Creational Pattern: Singleton, Factory **Structural Pattern:** Adapter, Façade Behavioral Patterns: Strategy, State		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**SOFTWARE ARCHITECTURAL DESIGN**	**(06 hrs)**
Anatomy of Software Architecture, Quality attributes in architecture design, Designing Object-Oriented Software Architecture, Designing Client/Server Software Architecture, Designing Service-Oriented Architectures, Designing Component-Based Software Architectures, Designing Concurrent and Real-Time Software Architectures. Product Line Architecture design		
Mapping of Course Outcomes for Unit VI	**CO6**	

Text Books:

1. Ali Bahrami, Object Oriented systems Development using Unified Modelling Language McGraw – Hill, International Editions 1999, ISBN: 0-07-1160090-6
2. Erich Gamma et al, Design Patterns: Elements of Reusable Object, Pearson, First Edition,ISBN:9789332555402, 9332555400
3. Erich Gamma et al, Design Patterns: Elements of Reusable Object, Pearson, First Edition, ISBN:9789332555402, 9332555400.

Reference Books:

1. Dan Pilone, Neil Pitman, UML in Nutshell, O'reilly Pub., ISBN:8184040024, 9788184040029.
2. Object-Oriented Analysis and Design with Applications, Third Edition by Grady Booch, Robert A. Maksimchuk, Michael W. Engle, Bobbi J. Young, Jim Conallen, and Kelli Houston, 2007.
3. An introduction to Software Architecture by Shaw & Garlan, http://sunnyday.mit.edu/16.355/intro_softarch.pdf
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, Pune

Third Year Information Technology (2019 Course)

314455: Internship

HOME

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory (TH) : 4 hrs/week	04 Credit	Team work: 100 Marks

Prerequisite Courses: if Any

Course Objectives:

- To encourage and provide opportunities for students to get professional/personal experience through internships.
- To learn and apply the technical knowledge gained from academics /classroom learning in real life/industrial situations.
- To get familiar with various tools and technologies used in industries and their applications.
- To enable students to develop professional skills and expand their professional network with thedevelopment of employer-valued skills like teamwork, communication.
- To apply the experience gained from industrial internship to the academic course completion project.
- To nurture professional and societal ethics in students
- Understand the social, economic and administrative considerations that influence the working environment of industrial organizations

Course Outcomes:

On completion of the internship, learner will be able to –

CO1: To develop professional competence through industry internship.
CO2: To apply academic knowledge in a personal and professional environment
CO3: To build the professional network and expose students to future employees.
CO4: To Apply professional and societal ethics in their day to day life.
CO5: To become a responsible professional having social, economic and administrative considerations.
CO6: To make own career goals and personal aspirations.

Guidelines:

Internships are educational and career development opportunities, providing practical experience in a field or discipline. Internships are far more important as the employers are looking for employees who are properly skilled and having awareness about industry environment, practices and culture. Internship is structured, short- term, supervised training often focused around particular tasks or projects with defined time scales.

Core objective is to expose technical students to the industrial environment, which cannot be simulated/experienced in the classroom and hence creating competent professionals in the industry and to understand the social, economic and administrative considerations that influence the working environment of industrial organizations.

Engineering internships are intended to provide students with an opportunity to apply theoretical knowledge from academics to the realities of the field work/training. The following guidelines are proposed to give academic credit for the internship undergone as a part of the Third Year Engineering curriculum.

Duration:

Internship to be completed after semester 5 and before commencement of semester 6 of at least 4 to 6 weeks; and it is to be assessed and evaluated in semester 6.

Internship work Identification:

Student may choose to undergo Internship at Industry/Govt./NGO/MSME/Rural Internship/ Innovation/IPR/Entrepreneurship. Student may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/NGO's/Government organizations/Micro/Small/ Medium enterprises to makethemselves ready for the industry.

Contacting various companies for Internship and Internship work identification process should be initiated in the Vth semester in coordination with training and placement cell/ industry institute cell/ internship cell. This will help students to start their internship work on time. Also, it will allow students to work in vacation period after their Vth semester examination.

Student can take internship work in the form of Online/onsite work from any of the following but not limited to:

- Working for consultancy/ research project,
- Participation at Events (Technical / Business)/in innovation related completions like Hackathon,
- Contribution in Incubation/ Innovation/ Entrepreneurship Cell/ Institutional Innovation Council/ startups cells of institute /
- Learning at Departmental Lab/Tinkering Lab/ Institutional workshop,
- Development of new product/ Business Plan/ registration of start-up,
- Participation in IPR workshop/Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos,
- Industry / Government Organization Internship,
- Internship through Internshala,
- In-house product development, intercollegiate, inter department research internship under research lab/group, micro/small/medium enterprise/onle ineinternship,
- Research internship under professors, IISC, IIT's, Research organizations,
- NGOs or Social Internships, rural internship,
- Participate in open source development.

Internship Diary/ Internship Workbook:

Students must maintain Internship Diary/ Internship Workbook. The main purpose of maintaining diary/workbook is to cultivate the habit of documenting. The students should record in the daily training diary the day-to-day account of the observations, impressions, information gathered and suggestions given, if any. The training diary/workbook should be signed after every day by the supervisor/ in charge of the section where the student has been working.

Internship Diary/workbook and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training. Internship Diary/workbook may be evaluated on the basis of the following criteria:

- Proper and timely documented entries
- Adequacy & quality of information recorded
- Data recorded
- Thought process and recording techniques used
- Organization of the information

Internship Work Evaluation:

Every student is required to prepare a maintain documentary proofs of the activities done by him as internship diary or as workbook. The evaluation of these activities will be done by Programme Head/Cell In-charge/ Project Head/ faculty mentor /faculty or Industry Supervisor based on- Overall compilation of internship activities, sub-activities, the level of achievement expected, evidence needed to assign the points and the duration for certain activities.

Assessment and Evaluation is to be done in consultation with internship supervisor (Internal and External – a supervisor from place of internship.

Recommended evaluation parameters-Post Internship Internal Evaluation -50 Marks +Internship Diary/Workbook and Internship Report - 50 Marks

Evaluation through Seminar Presentation/Viva-Voce at the Institute-

The student will give a seminar based on his training report, before an expert committee constituted by the concerned department as per norms of the institute. The evaluation will be based on the following criteria:

- Depth of knowledge and skills Communication & Presentation Skills
- Team Work
- Creativity
- Planning & Organizational skills
- Adaptability
- Analytical Skills
- Attitude & Behavior at work

- Societal Understanding
- Ethics
- Regularity and punctuality
- Attendance record
- Log book
- Student's Feedback from External Internship Supervisor

After completion of Internship, the student should prepare a comprehensive report to indicate what he/she has observed and learnt in the training period. The student may contact Industrial Supervisor/ Faculty Mentor/Faculty/TPO for assigning special topics and problems and should prepare the final report on the student's presence physically, if the student is found absent without prior intimation to the department/institute/concern authority/T & P Cell, entire training can be cancelled.

The report shall be presented covering following recommended fields but limited to,

- Title/Cover Page
- Internship completion certificate
- Internship Place Details- Company background-organization and activities/Scope and object of the study / personal observations
- Index/Table of Contents
- Introduction
  Title/Problem statement/objectives Motivation/Scope and rationale of the study Methodological details
  Results / Analysis /inferences and conclusion
  Suggestions / Recommendations for improvement to industry, if any Attendance Record
  Acknowledgement
  List of reference (Library books, magazines and other sources)

Feedback from internship supervisor(External and Internal)

Post internship, faculty/faculty coordinator should collect feedback about student with following recommended parameters-

Technical knowledge, Discipline, Punctuality, Commitment, Willingness to do the work, Communication skill, individual work, Team work, Leadership.

Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)
314456: Computer Network Security Lab

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR) : 4 Hrs/week	02 Credit	OR: 50 Marks TW: 25 Marks

HOME

Prerequisites:

1. Fundamentals of Computer Networks.

Course Objectives:

1. To design and implement small size network and to understand various networking commands.
2. To learn various client/server environments to use application layer protocols.
3. To understand network layer routing protocols and its implementations.
4. To understand the network security by using public key cryptography algorithms.

Course Outcomes:

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

CO1: Design and configure small size network and associated networking commands.

CO2: Understand various client/server environments to use application layer protocols.

CO3: Use basic cryptographic techniques in software and system design.

CO4: Apply methods for authentication, access control, intrusion detection.

Guidelines for Instructor's Manual

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

Guidelines for Student's Lab Journal

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

Guidelines for Lab /TW Assessment

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

Guidelines for Laboratory Conduction

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

List of Laboratory Assignments

Group A: Computer Network

1. **Using a Network Simulator (e.g. packet tracer) Configure Router for…**
   - **a)** Configure a router using router commands and Configure Routing Information Protocol(RIP).
   - **b)** Configure Access Control lists – Standard & Extended.
   - **c)** Network Address Translation: Static, Dynamic & PAT (Port Address Translation)
2. **Using a Network Simulator (e.g. packet tracer) Configure Routing Protocols,**
   - **a)** Configure EIGRP – Explore Neighbor-ship Requirements and Conditions, its K Values Metrics Assignment and Calculation.
   - **b)** OSPF – Explore Neighbor-ship Condition and Requirement, Neighbor-ship states, OSPF MetricCost Calculation.
   - **c)** WLAN with static IP addressing and DHCP with MAC security and filters.
3. **Socket Programming in C/C++ on Linux.**
   - **a)** TCP Client, TCP Server
   - **b)** UDP Client, UDP Server
4. **Introduction to server administration** (server administration commands and their applications) and configuration of below Server: (Study/Demonstration Only)
   - **a)** FTP **b)** Web Server

Group B: Network Security

1. Implement a client and a server on different computers using python. Perform the communication between these two entities by using RSA cryptosystem.
2. Implement a client and a server on different computers using python. Perform the authentication of sender between these two entities by using RSA digital signature cryptosystem.
3. Implement a client and a server on different computers using python. Perform the encryption of message of sender between these two entities by using DES Algorithm and use Diffie Hellman method for exchange of keys.
4. Use the snort intrusion detection package to analyze traffic and create a signature to identify problem traffic.

Reference Books:

1. Andrew S. Tanenbaum, David J. Wethrall, Computer Network, Pearson Education, ISBN: 978-0-13-212695-3.
2. Kurose Ross, Computer Networking: A Top Down Approach Featuring the Internet, Pearson Education, ISBN: 978-81-7758-878-1
3. William Stallings, Cryptography and Network Security, Pearson Education, 7th Edition, ISBN 978-0-13-444428-4

Savitribai Phule Pune University, Pune **Third Year Information Technology (2019 Course)** **314457: DS & BDA Lab**		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical (PR) : 2 hrs/week	**01 Credit**	**PR : 25 Marks** **TW: 25 Marks**

HOME

Prerequisites:

1. Discrete mathematics
2. Database Management Systems, Data warehousing, Data mining
3. Programming in Python

Course Objectives:

1. To understand Big data primitives and fundamentals.
2. To understand the different Big data processing techniques.
3. To understand and apply the Analytical concept of Big data using Python.
4. To understand different data visualization techniques for Big Data.
5. To understand the application and impact of Big Data.
6. To understand emerging trends in Big data analytics.

Course Outcomes:

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

CO1: Apply Big data primitives and fundamentals for application development.

CO2: Explore different Big data processing techniques with use cases.

CO3: Apply the Analytical concept of Big data using Python.

CO4: Visualize the Big Data using Tableau.

CO5: Design algorithms and techniques for Big data analytics.

CO6: Design and develop Big data analytic application for emerging trends.

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

Student should submit term work in the form of handwritten journal based on specified list of assignments.

Practical Examination will be based on the term work.

Candidate is expected to know the theory involved in the experiment.

The practical examination should be conducted if and only if the journal of the candidate iscomplete in all respects.

Guidelines for Lab /TW Assessment
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. 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. Appropriate knowledge of usage of software and hardware related to respective laboratory should be checked by the concerned faculty member.
Guidelines for Laboratory Conduction
1. All assignments of Part-A, Part-B and first assignment of Part-C should be covered in Laboratory and part of SPPU Practical examination. **2.** Part-C second assignments are a group activity to be carried out in group of 4-5 students and students should submit the document related to it as part of journal.
Guidelines for Practical Examination
1. During practical assessment, maximum weightage should be given to satisfactory implementation of the problem statement. **2.** Student 's understanding of the fundamentals, effective and efficient implementation can be evaluated by asking relevant questions based implementation of experiments he/she has carried out.
List of Laboratory Assignments
Group A: Assignments based on the Hadoop
1. Single node/Multiple node Hadoop Installation. **2.** Design a distributed application using MapReduce(Using Java) which processes a log file of a system. List out the users who have logged for maximum period on the system. Use simple log file from the Internet and process it using a pseudo distribution mode on Hadoop platform. **3.** Write an application using HiveQL for flight information system which will include **a.** Creating, Dropping, and altering Database tables. **b.** Creating an external Hive table. **c.** Load table with data, insert new values and field in the table, Join tables with Hive **d.** Create index on Flight Information Table **e.** Find the average departure delay per day in 2008.

Group B: Assignments based on Data Analytics using Python

1. Perform the following operations using Python on the Facebook metrics data sets
   - **a.** Create data subsets
   - **b.** Merge Data
   - **c.** Sort Data
   - **d.** Transposing Data
   - **e.** Shape and reshape Data
2. Perform the following operations using Python on the Air quality and Heart Diseases data sets
   - **a.** Data cleaning
   - **b.** Data integration
   - **c.** Data transformation
   - **d.** Error correcting
   - **e.** Data model building
3. Integrate Python and Hadoop and perform the following operations on forest fire dataset
   - **a.** Data analysis using the Map Reduce in PyHadoop
   - **b.** Data mining in Hive
4. Visualize the data using Python libraries matplotlib, seaborn by plotting the graphs for assignment no. 2 and 3 (Group B)
5. Perform the following data visualization operations using Tableau on Adult and Iris datasets.
   - **a.** 1D (Linear) Data visualization
   - **b.** 2D (Planar) Data Visualization
   - **c.** 3D (Volumetric) Data Visualization
   - **d.** Temporal Data Visualization
   - **e.** Multidimensional Data Visualization
   - **f.** Tree/ Hierarchical Data visualization
   - **g.** Network Data visualization

Group C: Model Implementation

1. Create a review scrapper for any ecommerce website to fetch real time comments, reviews, ratings, comment tags, customer name using Python.
2. Develop a mini project in a group using different predictive models techniques to solve any real life problem. (Refer link dataset- https://www.kaggle.com/tanmoyie/us-graduate-schools- admission-parameters)

Reference Books:

1. Big Data, Black Book, DT Editorial services, 2015 edition.
2. Data Analytics with Hadoop, Jenny Kim, Benjamin Bengfort, OReilly Media, Inc.
3. Python for Data Analysis by Wes McKinney published by O' Reilly media, ISBN : 978-1-449-31979-3.
4. Python Data Science Handbook by Jake VanderPlas https://tanthiamhuat.files.wordpress.com/2018/04/pythondatasciencehandbook.pdf
5. Alex Holmes, Hadoop in practice, Dreamtech press.
6. Online References for data set

- http://archive.ics.uci.edu/ml/
- https://www.kaggle.com/tanmoyie/us-graduate-schools-admission-parameters
- https://www.kaggle.com

Savitribai Phule Pune University, Pune

Third Year Information Technology (2019 Course)

314458: Laboratory Practice-II (Web Application Development)

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR) : 4 hrs/week	02 Credit	PR : 25 Marks TW : 50 Marks

HOME

Prerequisites: Programming languages C++, Java

Course Objectives:

1. To understand basic concepts of web programming and scripting languages.
2. To learn Version Control Environment.
3. To learn front end technologies and back end technologies.
4. To understand mobile web development.
5. To comprehend web application deployment.

Course Outcomes:

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

CO1: Develop Static and Dynamic responsive website using technologies HTML, CSS, Bootstrapand AJAX.
CO2: Create Version Control Environment.
CO3: Develop an application using front end and backend technologies.
CO4: Develop mobile website using JQuery Mobile.
CO5: Deploy web application on cloud using AWS.

Guidelines for Instructor's Manual

Lab Assignments: Following is a list of suggested laboratory assignments for reference. Laboratory Instructors may design a suitable set of assignments for their respective courses at their level. Beyond curriculum assignments, the mini-project is also included as a part of laboratory work. The Inclusion of few optional assignments that are intricate and/or beyond the scope of curriculum will surely be the value addition for the students and it will satisfy the intellectuals within the group of the learners and will add to the perspective of the learners. For each laboratory assignment, it is essential for students to draw/write/generate flowchart, algorithm, test cases, mathematical model, Test data set and comparative/complexity analysis (as applicable).

Guidelines for Student's Lab Journal

Program codes with sample output of all performed assignments are to be submitted as softcopy. Use of DVD or similar media containing students programs maintained by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints in the Laboratory. 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 journals may be avoided. Submission of journal/ term work in the form of softcopy is desirable and appreciated.

Guidelines for Lab /TW Assessment
Term work is continuous assessment that evaluates a student's progress throughout the semester. Term work assessment criteria specify the standards that must be met and the evidence that will be gathered to demonstrate the achievement of course outcomes. Categorical assessment criteria for the term work should establish unambiguous standards of achievement for each course outcome. They should describe what the learner is expected to perform in the laboratories or on the fields to show that the course outcomes have been achieved. It is recommended to conduct an internal monthly practical examination as part of continuous assessment.
Guidelines for Laboratory Conduction
Following is a list of suggested laboratory assignments for reference. Laboratory Instructors may design a suitable set of assignments for respective courses at their level. Beyond curriculum assignments and mini-project may be included as a part of laboratory work. 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. The Inclusion of few optional assignments that are intricate and/or beyond the scope of curriculum will surely be the value addition for the students and it will satisfy the intellectuals within the group of the learners and will add to the perspective of the learners. For each laboratory assignment, it is essential for students to draw/write/generate flowchart, algorithm, test cases, mathematical model, Test data set and comparative/complexity analysis (as applicable). Batch size for practical and tutorials may be as per guidelines of authority.
Guidelines for Practical Examination
Students' work will be evaluated typically based on the criteria like attentiveness, proficiency in execution of the task, regularity, punctuality, use of referencing, accuracy of language, use of supporting evidence in drawing conclusions, quality of critical thinking and similar performance measuring criteria.
List of Laboratory Assignments
Group A-(WAD)
Assignment 1 **a.** Create a responsive web page which shows the ecommerce/college/exam admin dashboard with sidebar and statistics in cards using HTML, CSS and Bootstrap. **b.** Write a JavaScript Program to get the user registration data and push to array/local storage with AJAX POST method and data list in new page.

Assignment 2

a. Create version control account on GitHub and using Git commands to create repository and push your code to GitHub.

b. Create Docker Container Environment (NVIDEIA Docker or any other).

c. Create an Angular application which will do following actions: Register User, Login User, Show User Data on Profile Component

Assignment 3

a. Create a Node.JS Application which serves a static website.

b. Create four API using Node.JS, ExpressJS and MongoDB for CURD Operations on assignment 2.C.

Assignment 4

a. Create a simple Mobile Website using jQuery Mobile.

b. Deploy/Host Your web application on AWS VPC or AWS Elastic Beanstalk. Mini Project

Develop a web application using full stack development technologies in any of the following domains:

1. Social Media
2. ecommerce
3. Restaurant
4. Medical
5. Finance
6. Education
7. Any other

Reference 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. Steven M. Schafer, “HTML, XHTML and CSS”, Wiley India Edition, Fourth Edition, 978- 81-265-1635-3
4. Dr.HirenJoshi, Web Technology and Application Development, DreamTech, First,ISBN:978-93-5004-088-1
5. Steven M. Schafer, “HTML, XHTML and CSS”, Wiley India Edition, Fourth Edition, 978- 81-265-1635-3
6. Ivan Bayross,”Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP,BPB Publications,4th Edition,ISBN:978-8183330084.
7. Brain Fling, Mobile Design and Development, O'REILLY, First Edition, ISBN: 13:978-81- 8404-817-
8. Adam Bretz & Colin J Ihrig, Full Stack Javascript Development with MEAN, SPD, First Edition, ISBN:978-0992461256.

- Books / E- Learning References

1. https://www.meanacademy.in/web-technologies
2. https://www.meanacademy.in/angular
3. https://www.meanacademy.in/mongodb
4. https://www.meanacademy.in/nodejs
5. https://www.meanacademy.in/aws

SavitribaiPhule Pune University, Pune
Third Year Information Technology (2019 Course)
314458 : Lab Practice – II (Artificial Intelligence)

HOME

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR) : 4 hrs/week	02 Credit	PR : 25 Marks TW : 50 Marks

Prerequisites: Programming knowledge (Python)

Course Objectives:

1. To develop real world problem solving ability
2. To enable the student to apply AI techniques in applications which involve perception, reasoning and planning
3. To work in team to build industry compliant AI applications

Course Outcomes:

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

CO1: Evaluate and apply core knowledge of AI on various real world problems.

CO2: Illustrate and demonstrate AI tools for different dynamic applications.

Guidelines for Instructor's Manual

Lab Assignments: Following is a list of suggested laboratory assignments for reference. Laboratory Instructors may design a suitable set of assignments for their respective courses at their level. Beyond curriculum assignments, the mini-project is also included as a part of laboratory work. The Inclusion of few optional assignments that are intricate and/or beyond the scope of curriculum will surely be the value addition for the students and it will satisfy the intellectuals within the group of the learners and will add to the perspective of the learners. For each laboratory assignment, it is essential for students to draw/write/generate flowchart, algorithm, test cases, mathematical model, Test data set and comparative/complexity analysis (as applicable).

Guidelines for Student's Lab Journal

Program codes with sample output of all performed assignments are to be submitted as softcopy. Use of DVD or similar media containing student's programs maintained by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints in the Laboratory. 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 journals may be avoided. Submission of journal/ term work in the form of softcopy is desirable and appreciated.

Guidelines for Lab /TW Assessment

Term work is continuous assessment that evaluates a student's progress throughout the semester. Term work assessment criteria specify the standards that must be met and the evidence that will be gathered to demonstrate the achievement of course outcomes. Categorical assessment criteria for the term work should establish unambiguous standards of achievement for each course outcome. They should describe what the learner is expected to perform in the laboratories or on the fields to show that the course outcomes have been achieved. It is recommended to conduct an internal monthly practical examination as part of continuous assessment.

Guidelines for Laboratory Conduction

Following is a list of suggested laboratory assignments for reference. Laboratory Instructors may design a suitable set of assignments for respective courses at their level. Beyond curriculum assignments and mini-project may be included as a part of laboratory work. 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. The Inclusion of few optional assignments that are intricate and/or beyond the scope of curriculum will surely be the value addition for the students and it will satisfy the intellectuals within the group of the learners and will add to the perspective of the learners. For each laboratory assignment, it is essential for students to draw/write/generate flowchart, algorithm, test cases, mathematical model, Test data set and comparative/complexity analysis (as applicable). Batch size for practical and tutorials may be as per guidelines of authority.

Guidelines for Practical Examination

Students' work will be evaluated typically based on the criteria like attentiveness, proficiency in execution of the task, regularity, punctuality, use of referencing, accuracy of language, use of supporting evidence in drawing conclusions, quality of critical thinking and similar performance measuring criteria.

List of Laboratory Assignments

Group A

1. Identify and Implement heuristic and search strategy for Travelling Salesperson Problem
2. Implement n-queens problem using Hill-climbing / simulated annealing / A* algorithm etc. Write a program for Water jug problem / Towers of Hanoi
3. Write a program for sorting algorithms using appropriate knowledge representation andreasoning techniques.
4. Write a program for the Information Retrieval System using appropriate NLP tools (such as NLTK, Open NLP, …)
   a. Text tokenization
   b. Count word frequency
   c. Remove stop words
   d. POS tagging
5. Write a program for the Tic-Tac-Toe game.

Group B (Mini Project)

Develop a Web Based Application for any one of the following:

1. Develop a Text Classification tool as a CRM task or Web Crawler application.
2. Develop a Speech to Text System with the help of POS tagging
3. E-commerce stores using Forward/backward chaining
4. Sudoku puzzle
5. Detection and recognition of object such as Face, Fruit, Finger print etc. using Deep Learning

Reference Books:

1. Natural Language Processing with Python by Steven Bird, Ewan Klein, Edward Loper
2. https://www.deeplearningbook.org/contents/TOC.html
3. https://www.nltk.org/
4. K. Boyer, L. Stark, H. Bunke, "Applications of AI, Machine Vision and Robotics, World Scientific PubCO, 1995

Savitribai Phule Pune University, Pune

Third Year Information Technology (2019 Course)

314458: Lab Practice –II (Cyber Security)

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR) : 04 hrs/week	02 Credit	PR : 25 Marks TW : 50 Marks

Prerequisites: Computer network and security

Course Objectives:

1. To develop and understand the placement of packet-sniffer in networking and internetworking environment.
2. To implement the cyber-attacks.
3. To implement intrusion detection and basic mail spamming.

Course Outcomes:

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

CO1: To know the different guidelines for Packet Sniffing in networking and internetworking environment.

CO2: To know the different types of cyber-attacks and will be able analyze theattacks.

CO3: Apply the knowledge of IDS to secure network and performing analysis of IDS attack on network.

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, references. Experiments to be conducted in Python/any open source language.

Guidelines for Student's Lab Journal

1. The laboratory assignments are to be submitted by students in the form of journals. The Journal consists ofprologue, 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, printouts of the code written using coding standards, sample test cases etc. To support Go-green, printouts on paper are discouraged and should be maintained in soft copy. However, all students must submit the soft copy and should be maintained by batch teacher.
2. Practical Examination will be based on the CS theory and CS lab Assignments.
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 andcertified by concerned faculty and head of the department.
5. All the assignment mentioned in the syllabus must be conducted.

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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 tags, coding standards, design flow 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 open-source software.

Guidelines for Practical Examination

Both internal and external examiners should jointly conduct practical examination. During assessment, the examiners should give the maximum weight age to the satisfactory answer of the problem statement In question. 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.

List of Laboratory Assignments

1. Write a program to sniff packet sent over the local network and analyze it.
2. Create an attack using python script and implement attack and analyze the effect of attack.
   - **a)** DDOS Attack
   - **b)** IP spoofing
   - **c)** DNS Attack
3. Write a program in python script for Spam Mail Detection (Spam Filtering Implementation).
4. IDS Use Distributed IDS Attack Information to gathers log files from users around the network and prepares reports to determine if their networks have encountered intrusion attempts.

Reference Books:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA. ISBN 978-81-265-2179-1.
2. Practical Cyber Forensics an Incident-Based Approach to Forensic Investigations, Niranjan Reddy, Apress, ISBN-13: 978-1-4842-4459-3.
3. Practical Digital forensics – Richard Boddingtion, PACKT Publishing ISBN 978-1-78588.

Savitribai Phule Pune University, Pune

Third Year Information Technology (2019 Course)

314458: Laboratory Practice-II (Cloud Computing)

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR) : 04 hrs/week	02 Credit	PR :25 Marks TW : 50Marks

Prerequisite Courses:

- Basics of Computer Networks
- Operating Systems

Course Objectives:

1. To develop web applications in cloud.
2. To learn the design and development process involved in creating a cloud based application.

Course Outcomes:

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

CO1: To design and develop cloud based applications.

CO2: To Simulate a cloud scenario using CloudSim.

CO3: To design and deploy web applications in cloud environment.

LIST OF ASSIGNMENTS

1. Install Google App Engine. Create hello world app and other simple web applications using python/java.
2. Use GAE launcher to launch the web applications.
3. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
4. Find a procedure to transfer the files from one virtual machine to another virtual machine.
5. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
6. Design and deploy a web application in a PaaS environment.
7. Design and develop custom Application (Mini Project) using Salesforce Cloud.
8. Design an Assignment to retrieve, verify, and store user credentials using Firebase Authentication, the Google App Engine standard environment, and Google Cloud Data store.

CASE STUDIES

- Data storage security in private cloud
- Application of IoT/Ubiquitous based on cloud
- Tools for building private cloud

Text Books:

1. Thomas Erl, Zaigham Mahmood and Ricardo Puttini, Cloud Computing: Concepts, Technology & Architecture, Pearson, ISBN :978 9332535923, 9332535922, 1 st Edition
2. Anthony T. Velte Toby J. Velte, Robert Elsenpeter, “Cloud Computing: A Practical Approach”, 2010, The McGraw-Hill.

Reference Books:

1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiS elvi, Mastering Cloud Computing: Foundationsand Applications Programming, McGraw Hill, ISBN: 978 1259029950, 1259029956.
2. Gautam Shrof, "ENTERPRISE CLOUD COMPUTING Technology Architecture, Applications, Cambridge University Press, ISBN: 9780511778476
3. Srinivasan, J. Suresh, Cloud Computing: A practical approach for learning and implementation, Pearson, ISBN :9788131776513.
4. Jack J. Dongarra, Kai Hwang, Geoffrey C. Fox, Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, Elsevier, ISBN :9789381269237, 9381269238, 1st Edition.
5. Brian J.S. Chee and Curtis Franklin, Jr., Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center, CRC Press, ISBN :9781439806128.
6. Kris Jamsa, Cloud Computing: Saas, Paas, Iaas, Virtualization, Business Models, Mobile, Security,and More, Jones and Bartlett, ISBN :9789380853772.
7. John W. Ritting house, James F. Ransome, Cloud Computing Implementation, Management, and Security, CRC Press, ISBN : 978 1439806807, 1439806802.
8. Karl Matthias, Sean P. Kane, Docker: Up and Running, OReilly, ISBN:9781491917572,1491917571.
9. Barrie Sosinsky, Cloud Computing Bible, Wiley, ISBN: 978 8126529803.
10. Ronald L. Krutz and Russell D. Vines, Cloud Security: A Comprehensive guide to Secure Cloud Computing, Wiley, ISBN: 9788126528097.
11. Scott Adkins, John Belamaric, Vincent Giersch, Denys Makogon, Jason E. Robinson, OpenStack: Cloud Application Development, Wrox, ISBN :9781119194316.
12. Kailash Jayaswal, Jagannath Kallakurchi, Donald J. Houde, Cloud Computing Black Book ,Wiley Dreamtech,ISBN:9789351194187

Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)
314458 :Laboratory Practice-II (Software Modeling Design)

Teaching Scheme: Hrs	Credit Scheme:	Examination Scheme:
Practical (PR) : 04 hrs/week	02 Credit	PR : 25 Marks TW : 50 Marks

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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)
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 develop a system with design and modeling concepts.

Course Outcomes:

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

CO1: Develop use case model with the help of UML notations.

CO2: Develop and implement analysis model and design model.

CO3: Develop and implement Interaction and behavior Model.

Guidelines for Instructor's Manual

Students should work in group of 3-4 students. Student should Identify Project title of enough complexity, which has at least 4-5 major functionalities.

Guidelines for Student's Lab Journal

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

Guidelines for Lab /TW Assessment

1. Examiners will assess the term work based on performance of students considering theparameters 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 diagrams specified in the assignment, implementation (wherever applicable) attendance etc.
2. Examiners will judge the understanding of the practical/ oral 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 should be checked by the concerned faculty member(s).

Guidelines for Laboratory Conduction

1. The instructor is expected to frame the assignments by understanding the prerequisites, technologicalaspects, utility and recent trends related to the topic.
2. The instructor may set multiple sets of assignments and distribute among batches of students. Students should work in group of 3-4 students. Common problem statement (minimum 3-4 major functionalities it should cover) should be considered to execute all assignment.
3. It is appreciated if the assignments are based on real world problems/applications.
4. Any open-source UML designing tool like StarUML, Visual Paradigm, Umbrello, AgroUML, can be used todraw UML diagram. Languages and databases : JAVA, MySQL, MongoDB, C#.

Guidelines for Practical Examination

Both internal and external examiners should jointly set problem statements for practical/ Oral examination. During practical / Oral 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

Assignment 1: Write Problem Statement and draw Use Case diagrams for Mini Project (4Hrs)
Identify Project of enough complexity, which has at least 4-5 major functionalities.
Identify stakeholders, actors and write detail problem statement for your system.
Identify Major Use Cases, Identify actors. Write formal Use Case specification for all major Use Cases.

Assignment 2: Prepare Dynamic Model for the system (4 Hrs)
Identify Activity states and Action states.
Draw Activity diagram with Swim lanes and fork-joins using UML 2.0 Notations for major Use CasesDraw Sequence Diagram Using UML 2.0 notations for major Use Cases.

Assignment 3: Prepare Static Model for the System (6 Hrs)
Draw class diagram using UML 2.0 notations.
Prepare Data Dictionary for the databases. Draw Deployment diagram UML 2.0 notations.

Assignment 4: Outputs and Code demonstration **(10 Hrs)**
Write the code for the Mini Project.
Execute the code and record the output screens

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

Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)
Mandatory Audit Course 6
314459 (A) : Green and Unconventional Energy

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory (TH) : 1 hrs/week **Tutorial(TUT): 3 hrs/week** **(Assignments and Self-study)**	**Non Credit**	**Audit Course**

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Prerequisite Courses, if any:

Course Objectives:

1. To know the importance of the energy and the the basic infrastructures for the economic development of the country.
2. To know about the most important renewable energy resources and the technologies for harnessing these resources within the framework of a broad range of simple to state- of -the-art energy systems.
3. To understand the application of non-conventional energy technologies.

Course Outcomes:

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

CO1: List and explain the main sources of energy and their primary applications in the India, and theworld.
CO2: Describe the challenges and problems associated with the use of various energy sources and itsconservation.
CO3: List and describe the primary renewable energy resources and technologies.
CO4: Collect and organize information on renewable energy technologies as a basis for further analysis and evaluation.

COURSE CONTENTS

Unit I	INTRODUCTION TO GREEN AND UNCONVENTIONAL ENERGY STUDIES	(04 hrs)

Various Non-Conventional energy sources, Need, Availability, Classification, Relative merits & demerits, Global energy scenario, Indian energy scenario, Energy Storage, Distribution and Conservation

Mapping of Course Outcomes for Unit I	CO1, CO2

Unit II	SOLAR and WIND ENERGY	(04 hrs)

Solar energy: Introduction, Conservation of Solar energy

Applications: Solar Energy - solar water heater- Solar Cooker-Box type- Solar dryer-solar green house—Summer and winter greenhouse-solar electric power generation-Solar photovoltaic

Wind Energy: Introduction- Basic Principles of Wind energy conversion-The nature of wind- The power inthe wind. Wind energy conversion system (WECS), Advantages & Limitations of WECS
, Environmental aspect. Government Schemes.

Mapping of Course Outcomes for Unit II	**CO2, CO3**	
Unit III	**BIOMASS ENERGY, GEO THERMAL & TIDAL ENERGY.**	**(04 hrs)**

Biomass Energy: Introduction- Biomass conversion techniques -Biogas Generation-Factors affecting biogas Generation, urban waste to energy conversion.

Geothermal Sources: Hydro thermal Source (Vapor &Liquid dominated systems), geothermalenergy conversion

Tidal Energy-Basic Principles of Tidal Power, Schematic Layout of Tidal Power house, Advantages & Limitations of Tidal power.

Mapping of Course Outcomes for Unit III	**CO3, CO4**

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

Guest Lectures / Group Activities / Assignments / Taking up small project for short duration Guidelines for Assessment (Any one or more of following but not limited to) / Practical Test / Presentation / Paper / (Theory assessment test) / Report

SUGGESTED LIST OF STUDENT ACTIVITYS

1. Prepare a of monthly energy consumption of your institute and find the ways how it can be conserved
2. Conduct an energy audit of your institute; suggest the ways how the conventional energy resources utilization can be minimized. Suggest the areas ,where the non-conventional energy may be used
3. Visit solar power plant /wind power plant available in your locality/ nearer to your institute and understand different elements, working, and note the power generation by these plants
4. Visit government website for renewable energy and find out different schemes run by government.

Text Books:

1. Non-Conventional Energy Sources by G.D. Rai, Khanna Publication
2. Renewable Energy (2nd edition). Oxford University Press, 450 pages (ISBN: 0-19- 926178-4).
3. Renewable Energy Sources & Emerging Technologies, D P Kothari, K C Singal & Rakesh Ranjan, Prentice Hall India.

Reference Books:

1. http://www.ener-supply.eu/downloads/ENER_handbook_en.pdf
2. Energy opportunities and social responsibility. Satyesh C. Chakraborty, Jaico publications
3. Energy Systems and Sustainability: Power for a Sustainable Future. Oxford University Press, 619 pages (ISBN: 0-19-926179-2)
4. Ashok Desai V, Non-Conventional Energy, Wiley Eastern Ltd, 1990.
5. Mittal K.M, Non-Conventional Energy Systems, Wheeler Publishing Co. Ltd, 1997.

E- Books / E- Learning References :

1. RENEWABLE ENERGY SOURCES AND THEIR APPLICATIONS: http://www.ifeed.org/pdf/media/BOOK_Renewable-Energy-Sources-and-their-Applications.pdf
2. http://nptel.ac.in/courses/112105051/

Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)
Mandatory Audit Course 6
314459 (B): Leadership and Personality Development

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory (TH) :1 hrs/week Tutorial(TUT): 3 hrs/week (Assignments and Self-study)	Non Credit	Audit Course

HOME

Prerequisite Courses: if Any

Course Objectives:

1. To develop inter personal skills and be an effective goal oriented leader.
2. To develop personalities of students in order to empower them and get better insights into self-responsibilities in personal life to build better human being.
3. To develop professionals with leadership quality along with idealistic, practical and moral values.
4. To re-engineer attitude and understand its influence on behavior.
5. To help students to evolve as leaders who can effectively handle real life challenges in and across the dynamic environment.

Course Outcomes:

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

CO1: Practice responsible decision-making and personal accountability.

CO2: Demonstrate an understanding of group dynamics and effective teamwork.

CO3: Develop a range of leadership skills and abilities such as effectively leading change, resolving conflict, and motivating others.

CO4: Develop multi-dimensional personality.

COURSE CONTENTS

Unit I	PERSONALITY DEVELOPMENT	(03 hrs)

Laws of Personality Development, Different Layers of Personality, How to Change Our Character, Influence of Thought, Take the Whole Responsibility on Yourself, Self-analysis: Johari 's Window, Attitude: Factors influencing Attitude, Challenges and lessons from Attitude, Personality Traits, Sharpening Memory Skills, Decision-Making, Negotiation and Problem-Solving. Importance of Self Confidence, Self Esteem, Creativity: Out of box thinking, Lateral Thinking

Mapping of Course Outcomes for Unit I	CO1

Unit II	TECHNIQUES IN PERSONALITY DEVELOPMENT	(03 hrs)

Techniques for better Time Management, Meditation and concentration techniques, Self- hypnotism, Self-acceptance, and self-growth, Goal setting: Wish List, SMART Goals, Blueprint for success, Short Term, Long Term, Lifetime Goals. Confidence Building: Case studies, Confidence building videos of motivational speakers.

Mapping of Course Outcomes for Unit II	**CO1, CO2**	
Unit III	**LEADERSHIP SKILLS**	**(03 hrs)**
Working individually and in a team, Levels of Leadership, Making of a leader, Types of leadership, Transactions Vs Transformational Leadership, VUCA Leaders, DART Leadership, Leadership Grid & leadership Formulation, Introduction to Interpersonal Relations, Virtual Leadership: Introduction, Essential Skills for Managing Remote Teams and challenges of virtual leadership.		
Mapping of Course Outcomes for Unit III	**CO3, CO4**	
Unit IV	**TEAM BUILDING**	**(03 hrs)**
Importance of groups in organization and Team Interactions in group, Group Vs Teams, Team formation process, Stages of Group, Group Dynamics, Managing Team Performance & Team Conflicts., How to build a good team? Teamwork & Team building Interpersonal skills, Virtual team dynamics: issues and resolutions		
Mapping of Course Outcomesfor Unit IV	**CO2 ,CO4**	

Reference Books:

1. Barun K. Mitra; (2011), "Personality Development & Soft Skills", First Edition; Oxford Publishers.2E, ISBN: 780199459742, ISBN: 0199459746.
2. SKILLS, 2015, Career Development Centre, Green Pearl Publications.
3. ShaliniVerma (2014); "Development of Life Skills and Professional Practice"; First Edition; Sultan Chand (G/L) & Company. ISBN: 9789325974203, ISBN: 9325974207.
4. John C. Maxwell (2014); "The 5 Levels of Leadership", Centre Street, A division of Hachette Book Group Inc, ISBN: 9789350098714, ISBN: 9350098717.
5. Basic Managerial Skills for All by E. H. McGrath, S. J., PHI Personality Development and Soft Skill, Mitra, Barun, Oxford University Press, ISBN: 9788120343146, ISBN:812034314X.
6. Personality Development by Rajiv K. Mishra. Rupa& Co.
7. How to deal with Stress by Stephen Palmer & Cary Cooper, Kogan Page India Pvt. Ltd., South Asian Edition Successful Time Management by Patrick Forsyth, Kogan Page
8. Shiv Khera, "You Can Win", A&C Black, 2014, ISBN: 13: 9789350593783
9. Gajendra Singh Chauhan, Sangeeta Sharma: Soft Skills – An Integrated Approach to Maximize Personality, Wiley India, ISBN:13:9788126556397

E-Books/ E- Learning References:

1. Developing Soft Skills and Personality: By Prof.T.Ravichandran, IIT Kanpur https://onlinecourses.nptel.ac.in/noc19_hs32/preview
2. Leadership:Prof KalyanChakravatti, IIT Kharagpur https://nptel.ac.in/courses/122/105/122105021/
3. Virtual leadership https://youtu.be/SNeTzgBE93o
4. Motivation and Confidence building videos of motivational speakers like Shiv Khera, Sandeep Maheshwari , Sonu Sharma , Vivek Bindra , B.K.Shivani

Savitribai Phule Pune University, Pune

Third Year Information Technology (2019 Course)

Mandatory Audit Course 6

314459 (C): Foreign Language-(Japanese Language- IV)

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory (TH) :1 hrs/week Tutorial(TUT): 3 hrs/week (Assignments and Self-study)	Non Credit	Audit Course

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Prerequisite Courses:

1. Students must have already studied can read/write Hiragana and Katakana script
2. Students must have studied Japanese for beginners that includes the syllabus of Audit course Module 1 to 3

Course Objectives:

1. Japan Market needs: To meet the needs of ever growing industry with respect to the Japanese language support.
2. Japanese Culture and Mindset: To get introduced to Japanese society and culture throughlanguage.
3. Career opportunities: To know more about Higher studies, Career opportunities in Japan /Japanese companies across the world.
4. Soft skills and self-development: To learn the manners, business culture and develop the confidence by gaining the knowledge of global perspective and cross-cultural studies.

Course Outcomes:

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

CO1: Do Better Communication in Japanese language.

CO2: Demonstrate knowledge of Japanese Language Scripts (Reading, Writing, etc).

CO3: Demonstrate knowledge of Japanese culture, lifestyle, etc.

CO4: Pursue advanced Professional Japanese Language course.

COURSE CONTENTS

Unit I	JAPANESE GRAMMAR	(3 hrs Lecture + 3 hrs Self-study)

Receiving and Giving, Verb past tense, Negative, Make sentences using various adjectives, Culture/Others: Conversation/Essay about some place, Introduction to the tourism in Japan, Introduction to Business/Work culture in Japan,Kanjis: 41 to 50,Listening practice, Vocabulary and conversation practice

Reference:

a. Minna no Nihongo I : Lesson 7and 8 (Text book + Audio and Video)
b. Nihongo Challenge Kanji - Lesson 5

Mapping of Course Outcomes for Unit I	**CO1**	
Unit II	**INTERACTIVE JAPANESE**	
Adverbs of degree, Stating like / dislike, Living and Non-living things, Stating wish/desire, Stating the present action (verb te form), Culture/Others: Introduction to Career Opportunities, Education and Higher studies in Japan,Kanjis: 51 to 60,Listening practice, Vocabulary and conversation practice **Reference:** **a.** Minna no Nihongo I : Lesson 9 and 10 (Text book + Audio and Video) **b.** Nihongo Challenge Kanji - Lesson 6		
Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**FORMAL JAPANESE**	**(3 hrs Lecture + 3 hrs Self-study)**
Counters , Making comparisons, Past tense of verbs ,Past tense of adjectives, Combining adjectives (i + i, na+i …), Culture/Others: Information about career forums and Job Fairs Introduction about Japanese companies recruitment process, Kanjis: 61 to 70, Listening practice, Vocabulary and conversation practice **Reference:** **c.** Minna no Nihongo Lesson 11 and 12 (Text book + Audio and Video) **d**. Nihongo Challenge Kanji - Lesson 7		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**LIFE IN JAPAN**	**(3 hrs Lecture + 3 hrs Self-study)**
Stating wish/desire (ga hoshi, verb tai form), Stating / combining multiple actions (verb te form), Stating the order of multiple actions (verb te kara form),Expressing "Permission" and "Prohibition" (te mo ii, te wa ikenai forms),Culture/Others: Preparation of a job interview for a Japanese company, Do's and Don'ts in a Job Interview ,Kanjis: 71 to 80,Listening practice, Vocabulary and conversation practice **Reference:** **a.** Minna no NihongoI : Lesson 13 and 14 (Text book + Audio and Video) **b.** Nihongo Challenge Kanji - Lesson 8		
Mapping of Course Outcomes for Unit IV	**CO4**	
Text Books:		
1. Minna no Nihongo I–MainText book with audio and video files(Books by Goyal Publishers – Available in shops / Online) **2.** Minna no Nihongo - Translation and grammatical notes for self-study(Books by Goyal Publishers **3.** Available in shops / Online) **4.** Nihongo Challenge – Kanji(Available with Japanese Language schools/teachers)		

Reference Books:
1. Nihongo Shoho: For better understanding and practice of Basic Japanese Grammar **2.** Marugoto : For scenario based Japanese conversation practice
E -Books / E- Learning References :
1. nihongo ichiban **a.** https://nihongoichiban.com/home/jlpt-n5-study-material/ **2.** jlpt sensei **a.** https://jlptsensei.com/how-to-pass-jlpt-n5-study-guide/

Syllabus Fourth Year(B.E) Engg

Sppu 2015 pattern

FACULTY OF ENGINEERING

Syllabus

B.E. (Information Technology) 2015 Course

(With effect from Academic Year 2018-2019)

SAVITRIBAI PHULE PUNE UNIVERSITY

The syllabus is prepared by

B.O.S. in Information Technology, Savitribai Phule Pune University

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PROGRAM EDUCATIONAL OBJECTIVES

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The students of Information Technology course after passing out will

1. Graduates of the program will possess strong fundamental concepts in mathematics, science, engineering and Technology to address technological challenges.
2. Possess knowledge and skills in the field of Computer Science & Engineering and Information Technology for analyzing, designing and implementing complex engineering problems of any domain with innovative approaches.
3. Possess an attitude and aptitude for research, entrepreneurship and higher studies in the field of Computer Science & Engineering and Information Technology.
4. Have commitment to ethical practices, societal contributions through communities and life-long learning.
5. Possess better communication, presentation, time management and team work skills leading to responsible & competent professionals and will be able to address challenges in the field of IT at global level.

PROGRAM OUTCOMES

The students in the Information Technology course will attain:

1. An ability to apply knowledge of computing, mathematics including discrete mathematics as well as probability and statistics, science, and engineering and technology;
2. An ability to define a problem and provide a systematic solution with the help of conducting experiments, as well as analyzing and interpreting the data;
3. An ability to design, implement, and evaluate a software or a software/hardware system, component, or process to meet desired needs within realistic constraints;
4. An ability to identify, formulate, and provide systematic solutions to complex engineering problems;
5. An ability to use the techniques, skills, and modern engineering technologies tools, standard processes necessary for practice as a IT professional;
6. An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems with necessary constraints and assumptions;
7. An ability to analyze the local and global impact of computing on individuals, organizations and society;
8. An ability to understand professional, ethical, legal, security and social issues and responsibilities;
9. An ability to function effectively as an individual or as a team member to accomplish a desired goal(s);
10. An ability to engage in life-long learning and continuing professional development to cope up with fast changes in the technologies/tools with the help of electives, professional organizations and extra-curricular activities;
11. An ability to communicate effectively in engineering community at large by means of effective presentations, report writing, paper publications, demonstrations;
12. An ability to understand engineering, management, financial aspects, performance, optimizations and time complexity necessary for professional practice;
13. An ability to apply design and development principles in the construction of software systems of varying complexity.

B.E. (Information Technology) 2015 Course to be implemented from Academic Year 2018-19

SEMESTER –I

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

Abbreviations: TW: Term Work **TH:** Theory **OR:** Oral **PR**: Practical **Sem**: Semester

Computer Laboratory-VII (Information and Cyber Security+ Machine Learning and Application)

Computer Laboratory-VIII (Software Design and Modeling)

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

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

SEMESTER –II

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

Abbreviations: TW: Term Work **TH:** Theory **OR:** Oral **PR**: Practical **Sem**: Semester

Computer Laboratory-IX (Distributed Computing System)

Computer Laboratory-X (Ubiquitous Computing)

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

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

SEMESTER-I

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Savitribai Phule Pune University
Fourth Year of Information Technology Engineering (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:

Data Communication and Computer Network

Course Objectives:

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

Course Outcomes:

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

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

Unit I	SECURITY BASICS	7 Hrs

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

Unit II	SYMMETRIC AND ASYMMETRIC KEY CRYPTOGRAPHY	7Hrs

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

Unit III	DATA INTEGRITY ALGORITHMS AND SECURITY REQUIREMENTS	7 Hrs

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

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

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

Unit V	INTRODUCTION TO CYBER SECURITY	7 Hrs

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

Unit VI	TOOLS AND METHODS USED IN CYBERCRIME	7 Hrs

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

Text Books

1. William Stallings, Computer Security : Principles and Practices, Pearson 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

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Savitribai Phule Pune University
Fourth Year of Information Technology Engineering (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 Perceptrons as Neurons, Feed Forward Neural Networks, Linear Neurons and their Limitations, Sigmoid, Tanh and ReLU Neurons

Text Books

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

Reference Books

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

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Savitribai Phule Pune University
Fourth Year of Information Technology Engineering (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 Behavior Modeling,
4. Aware students with design process in software development
5. Orient students with the software design principles and patterns
6. Enable students to learn the architectural design guidelines in various type of application development

Course Outcomes:

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

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

Unit I	OBJECT ORIENTED METHODOLOGIES, UML	7 Hrs

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

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

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

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

Unit II	OBJECT ORIENTED ANALYSIS	7 Hrs

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

Unit III	INTERACTION AND BEHAVIOR MODELING	7 Hrs

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

Unit IV	OBJECT ORIENTED DESIGN	7 Hrs

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

Unit V	DESIGN PRINCIPLES AND PATTERNS	7 Hrs

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

Unit VI	ARCHITECTURAL DESIGN	7 Hrs

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

Text Books

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

Reference Books

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

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

Teaching Scheme:	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

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Savitribai Phule Pune University
Fourth Year of Information Technology Engineering (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

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Savitribai Phule Pune University
Fourth Year of Information Technology Engineering (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:

Human Computer Interaction

Course Objectives:

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

Course Outcomes:

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

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

Unit I	INTRODUCTION	7 Hrs

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

Unit II	THE USABILITY ENGINEERING LIFECYCLE	7 Hrs

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

Unit III	USABILITY HEURISTICS	7 Hrs
Usability Heuristics: Simple and Natural Dialogue, Speak the Users' Language, Minimize User Memory Load, Consistency, Feedback, Clearly Marked Exits, Shortcuts, Good Error Messages, Prevent Errors, Help and Documentation, Heuristic Evaluation		
Unit IV	**USABILITY TESTING**	**7 Hrs**
Usability Testing: Test Goals and Test Plans, Getting Test Users, Choosing Experimenters, Ethical Aspects of Tests with Human, Subjects, Test Tasks, Stages of a Test, Performance Measurement, Thinking Aloud, Usability Laboratories. Usability Assessment Methods beyond Testing: Observation, Questionnaires and Interviews, Focus Groups, Logging Actual Use, User Feedback, Choosing Usability Methods		
Unit V	**INTERFACE STANDARDS**	**7 Hrs**
Interface Standards: National, International and Vendor Standards, Producing Usable In-House Standards. International User Interfaces: International Graphical Interfaces, International Usability Engineering Guidelines for Internationalization Resource Separation, Multi-locale Interfaces.		
Unit VI	**FUTURE DEVELOPMENTS**	**7 Hrs**
Future Developments: Theoretical Solutions, Technological Solutions, CAUSE Tools: Computer-Aided Usability Engineering, Technology Transfer, Ubiquitous Computing, Intelligent User-interfaces, Simulation and Virtual Reality, Case Study: Usability Issues in Organizations, Organizational Roles and Structures, Ethics of Usability, Web Analytics		
Text Books		
1. Jakob Nielsen, “Usability Engineering”, Morgan Kaufmann, An Imprint of Academic Press, Harcourt Science and Technology Company		
Reference Books		
1. Rosson, M. B., & Carroll, J. M. (2001), “Usability Engineering: Scenario-Based development of human-computer interaction”, Elsevier. 2. Mayhew, D. (1999), “The Usability Engineering Lifecycle: A Practitioner's Handbook for user interface design”, Morgan Kaufmann		

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

Teaching Scheme:	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:

Course Objectives:

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

Course Outcomes:

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

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

Unit I	Decision Making and Decision Support Systems	7 Hrs

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

Unit II	Business Intelligence Concepts and Platform Capabilities	7 Hrs

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

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

Unit III	Data Visualization and Dashboard Design	7 Hrs

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

Unit IV	Business Performance Management Systems	7 Hrs

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

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

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

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

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

Text Books

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

Reference Books

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

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

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

Prerequisites:

The course assumes prior knowledge of fundamentals of computer network

Course Objectives:

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

Course Outcomes:

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

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

Unit I	INTRODUCTION TO SDN: AN OVERVIEW	7 Hrs

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

Unit II	OPEN FLOW PROTOCOLS	7 Hrs

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

Unit III	NETWORK VIRTUALIZATION (NV)	7 Hrs

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

Unit IV	CONTROL PLANE	7 Hrs

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

Unit V	DATA PLANE	7 Hrs

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

Unit VI	NETWORK FUNCTIONS VIRTUALIZATION (NFV)	7 Hrs

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

Text Books

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

Reference Books

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

Savitribai Phule Pune University
Fourth Year of Information Technology Engineering (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 – I	7 Hrs

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

Unit III	NEURAL NETWORKS – II	7 Hrs

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

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

Unit IV	FUZZY LOGIC AND FUZZY SYSTEMS	7 Hrs

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

Unit V	GENETIC ALGORITHMS	7 Hrs

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

Unit VI	ADVANCES IN SOFT COMPUTING	7 Hrs

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

Text Books

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

Reference Books

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

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

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

Prerequisites:

Software Engineering

Course Objectives:

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

Course Outcomes:

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

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

Unit I	SOFTWARE TESTING BASICS	7 Hrs

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

Unit II	TESTING TECHNIQUES AND LEVELS OF TESTING	7 Hrs

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

Unit III	SOFTWARE TEST AUTOMATION AND QUALITY METRICS	7 Hrs

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

Unit IV	FUNDAMENTALS OF SOFTWARE QUALITY ASSURANCE	7 Hrs

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

Unit V	QUALITY ASSURANCE MODELS	7 Hrs

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

Unit VI	SOFTWARE QUALITY ASSURANCE TRENDS	7 Hrs

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

Text Books

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

Reference Books

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

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

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

Prerequisites:

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

Course Objectives:

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

Course Outcomes:

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

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

Unit I	FUNDAMENTALS OF COMPILATION	7 Hrs

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

Unit II	MEMORY UTILIZATION	7 Hrs

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

Unit III	OBJECT ORIENTED AND FUNCTIONAL PROGRAMMING LANGUAGE	7 Hrs

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

Unit IV	POLYMORPHIC TYPES AND DATA FLOW ANALYSIS	7 Hrs

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

Unit V	STATIC SINGLE ASSIGNMENT FORM	7 Hrs

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

Unit VI	PIPELINING AND SCHEDULING	7 Hrs

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

Text Books

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

Reference Books

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

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Savitribai Phule Pune University
Fourth Year of Information Technology Engineering (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:

Discrete Structures

Course Objectives:

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

Course Outcomes:

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

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

Unit I	Gaming Foundations	7 Hrs

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

Unit II	Developing Thinking	7 Hrs

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

Unit III	Opponent Moves in Gamification	7 Hrs

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

Unit IV	Game Design	7 Hrs

Game Mechanics and Dynamics: Feedback and Re-enforcement, Designing for engagement Game Mechanics in depth, Putting it together, Case study of 8 queen's problem.		
Unit V	**Advanced tools, techniques**	**7 Hrs**
Gamification case Studies, Coding basic game Mechanics		
Unit VI	**Applications**	**7 Hrs**
Instant Gamification Platforms, Mambo.io (Ref:http://mambi.io), Installation and use of BigDoor (OpenSourcehttp://bigdoor.com),ngageoint/gamification-server(ref:https://github.com/ ngageoint/ gamification-server).		

Text Books

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

Reference Books

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

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Savitribai Phule Pune University
Fourth Year of Information Technology Engineering (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.

Suggested List of Laboratory Assignments
PART –A (ICS)

Assignment 1

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

Assignment 2

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

Assignment 3

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

Assignment 4

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

PART –B (MLA)

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

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Savitribai Phule Pune University
Fourth Year of Information Technology Engineering (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 behaviour Model
6. Implement an appropriate design pattern to solve a design problem.

Suggested List of Laboratory Assignments

Assignment 1: Write Problem Statement for System / Project

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

Assignment 2: Prepare Use Case Model

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

Assignment 3: Prepare Activity Model

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

Assignment 4: Prepare Analysis Model-Class Model
Identify Analysis Classes and assign responsibilities. 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 Engineering (2015 Course)
414460: Project Phase-I

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

Prerequisites:

Project Based Seminar

Course Objectives:

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

Course Outcomes:

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

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

Contents

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

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

Guidelines for Students and Faculty

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

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

Review 2: SRS –
Deliverables:

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

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

project work done.

Project report contains the details as Follows:

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

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

Appendices

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

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

Term Work:

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

Reference Books

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

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

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

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

Criteria

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

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

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

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

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

Audit Course V Options

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

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

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

Course Objectives:

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

Course Outcomes:

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

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

Unit I	Introduction to Emotional Intelligence (EI) .	

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

Unit II	Know and manage your emotions.	

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

Unit III	Recognize Emotions in others.	

The universality of emotional expression, Learn tools to enhance your ability to recognize and appropriately respond to others' emotions, Perceiving emotions accurately in others to build empathy 4		
Unit IV	**Relate to others.**	
Applying EI in the workplace, the role of empathy and trust in relationships, Increase your ability to create effective working relationships with others (peers, subordinates, managers, clients, Find out how to deal with conflict, Tools to lead, motivate others and create a high performing team.		
Books		
1) Daniel Goleman," Emotional Intelligence – Why It Matters More Than IQ," , Bantam Books, 2) ISBN-10: 055338371X13: 978-0553383713 2. Steven Stein , "The EQ Edge" , Jossey-Bass, ISBN : 978-0-470-68161-9 3) Drew Bird , "The Leader's Guide to Emotional Intelligence" , ISBN: 9781535176002		

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

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

Course Objectives:

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

Course Outcomes:

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

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

Unit I	Fundamentals of Green IT.	

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

Unit II	Green Assets and Power Problems.	

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

Unit III	Green Information Systems.	

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

Unit IV	Green Grid Framework.	

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

Reference Books

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

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

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

Course Objectives:

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

Course Outcomes:

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

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

Unit I	Introduction to Critical Thinking.	

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

Unit II	Importance of being logical.	

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

Unit III	Pattern in deductive logic.	

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

Unit IV	Argumentation – Foundation of Critical Thinking.	

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

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

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

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

Course Objectives:

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

Course Outcomes:

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

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

Unit I	**Introduction to Statistical Learning.**	

What is Statistical Learning, Various issues to consider while “modeling”

Unit II	**Getting started with R programming.**	

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

Unit III	**Linear Regression models including Lab.**	

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

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

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

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

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

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

SEMESTER-II

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Savitribai Phule Pune University
Fourth Year of Information Technology Engineering (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, Computer Network Technology and Operating System.

Course Objectives :

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

Course Outcomes :

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

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

UNIT I	FUNDAMENTALS AND ARCHITECTURES	7 Hrs

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

Case Study: The World Wide Web

UNIT II	COMMUNICATION AND COORDINATION	7 Hrs

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

Case Study: IBM's Websphere Message-Queuing System

UNIT III	REPLICATION AND FAULT TOLERANCE	7 Hrs

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

UNIT IV	DISTRIBUTED FILES AND MULTIMEDIA SYSTEMS	7 Hrs

Distributed File Systems: Introduction, File System Architecture, Sun Network File System, and HDFS. Name Services: Introduction, Name Services and the Domain Name System, Directory Services.
Case Study: 1. The Global Name Service, 2. The X.500 Directory Service.
Distributed Multimedia Systems: Characteristics of Multimedia Data, Quality of Service Management, Resource management, Stream Adaptation.
Case Study: BitTorrent and End System Multicast.

UNIT V	DISTRIBUTED WEB BASED SYSTEM	7 Hrs

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

UNIT VI	SECURITY IN DISTRIBUTED SYSTEMS	7 Hrs

Introduction to Security: Security Threats, Policies, and Mechanisms, Design Issues, Cryptography.
Secure Channels: Authentication, Message Integrity and Confidentiality, Secure Group Communication,
Access Control: General Issues in Access Control, Firewalls, Secure Mobile Code, Denial of Service(DOS). Security Management: Key Management, Secure Group Management, Authorization Management. Emerging Trends In Distributed Systems: Grid Computing, Service Oriented Architectures(SOA).
Case Study: Kerberos.

Text Books

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

Reference Books

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

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

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

Prerequisites:

1. Human Computer Interaction
2. Computer Network Technology

Course Objectives :

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

Course Outcomes:

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

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

UNIT I	INTRODUCTION TO UBIQUITOUS COMPUTING	7 Hrs

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

UNIT II	UBIQUITOUS COMPUTING SMART DEVICES AND SERVICES	7 Hrs

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

UNIT III	ACTUATION AND CONTROL	7 Hrs

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

UNIT IV	HUMAN COMPUTER INTERACTION	7 Hrs

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

UNIT V	UBIQUITOUS COMPUTING PRIVACY	7 Hrs

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

UNIT VI	UBIQUITOUS COMMUNICATION AND MANAGEMENT	7 Hrs

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

Text Books

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

Reference Books

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

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Savitribai Phule Pune University
Fourth Year of Information Technology Engineering (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, BeagleBone Black ,CubieBoard, ARDUINO		
UNIT VI	**IoT PHYSICAL SERVERS AND CLOUD OFFEREINGS**	**8 Hrs**
Introduction to cloud storage models and communication API's, WAMP-AutoBahn for IoT, Python web application framework, Designing a RESTful web API, AMAZON web services for IoT, SkyNet IoT messaging platform, IoT case studies: Home Automation, Cities, Environment		

Text Books

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

Reference Books

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

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

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

Prerequisites:

1. Computer Network Technology
2. Processor Architecture and Interfacing

Course Objectives:

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

Course Outcomes:

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

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

Guidelines for Instructor

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

Suggested List of Assignments

Assignment 1

Study of Raspberry-Pi, Beagle board, Arduino.

Assignment 2

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

Assignment 3

Open source prototype platform- Raspberry-Pi/Beagle board/Arduino -Simple program digital read/write using LED and Switch -Analog read/write using sensor and actuators Index
Assignment 4
Upload data from environmental sensor to cloud server (You can use any public cloud IBM Watson IoT cloud or Google or AWS etc.)
Assignment 5
Introduction to MQTT/ CoAP and sending sensor data to cloud using Raspberry-Pi/Beagle board/Arduino.
Assignment 6
Design a web interface to control connected LEDs remotely using Raspberry-Pi/Beagle board/Arduino.
Assignment 7
Install, configure XMPP server and deployed an application on Raspberry Pi/Beagle board/Arduino. Write client applications to get services from the server application
Assignment 8
Install, configure APACHE server and deployed an application on Raspberry Pi/Beagle board/Arduino. Write client applications to get services from the server application
Reference Books
1. The Internet of Things Key applications and protocols Olivier Hersent Willy Publications 2nd Edition 978-1-119- 99435-0, 2.The Internet of Things Connecting Objects to the Web Hakima Chaouchi, Willy Publications 978-1-84821- 140-7 3.The Internet of Things Donald Norris TAB 4 Smart Internet of Things Projects Agus Kurniawan PACKT 4.Getting Started with the Internet of Things Cuno Pfister SPD O'REILL Y IOT

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

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

Prerequisites:

1. Data Structures and Files, Database management systems.

Course Objectives :

1. To understand information retrieval process.
2. To understand concepts of clustering and how it is related to Information retrieval.
3. To deal Storage, Organization & Access to Information Items.
4. To evaluate the performance of IR system and understand user interfaces for searching.
5. To understand information sharing on semantic web.
6. To understand the various applications of Information Retrieval giving emphasis to multimedia and distributed IR, web Search.

Course Outcomes :

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

1. Student should be able to understand the concept of Information retrieval.
2. Student should be able to deal with storage and retrieval process of text and multimedia data.
3. Student should be able to evaluate performance of any information retrieval system.
4. Students should be able to design user interfaces
5. Student should be able to understand importance of recommender system.
6. Student should be able to understand concept of multimedia and distributed information retrieval.

UNIT I	INTRODUCTION	8 Hrs

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

UNIT II	CLASSIFICATOIN AND RETRIEVAL SEARCH STRATEGIES	8 Hrs

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

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

UNIT III	RETRIEVAL PERFORMANCE EVALUATION AND VISUALISATION	8 Hrs

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

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

UNIT IV	DISTRIBUTED AND MULTIMEDIA IR	8 Hrs

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

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

UNIT – V	WEB SEARCHING	8 Hrs

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

UNIT VI	ADVANCED INFORMATION RETRIEVAL	8 Hrs

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

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

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

Text Books

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

Reference Books

1. Christopher D. Manning, Prabhakar Raghavan and HinrichSchutzen, Introduction to Information Retrieval, Cambridge University Press, Online book, ISBN:978-0-521-86571-5
2. Robert Korfhage, Information Storage and Retrieval, John Wiley & Sons,1 Edition, ISBN:9788126507702
3. Kowalski, Gerald, Maybury, Mark, Information Storage and Retrieval Systems :Theory and Implementation, Springer US, 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

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

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

Prerequisites:

1. Data Structures and Files, Database management systems.

Course Objectives:

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

Course Outcomes:

1. Student should be able to understand the concept, data structure and preprocessing algorithms of Information retrieval.
2. Student should be able to deal with storage and retrieval process of text and multimedia data.
3. Student should be able to evaluate performance of any information retrieval system.
4. Students should be able to design user interfaces
5. Student should be able to understand importance of recommender system. (take decision on design parameters of recommender system.)
6. Student should be able to understand concept of multimedia and distributed information retrieval.
7. Students must be able to map the concepts of the subject on recent developments in the Information retrieval field

Guidelines for Instructor

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

Suggested List of Assignments
Assignment 1
To implement Conflation Algorithm using File Handling.
Assignment 2
To implement single pass algorithm for clustering.
Assignment 3
To implement a program Retrieval of documents using inverted files.
Assignment 4
To implement a program for feature extraction in 2D colour images (any features like colour, texture etc
Assignment 5
To implement a simple Web Crawler in Java.
Assignment 6
Extract features from input image and plot histogram for the features.
Assignment 7
Write a program to recommend a product / learning course based on person preferences / education details.
Assignment 8
Consider set of 25 to 30 documents on 5 to 7 distinct topics. Define 5 queries and map the document that will be retrieved for every query. Write a program using any algorithm to retrieve documents. Evaluate the algorithm using all evaluation methods.
Assignment 9
Case study on Image retrieval for ADAS (Advanced Driver Assistance System) (Here students are expected to research the topics like Lane Change Assist (LCA), Driver Drowsiness and inattentiveness, Lane Change Assist, Automatic Parking, ACC etc.)
Reference Books
1. Yates & Neto, "Modern Information Retrieval", Pearson Education 2. C.J. Rijsbergen, "Information Retrieval", (www.dcs.gla.ac.uk) 3. R. C. Gonzalez, R. E. Woods, “Digital Image Processing”, Pearson Education 4. Zhang, Jin, “Visualization for Information Retrieval”, Springer-Verlag Berlin Heidelberg 5. V. S. Subrahamanian, Satish K. Tripathi, “Multimedia information System”, Kulwer Academic Publisher. 6. Ricci, F, Rokach, L. Shapira, B.Kantor, “Recommender Systems Handbook”

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

Teaching Scheme:	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: Lossy & Lossless,
Lossless: RLE, Shannon - Fano algorithm, Arithmetic coding.
Lossy: Vector quantization, Fractal Compression Technique, Transform coding andHybrid: JPEG-DCT

UNIT III	AUDIO AND VIDEO PROCESSING	8 Hrs

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

Audio compression techniques: DM, ADPCM and MPEG
Video: Video signal formats, Video transmission standards: EDTV, CCIR, CIF, SIF, HDTV, digitization of video,
Video file formats: MOV, Real Video, H-261, H-263, Cinepack, Nerodigtal,Video editing, DVD formats, MPEG,

UNIT IV	ANIMATION AND VIRTUAL REALITY	8 Hrs

Animation: Basics of animation, types of animation, principles of animation,
Methods of controlling animation, frame-by-frame animation techniques, real-time animation techniques, Programming aspects in creating simple animation, OpenGL: Open GL over windows/Linux, Extension.
Virtual Reality: Concept, Forms of VR, VR applications, VR devices: Hand Gloves, Head mounted tracking system, VR chair, CCD, VCR, 3D Sound system, Head mounted display

UNIT – V	RENDERING	8 Hrs

Introduction, Basics of illumination and shading models, Transparency,
Shadows and textures, Ray tracing from the light source, cone, beam and pencil tracing. Point based rendering, Mesh Simplification, Spatial partitioning, Solid Modeling

UNIT – VI	ADVANCES IN MULTIMEDIA	8 Hrs

Multimedia Communication and applications, Study of Multimedia networking, Quality of data transmission, Multimedia over IP, Media on Demand.
Multimedia in Android: Android Multimedia Framework Architecture
Gaming: Facial Recognition, Voice Recognition, Gesture Control, High-Def Displays, Augmented Reality, Mobile Gaming, Cloud Gaming, On-Demand Gaming.

Text Books

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

Reference Books

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

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

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

Prerequisites:

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

Course Objectives:

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

Course Outcomes:

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

Suggested List of Assignments

Assignment 1

Write a program to open and display Images in Python or Java using OpenCV tool.

Assignment 2

Write a program for generating Huffman codes for a gray scale 8-bit image

Assignment 3

Write a program for implementation of ray-tracing algorithm in Java.

Assignment 4

Create a simple animation using OpenGL

Assignment 5

Study of any virtual reality tool/software. (3DS MAX, BLENDER, GOOGLE VR)

Assignment 6

Write a Program to compress image using Python

Assignment 7

Create a short movie clip using open source tool
Assignment 8
Build a Virtual Reality web application using open source tool
Assignment 9
Write a Program to implement basic game in Python
Reference Books
1. Ralf Steinmetz and Klara Nahrstedt "Multimedia Computing, Communication and Applications", Pearson Education. 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 Engineering (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 / Joomala, Advanced Technology: Bootstrap, JSF, Spring.

UNIT V	MOBILE WEB DEVELOPMENT	8 Hrs

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

UNIT VI	WEB SECURITY AND CYBER ETHICS	8 Hrs

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

Text Books

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

Reference Books

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

enterprise solutions, Tata McGraw Hill Publishing Company, Second Edition, ISBN:978-0-070-621-633
5. Ivan Bayross, ”Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP,BPB Publications,4th Edition,ISBN:978-8183330084
6. Brain Fling, Mobile Design and Development, O'REILLY, First Edition, ISBN:13:978-81-8404-817-9
7. Jason Hunter, Java Servlet Programming, O'reilly Publications, 2nd Edition, ISBN: 978-0-596-00040-0
8. Adam Bretz & Colin J Ihrig, Full Stack Javascript Development with MEAN, SPD, First Edition, ISBN:978-0992461256

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

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

Prerequisites: Basic Programming Skills

Course Objectives:

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

Course Outcomes:

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

1. Use fundamental skills to develop and maintain website and web application
2. Apply scripting skills for Server side and Client-side Programming
3. Develop web services to transfer data and add interactive components to website.
4. Combine multiple web technologies to create advanced web components

Guidelines for Instructor's Manual

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

Guidelines for Student Journal

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

Guidelines for Assessment
Continuous assessment of laboratory work is done based on overall performance and laboratory assignments performance of student. Each laboratory assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness
Guidelines for Practical Examination
Both internal and external examiners should jointly set problem statements. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at the time of evaluation to test the student's for advanced learning, understanding of the fundamentals, effective and efficient implementation. So encouraging efforts, transparent evaluation and fair approach of the evaluator will not create any uncertainty or doubt in the minds of the students. So adhering to these principles will consummate our team efforts to the promising start of the student's academics.
Guidelines for Laboratory Conduction
The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications. Encourage students for appropriate use of Hungarian notation, proper indentation and comments. Use of open source software is to be encouraged. In addition to these, instructor may assign one real life application in the form of a mini-project based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus.
Suggested List of Assignments
Assignment 1
1.1 Using HTML5 layout tags develop informative page with sections which include various images, links to other pages for navigation, make use of all possible formatting (for example font, color etc.). 1.2 Apply CSS properties Border, margins, Padding, Navigation, dropdown list to page created in first assignment.
Assignment 2
Design an online registration form for any application and validate it using JQuery
Assignment 3
Design Login Application using PHP and add essence of Ajax in it
Assignment 4
Create any Java Web Service and integrate it with any suitable application
Assignment 5
Create JSP login page and validate it. Make use of Servelets
Assignment 6

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

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

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

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

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

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

Prerequisites:

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

Course Objectives:

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

Course Outcomes:

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

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

Guidelines for Instructor

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

Suggested List of Assignments

Assignment 1

Transportation problem

Assignment 2

Assignment problem

Assignment 3

0/1 knapsack problem solved by brute force method

Assignment 4

0/1 knapsack problem solved by dynamic programing

Assignment 5

Duality

Assignment 6

Simplex

Assignment 7

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

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

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

Course Objectives :

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

Course Outcomes :

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

4. understand rural development model
5. learn different measures in rural development and its impact on overall economy
6. understand and learn importance of technologies in rural and community development
7. understand challenges and opportunities in rural development.

UNIT I	INTRODUCTION	7 Hrs

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

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

UNIT II	RURAL DEVELOPMENT - MEASURES AND PARADIGMS	7 Hrs

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

UNIT III	TECHNOLOGIES FOR RURAL DEVELOPMENT	7 Hrs

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

storage

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

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

UNIT IV	COMMUNITY DEVELOPMENT	7 Hrs

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

UNIT V	COMMUNITY DEVELOPMENT - RURAL ENTREPRENEURSHIP	7 Hrs

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

UNIT VI	CASE STUDIES AND FIELD VISIT	7 Hrs

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

Text Books

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

Reference Books

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

Savitribai Phule Pune University
Fourth Year of Information Technology Engineering (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 : System Programming, Operating System

Course Objectives :

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

Course Outcomes :

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

1. understand fundamentals in parallel computing
2. understand and learn importance of technologies including different hardware structures used in parallel computing
3. understand challenges and opportunities in parallel computing

UNIT I	FUNDAMENTALS OF PARALLEL COMPUTING	7 Hrs

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

UNIT II	PARALLEL HARDWARE AND LANGUAGES	7 Hrs

Introduction to parallel hardware: Multi-cores and multiprocessors; shared memory and message passing architectures; cache hierarchy and coherence; sequential consistency, Parallel languages and compilers: Language features for parallelism, parallel language constructs, optimizing compilers for parallelism, dependency analysis, code optimization and scheduling, loop parallelization and pipelining

UNIT III	CHALLENGES OF PARALLEL PROGRAMMING	7 Hrs

Identifying Potential Parallelism , Techniques for Parallelizing Programs , Issues , Cache Coherence issues, Memory Consistency Models, Maintaining Memory Consistency, Synchronization Issues , Performance Considerations.

UNIT IV	OPENMP PROGRAMMING	7 Hrs

OpenMP Execution Model, Memory Model and Consistency , Open MP Directives , Run Time Library Routines , Handling Data and Functional Parallelism

UNIT V	MPI PROGRAMMING AND PROGRAMMING HETEROGENEOUS PROCESSORS	7 Hrs

The MPI Programming Model, Global Operations, Asynchronous Communication , Collective Communication , Other MPI Features ,Performance Issues , Combining OpenMP and MPI, GPU Architecture

UNIT VI	GPU PROGRAMMING	7 Hrs

Introduction to GPU programming: GPU architecture; Introduction to CUDA programming, CUDA Threads and Memories, Concept of SIMD and SIMT computation; Thread blocks; Warps; Global memory; Shared memory; Thread divergence in control transfer; Example case studies, CUDA Threads and Memories , Application Development. Introduction to OpenCL

Text Books

1. John L. Hennessey and David A. Patterson, “Computer Architecture , A quantitative approach”, Morgan Kaufmann / Elsevier Publishers, 5th. Edition, 2012.

2. Peter S. Pacheco, “An Introduction to Parallel Programming”, Morgan Kaufmann, 2011.

3. Michael J Quinn, “Parallel programming in C with MPI and OpenMP”, Tata McGraw Hill, 2003.

4. David B. Kirk and Wen,mei W. Hwu, “Programming Massively Parallel Processors”, Morgan Kaufmann, 2010.

5. David Culler: Parallel Computer Architecture: A Hardware/Software Approach, Morgan Kaufmann.

6. Jack Dongarra et al., Sourcebook of Parallel Computing, Morgan Kaufman Publishers, San Francisco, CA, 2003

Reference Books

1 Ananth Grama, George Karypis, Vipin Kumar and Anshul Gupta, “Introduction to Parallel Computing”, Second Edition, Pearson Education Limited, 2003.

2. Shameem Akhter and Jason Roberts, “Multi,core Programming”, Intel Press, 2006.

3. Ian Foster, “Designing and Building Parallel Programs: Concepts and Tools for Parallel Software Engineering”, Addison Wesley Longman Publishing Co., USA, 1995.

4. David E. Culler, Jaswinder Pal Singh, “Parallel Computing Architecture: A hardware Software approach” , Morgan Kaufmann / Elsevier Publishers, 1999.

Savitribai Phule Pune University
Fourth Year of Information Technology Engineering (2015 Course)
414464C: Elective IV
Computer Vision

Teaching Scheme:	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. To implement fundamental image processing techniques required for computer vision
2. To implement boundary tracking techniques
3. To apply Hough Transform for line, circle, and ellipse detections
4. To implement motion related techniques
5. to develop skills to develop applications using computer vision techniques

UNIT I	FUNDAMENTALS OF DIGITAL IMAGE PROCESSING	7 Hrs

Review of image processing techniques , classical filtering operations ,Thresholding techniques, edge detection techniques, corner and interest point detection , mathematical morphology and textures.

UNIT II	SHAPES AND REGIONS	7 Hrs

Binary shape analysis – connectedness – object labeling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments

UNIT III	HOUGH TRANSFORM	7 Hrs

Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line

localization – line fitting – RANSAC for straight line detection – HT based circular object detection – accurate center location – speed problem – ellipse detection –
Applications and case study: Human Iris location – hole detection – generalized Hough Transform – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation

UNIT IV	3D VISION AND MOTION	7 Hrs

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline based motion – optical flow – layered motion

UNIT V	OBJECT DETECTION AND TRACKING	7 Hrs

Introduction to Motion Detection , Applications of Motion Detection and Tracking, Background Subtraction (BGS), Basic BGS Algorithms, Mixture of Gaussians (MoG), Block matching for object tracking. Single object and multi-object tracking

UNIT VI	COMPUTER VISION APPLICATIONS	7 Hrs

Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians

Text Books

1. Simon J. D. Prince, “Computer Vision: Models, Learning, and Inference”, Cambridge University Press, 2012.

Reference Books

2. E. R. Davies, “Computer & Machine Vision”, Fourth Edition, Academic Press, 2012.
3. R. Szeliski, “Computer Vision: Algorithms and Applications”, Springer 2011.
4. Mark Nixon and Alberto S. Aquado, “Feature Extraction & Image Processing for Computer Vision”, Third Edition, Academic Press, 2012.
5. D. L. Baggio et al., “Mastering OpenCV with Practical Computer Vision Projects”, Packt Publishing, 2012.
6. Jan Erik Solem, “Programming Computer Vision with Python: Tools and algorithms for analyzing images”, O'Reilly Media, 2012.
7. Sudha Challa, “ Fundamentals of Object Tracking”, Cambridge University Press, 2011

ONLINE REFERENCES

http://kercd.free.fr/linksKCD.html

http://www.cs.ubc.ca/spider/lowe/vision.html

http://www.teiath.gr/seyp/optics/Vision.htm

http://www.visionscience.com/

Savitribai Phule Pune University
Fourth Year of Information Technology Engineering (2015 Course)
414464D: Elective IV
Social Media Analytics

Teaching Scheme:	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, Data mining
2. Data Analysis

Course Objectives :

1. To understand foundations of Social Media Analytics
2. To Visualize and understand the data mining aspects in social networks
3. To solve mining problems by different algorithms
4. To understand network measures for social data.
5. To understand behavioral part of web applications for Analysis
6. To analyze the data available on any social media applications

Course Outcomes :

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

1. Understand the basics of Social Media Analytics
2. Explain the significance of Data mining in Social media
3. Demonstrate the algorithms used for text mining
4. Apply network measures for social media data
5. Explain Behavior Analytics techniques used for social media data
6. Apply social media analytics for Face book and Twitter kind of applications

UNIT I	ANALYTICS IN SOCIAL MEDIA AND TYPES OF ANALYTICS TOOLS	7 Hrs

The foundation for analytics, Social media data sources, Defining social media data, data sources in social media channels, Estimated Data sources and Factual Data Sources, Public and Private data, data gathering in social media analytics

UNIT II	VISUALIZING SOCIAL NETWORKS	7 Hrs

Introduction, A Taxonomy of Visualization, The convergence of Visualization, Interaction and Analytics. Data mining in Social Media: Introduction, Motivations for Data mining in Social Media, Data mining methods for Social Media, Related Efforts.

UNIT III	TEXT MINING IN SOCIAL NETWORKS	7 Hrs

Introduction, Keyword search, Classification Algorithms, Clustering Algorithms-Greedy Clustering, Hierarchical clustering, k-means clustering, Transfer Learning in heterogeneous Networks, Sampling of online social networks, Comparison of different algorithms used for mining, tools for text mining

UNIT IV	NETWORK MEASURES	7 Hrs
Centrality: Degree Centrality , Eigenvector Centrality, Katz Centrality , PageRank, Betweenness Centrality, Closeness Centrality ,Group Centrality ,Transitivity and Reciprocity, Balance and Status, Similarity: Structural Equivalence, Regular Equivalence		
UNIT V	**BEHAVIOR ANALYTICS**	**7 Hrs**
Individual Behavior: Individual Behavior Analysis, Individual Behavior Modeling, Individual Behavior Prediction Collective Behavior: Collective Behavior Analysis, Collective Behavior Modeling, Collective Behavior Prediction		
UNIT VI	**CASE STUDY**	**7 Hrs**
Mining Twitter: Overview, Exploring Twitter's API, Analyzing 140 Characters Mining Facebook: Overview, Exploring Facebook's Social Graph API's, Analyzing Social Graph Connections.		

Text Books

Reza Zafarani Mohammad Ali Abbasi Huan Liu, Social Media Mining, Cambridge University Press, ISBN:10: 1107018854

Charu C. Aggarwal, Social Network Data Analytics, Springer, ISBN: 978-1-4419-8461-6

Reference Books

Marshall Sponder, Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics, McGraw Hill Education, 978-0-07-176829-0,

Matthew A. Russell, Mining the Social Web, O'Reilly, 2nd Edition, ISBN:10: 1449367615

Jiawei Han University of Illinois at Urbana-Champaign Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann, 2nd Edition, ISBN: 13: 978-1-55860-901-3 ISBN: 10: 1-55860-901-6

Bing Liu, Web Data Mining : Exploring Hyperlinks, Contents and Usage Data, Springer, 2nd Edition, ISBN: 978-3-642-19459-7

Savitribai Phule Pune University Fourth Year of Information Technology Engineering (2015 Course) 414465E: Elective IV Open Elective		
Teaching Scheme: **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 software company/industry. This syllabus should be approved by the University authorities and then students can opt for the same as an open elective.		

Savitribai Phule Pune University
Fourth Year of Information Technology Engineering (2015 Course)
414466: COMPUTER LABORATORY-IX

Teaching Scheme: Practical:04 Hours/Week	Credits:02	Examination Scheme: 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

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Savitribai Phule Pune University
Fourth Year of Information Technology Engineering (2015 Course)
414467: COMPUTER LABORATORY-X

Teaching Scheme: Practical:02 Hours/Week	Credits:01	Examination Scheme: TW:25Marks OR: 25Marks

Prerequisites:

1. Computer Network Technology
2. Human Computer Interface

Course Objectives :

1. To design and implement user interfaces for performing database operations
2. To design applications for accessing smart devices and data generated through sensors and services
3. To implement authentication protocols for providing security

Course Outcomes :

Upon successful completion of this course student will be able to:

1. set up the Android environment and explain the Evolution of cellular networks (BT-2)
2. develop the User Interfaces using pre-built Android UI components (BT -6)
3. create applications for performing CURD SQLite database operations using Android(BT-6)
4. create the smart android applications using the data captured through sensors (BT-6)
5. implement the authentication protocols between two mobile devices for providing security (BT-3)
6. analyze the data collected through android sensors using any machine learning algorithm (BT-4).

Guidelines:

This Computer Laboratory-IX course has Distributed Systems as a core subject. The problem statements should be framed based on first six assignments mentioned in the syllabus. The teachers will frame the problem statements with due consideration that students have three hours to complete that. The practical examination will comprise of implementation and related theory. All assignments to be performed in Java 9.

Tools Required: Android SDK / Android Studio, SQL Lite, Sensors, Ardunio kit

Assignment	1

Android development environment. Installing and setting up the environment. Hello world application. Running the emulator. Inserting debug messages.

Assignment	2

Android UI Design: Design a User Interface using pre-built UI components such as structured layout objects, UI controls and special interfaces such as dialogs, notifications, and menus. Also make this UI attractive using Android graphics platform OpenGL	
Assignment	**3**
Android-database Connectivity: Create a SQLite Database for an Android Application and perform CRUD (Create, Read, Update and Delete) database operations	
Assignment	**4**
Sensors for building Smart Applications: Use any sensors on the device to add rich location and motion capabilities to your app, from GPS or network location to accelerometer, gyroscope, temperature, barometer, and more	
Assignment	**5**
Develop a Smart Light System (Light that automatically switched on in evening and gets off in morning) using open source Hardware platform like Arduino and some sensors (Light dependent resistor) and actuator (An LED).	
Assignment	**6**
Design and Develop a GUI for FAN regulator that uses Android platform.	
Assignment	**7**
Develop an Android based FAN regulator using open source Hardware platform like NodeMcu and actuator (a SERVO Motor).	
Assignment	**8**
Android and Machine Learning: Mobile multimodal sensing- Draw inferences over the data coming from phone's sensing hardware (e.g. accelerometer, GPS, microphone), and processing these samples with the help of machine learning. (Any Application: Healthcare, Smart City, Agriculture, etc.)	
Assignment	**9**
Android API: Implement an application that uses Android APIs like Google Map, recording and playing audio and video, using the built-in camera as an input device	
Assignment	**10**
Wireless Network: Develop an app for a rolling display program of news on computer display. The input strings are supplied by the mobile phone/ by another computer connected through wireless networks.	
Assignment	**11**
Android Security: Authentication of two mobile devices	
Assignment	**12**
Case Study : Evolution of cellular networks all the way up to 7G.	

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Savitribai Phule Pune University
Fourth Year of Information Technology Engineering (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

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.

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

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

Criteria

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

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

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

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

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

Audit Course V Options

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

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Savitribai Phule Pune University
Fourth Year of Information Technology Engineering (2015 Course)
414469A: Audit Course-VI
IoT Applications in Engineering field.

IOT as a game changer in several fields of applications and poised for phenomenal growth. This course introduces Students to IOT applications in various Engineering disciplines: Civil, Chemical, Electrical, E&TC, Mechanical and Metallurgical Engineering This 20 hour course is aimed at covering various components involved in IOT, concepts, definitions and mainly Engineering Applications associated with IOT/IIOT.

Course Objectives:

1. To get the detailed insight of Internet of Things.
2. To learn the IoT terms in Engineering.
3. To understand how IoT concepts can be implement.
4. To know the protocols, Sensors and other elements for IoT implementation.

Course Outcomes:

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

1. Expand your knowledge of Internet of Things.
2. Discover how can you use IoT in your Engineering applications.
3. Build more effective hands on with IoT elements.
4. Expand the practical knowledge of using IoT components like sensors, processors.
5. Expand the understanding of using different protocols.

Unit I	**Basics of IOT – Difference between IOT and IIOT.**	
Overview of System Components of IOT.		
Unit II	**Architecture.**	
Importance, Advantages & Disadvantages		
Unit III	**Sensors, Transducers, Special requirements for IIOT sensors, Actuators, Types of Sensors, Actuators.**	
Sensors, Transducers, Special requirements for IIOT sensors, Actuators, Types of Sensors, Actuators.		
Unit IV	**Protocols - HART, MODBUS-Serial & Parallel, Ethernet, BACNet**	
Protocols - HART, MODBUS-Serial & Parallel, Ethernet, BACNet		
Unit V	**Introduction to IIOT Cloud Platform and Security Aspects Importance and likely Risk Elements**	
Introduction to IIOT Cloud Platform and Security Aspects Importance and likely Risk Elements		

Unit VI	Quiz, Case Studies and Student Presentations	
Illustrative IIOT applications in Engineering Disciplines – Civil, Chemical, Electrical, E & TC, Mechanical and Metallurgical.		

References

1. Internet of Things (A Hands-on-Approach) ISBN: 978-0996025515 - by ArshdeepBahga and Vijay Madisetti
2. Inside the Internet of Things (IoT), Deloitte University Press
3. Internet of Things- From Research and Innovation to Market Deployment; By Ovidiu& Peter; River Publishers Series
4.Five thoughts from the Father of the Internet of Things; by By Phil Wainewright - Kevin Ashton, who coined the word IoT

Savitribai Phule Pune University
Fourth Year of Information Technology Engineering (2015 Course)
414469B: Audit Course-VI
Entrepreneurship

Today Entrepreneurship & Start -Ups are Key Words. Developing Entrepreneurs & Jobs is National Requirement. Separate PPT - presentation from our EEC Group can be Guideline as Reference Though reference books are available, it is best to see - Google Search videos and films that elaborate most of these concepts. You tube is a rich source of such content on each of these topics. This module also helps students get better prepared for interviews and group discussions.

Course Objectives:

1. To get the detailed about Entrepreneurship.
2. To understand the abilities to become a Entrepreneur.
3. To understand how Business Finance concepts can be implement.

Course Outcomes:

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

1. Expand your knowledge of Entrepreneurship & Startups.
2. Discover how you can use Entrepreneur Qualities.
3. Expand the practical knowledge of Finance, Legal-Patents, Intellectual Property, and Business Associations.
4. Expand the understanding of Deliverables & Achieving Target.

Unit I	**Introduction To Entrepreneurship & Favorable Environment for Startups**	
Unit II	**Entrepreneur - Qualities, Strengths & Challenges - Govt. Regulations & Taxes**	
Unit III	**Road Map - Goal Setting & Methodology, Case Studies**	
Unit IV	**Skill Sets Various Skills - Communication, Linguistic, Analytical & Abstract Thinking. Engineering etc.**	

References

Burns, Paul, 1949- author. Title: **Entrepreneurship** and small business :

Hisrich R D and Peters M P; "**Entrepreneurship**"; 5th Edition Tata **McGraw-Hill**.

Savitribai Phule Pune University
Fourth Year of Information Technology Engineering (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
4. To get the detailed about appealing new model for application development.
5. To understand how to evaluate patterns and complex relationships in large unstructured data sets.
6. To understand how Cognitive computing supports human reasoning by evaluating data in context and presenting relevant findings along with the evidence that justifies the answers.

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:		
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 Engineering (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