Faculty of Science & Technology

Savitribai Phule Pune University, Pune

Syllabus

for

Second Year

Bachelor of Information Technology

(2019 Course)

(With effect from AY 2020-21)

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.
PEO 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

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, formulate, and provide 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;

Program Specific Outcomes (PSO)	
A graduate of the Information Technology Program will demonstrate-	
PSO 1	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 also in the interdisciplinary domain.
PSO 2	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.
PSO 3	An understanding of professional, business and business processes, ethical, legal, security and social issues and responsibilities. At times technical decisions are influenced by the needs of the business and its processes like quality control processes. An IT graduate should be able to deal with that.
PSO 4	Practice communication and decision making skills through the use of appropriate technology and be ready for industry culture

Savitribai Phule Pune University, Pune
SE (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	Computer Organization and Logic Design	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	Computer Organization and Logic Design 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	-	-	-	-	-	-	-	-	-	-	-	-	-
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 Engineering)

***Mandatory Audit Course 3:**

214450 A- Ethics and values in IT

214450 B- Quantitative Aptitude and Logical Reasoning

214450 C- Language Study- Japanese- Module I

214450 D - Cyber Security and Low

Savitribai Phule Pune University, Pune
SE (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#	-	-	-	-	-	-	-	-	-	-	-	-	-
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 Engineering)

#Mandatory Audit Course 4:

214459 A - Water Supply and Treatment
214459 B - Language Study- Japanese- Module II
214459 C - Waste Management and Pollution Control
214459 D - 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 carried out as mentioned in the syllabi of respective subjects from the set of prescribed Experiments/Assignments.
- 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 concepts from syllabi.
- For each experiment/ assignment in a practical/ tutorial subject, the instructor must ask students to prepare a write-up with explanation/ applicability/ flow charts/ algorithms/ problems incurred/ problems addressed etc. in related experiments/ assignment.
- Assessment of tutorial work has to be carried out as 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 four Hours/week/batch is associated with PBL subject and it is to be allocated to the faculty conducting PBL mentoring and internal continuous assessment. The Batch shall contain sub-groups each comprising 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. Systematic assessment has to be conducted at the end of semester for Semester III & IV respectively for award of grade at college level.
- The course objectives, course outcomes and CO-PO mapping table are provided for reference; the course instructor is requested to modify as per his perspective
- Case Studies may be assigned as self-study to students and to be excluded from theory examinations.
- The CO-PO mapping table at end of course contents, indicates the correlation levels of 3, 2, 1 and '- 'The notation of 3, 2 and 1 denotes (high), moderately (medium) and slightly (low) mapping level respectively. The meaning of '-'is no correlation between CO and PO.
- 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 - I

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

Teaching Scheme:	Credit	Examination Scheme:
TH: 03 hr/week Tutorial: 01 hr/week	03 01	Mid Semester: 30Marks End Semester: 70Marks TW : 25Marks

Prerequisite Courses, if any: Basic Mathematics

Companion Course, if any:

Course Objectives:

1. 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, learner will be able to–

CO1: Formulate, 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 + 2hrs 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.

Case Studies	**Discuss logical paradoxes**
Mapping of Course Outcomes for Unit I	**CO1**

Unit II	Combinatorics And Discrete Probability	(06 Hrs + 2hrs 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.		
Case Studies	**Discuss telephone numbering plan**	
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.		
Case Studies	**Investigate the properties of web graph**	
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's Algorithm, 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.		
Case Studies	**Describe basic principles of relational databases**	
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.		
Case Studies	**Number theoretic concepts public keys and private keys**	
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.

Case Studies	**Correlate the properties of binary operation**
Mapping of Course Outcomes for Unit VI	**CO6**

Books & Other Resources:

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, "Elementory Number Theory", &7th Edition, McGraw-Hill.

The CO-PO mapping for the course

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	1	1	-	-	-	1	-	2
CO2	2	3	1	1	1	1	-	-	-	1	-	2
CO3	3	3	2	2	1	1	-	-	-	2	-	2
CO4	3	2	1	2	1	1	-	-	-	2	-	2
CO5	2	2	2	2	1	2	-	-	-	1	-	2
CO6	2	3	2	1	1	1	-	-	-	1	-	2

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 performance in internal tests.

Examples on various topics of respective unit will be covered in tutorial sessions on the basis of 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. Proof by using Mathematical Induction	CO1
3	Combinatorics	Design problems to illustrate counting techniques by using 1. Permutation and Combinations 2. Permutation with repetition 3. Properties of *nCr and nPr* 4. Addition and Multiplication Principle	CO2
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	CO3

		4. Identify applications of tree for Searching Algorithms, Polish notation	
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
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 is free to give different tasks to students as per the above stated guidelines.
* Ideas of the students as per above stated guidelines can also be accepted.

Home

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

Teaching Scheme:	Credit	Examination Scheme:
TH:03hr/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, learner 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

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 function: 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 of computer units- CPU, Memory, IO & system bus; Von Neumann & Harvard architecture, Instruction cycle **Processor:** Single bus organization of CPU, organization & functions of: ALU, Register(general purpose, address registers, data registers, flags, PC, MAR, MBR, IR)& control unit, Control Signal examples with Micro Operations and Register Transfer. **Control unit:** Basic concepts of functional organization of Hardwired & Micro-Programmed Control unit		
Case Study : IAS computer		
Mapping of Course Outcomes for Unit 4: CO4		
Unit 5	**Processor Instructions & Processor Enhancements**	**06 Hrs**
Instruction : Opcode& mnemonics, Instruction Format & 0-1-2-3 address formats, Types of operands Addressing modes, Instruction types. RISC& CISC characteristics, Interrupt, instruction pipelining Multiprocessor systems & multicore processor.		
Case Study : Intel Core i7 Processor		
Mapping of Course Outcomes for Unit 5: CO5		
Unit 6	**Memory & Input / Output Systems**	**06 Hrs**
Memory Systems: Characteristics of Memory Systems, Internal & external memory: types & characteristics, Memory Hierarchy, signals to connect memory to processor, internal organization of		

memory chips, cell structure & characteristics of semiconductor memory: SRAM, DRAM &ROM, Cache **Memory –** Principle of Locality, Organization, Mapping functions, write policies, Replacement policies, Multilevel Caches, Cache Coherence, MESI Protocol,
Input / Output Systems: I/O Modules, Programmed I/O, Interrupt Driven I/O, Direct Memory Access (DMA).

Case Study : USB flash drive (block diagram and interface

Mapping of Course Outcomes for Unit 6 : 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

The CO-PO mapping for the course

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-
CO2	1	3	3	1	1	-	-	-	-	-	-	-	-
CO3	1	3	3	1	1	-	-	-	-	-	-	-	-
CO4	-	-	-	3	1	-	-	-	-	-	-	-	-
CO5	-	-	-	1	-	-	-	-	-	1	-	-	-
CO6	-	-	-	-	2	-	-	-	-	-	-	-	-

Home

Savitribai Phule Pune University, Pune Second Year Information Technology (2019 Course) 214443 :Data Structure & Algorithms		
Teaching Scheme:	**Credit**	**Examination Scheme:**
TH: 03hr/week	**03**	**Mid Semester: 30Marks** **End Semester: 70Marks**

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:

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

CO2: Understand different advanced abstract data type (ADT) and data structures and their implementations.

CO3: Understand different algorithm design techniques (brute -force, divide and conquer, greedy, etc.) and their implementation.

CO4: Apply and implement learned algorithm design techniques and data structures to solve problems.

CO5: Perform basic analysis of algorithms with respect to time and space complexity.

CO6: Use algorithmic foundations for solving problems and programming.

COURSE CONTENT

Unit- I	**Introduction**	**(06 Hrs)**

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, Array:** Single and multidimensional array address calculation, recursion.

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.

Case Studies	**Set Operation, String Operation**
Mapping of Course Outcomes for Unit I	**CO1, CO2, CO3, CO5**

Unit- II	**Stack &Queue**	**(06 Hrs)**

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

Stack: Concept of stack, Concept of implicit and explicit stack, stack as an ADT using sequential and linked

<table>
<tr><td colspan="3">organization, Applications of stack: 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.</td></tr>
<tr><td>Case Studies</td><td colspan="2">Reversing a string, balanced parentheses in algebraic expressions, Towers of Hanoi problem, double ended queue as Stack and Queue.</td></tr>
<tr><td>Mapping of Course Outcomes for Unit II</td><td colspan="2">CO1, CO2, CO3, CO5</td></tr>
<tr><td>Unit- III</td><td>Trees</td><td>(06 Hrs)</td></tr>
<tr><td colspan="3">Tree : Trees and binary trees-concept and terminology, Expression tree, Binary tree as an ADT, Recursive and Non recursive algorithms for binary tree traversals, Binary search trees, Binary search tree as ADT.
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.</td></tr>
<tr><td>Case Studies</td><td colspan="2">Construction of BST from pre and postorder traversal, Expression Tree construction</td></tr>
<tr><td>Mapping of Course Outcomes for Unit III</td><td colspan="2">CO1, CO2, CO3,CO5</td></tr>
<tr><td>Unit- IV</td><td>Graph</td><td>(06 Hrs)</td></tr>
<tr><td colspan="3">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 Warshall's algorithm, Shortest path using Dijkstra's algorithm, topological sorting.</td></tr>
<tr><td>Case Studies</td><td colspan="2">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.</td></tr>
<tr><td>Mapping of Course Outcomes for Unit IV</td><td colspan="2">CO1, CO2, CO3, CO5</td></tr>
<tr><td>Unit- V</td><td>Symbol Table &Heap</td><td>(06 Hrs)</td></tr>
<tr><td colspan="3">Symbol Table: Notion of Symbol Table, OBST, AVL Trees
Heap: Heap data structure, Min and Max Heap, Heap sort implementation, applications of heap
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.</td></tr>
<tr><td>Case Studies</td><td colspan="2">In a system, jobs are submitted for execution at different times. If the system is idle, the job is taken for execution immediately. If there is a job in execution, the newly submitted job has to be put in a queue. The jobs are</td></tr>
</table>

	assigned a number which tells the priority of the jobs. The system must take high priority jobs first for execution. Implement the above said system using heap data structure.
Mapping of Course Outcomes for Unit V	**CO1, CO2, CO4, CO6**

Unit- VI	**Analysis Of Algorithms &File Organization**	**(06 Hrs)**

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,Analyze Insertion sort, Quick Sort, binary search, hashing for Best, Worst and Average case.

File : Concept of File, File types and file organization (sequential, index sequential and DirectAccess), Comparison of different file organizations.

Case Studies	**Best case, Average case and Worst case analysis of Merge and Quick sort.**
Mapping of Course Outcomes for Unit VI	**CO1, CO3,CO5, CO6**

Text Books:

1. R. Gilberg, B. Forouzan, "Data Structures: A pseudo Code Approach with C++", Cengage Learning, ISBN 9788131503140.
2. E. Horowitz, S. Sahni, D. Mehta, "Fundamentals of Data Structures in C++", Galgotia Book Source, New Delhi, 1995, ISBN 16782928

Reference Books:

1. Bruno R Preiss, “Data Structures and Algorithms with Object-Oriented Design Patterns in C++”, Wiley India Edition
2. G. A.V, PAI , “Data Structures and Algorithms “, McGraw Hill, ISBN -13: 978-0-07-066726-6
3. Y. Langsam, M. Augenstin, A. Tannenbaum, "Data Structures using C and C++", 2nd Edition, Prentice Hall of India, 2002, ISBN-81-203-1177-9.
4. A. Tharp ,"File Organization and Processing", 2008 ,Willey India edition, 9788126518685
5. J. Tremblay, P. Soresan, "An Introduction to Data Structures with Applications", 2nd edition, Tata McGraw Hill International Editions, 1984, ISBN-0-07-462471-7.
6. M. Folk, B. Zoellick, G. Riccardi, "File Structure An Object Oriented Approach with C++", Pearson Education, 2002, ISBN 81 - 7808 - 131 - 8.
7. M. Welss, “Data Structures and Algorithm Analysis in C++", 2nd edition, Pearson Education, 2002, ISBN-81-7808-670-0

The CO-PO mapping for the course

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	3	3	2	3	-	3	-	-	-	-	-	-
CO2	1	3	3	3	-	3	-	-	-	-	-	-
CO3	2	1	2	3	-	3	-	-	-	-	-	-
CO4	2	3	3	3	-	3	-	-	-	-	-	-
CO5	3	3	2	3	-	3	-	-	-	-	-	-
CO6	1	3	3	3	-	3	-	-	-	-	-	-

Home

Savitribai Phule Pune University Second Year Information Technology (2019 Course) 214444: Object Oriented Programming		
Teaching Scheme	**Credit**	**Examination Scheme**
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:

CO1: Differentiate various programming paradigms and apply basic concepts of OOP.
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.

COURSE CONTENT

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 Studies	**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, Constructor with Default Arguments, Symbolic Constants, Garbage Collection: Destructors and Finalizers.		
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, 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 McGrawHill		

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.

The CO-PO mapping for the course

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	3	2	-	-	2	-	2
CO2	3	3	3	3	2	3	3	1	-	2	-	2
CO3	3	3	3	3	2	3	3	1	-	2	-	2
CO4	3	3	3	3	2	3	3	1	-	2	-	2
CO5	3	3	3	3	2	2	2	-	-	2	-	-
CO6	3	3	3	3	2	2	2	-	-	2	-	-

Home

Savitribai Phule Pune University, Pune Second Year Information Technology (2019 Course) 214445: Basics of Computer Network		
Teaching Scheme:	**Credit**	**Examination Scheme:**
TH: 03hr/week	**03**	**Mid Semester: 30Marks** **End Semester: 70Marks**

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:

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 Ethernet standards.
CO4: Apply the skills of subnetting, supernetting and routing mechanisms.
CO5: Compare IPv4 and IPv6
CO6: Understand services and protocols used at transport layer.

COURSE CONTENT

Unit I	Introduction	(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 Studies	**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	Data Link Layer Part- I	(06 Hrs)

Data Link Layer: Data Link Layer Services, Error Detection and Correction: Introduction, Error Detection, Error Correction. Linear Block Codes: hamming code, Hamming Distance, parity check code. Cyclic Codes: CRC (Polynomials), Advantages of Cyclic Codes, Other Cyclic Codes (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 Studies	**Draw PPPoE connection diagram with multiple devices**	
Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**Data Link Layer Part- II**	**(06 Hrs)**
Random Access Techniques: CSMA, CSMA/CD, CSMA/CA, Controlled Access Techniques: Reservation, Polling, Token Passing, Channelization: FDMA, TDMA, CDMA, SDMA, PDMA, PAMA Ethernet: IEEE Standards- 802.3, 802.4, 802.5, 802.6 Comparison of Standard Ethernet, Fast Ethernet, Gigabit Ethernet with reference to MAC layer and Physical Layer (Wired Network Only)		
Case Studies	**Campus network design case study**	
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Network Link Layer Part- I IP Addressing**	**(06 Hrs)**
Network Layer : Network Layer Services, IPv4 Addresses: Classful and Classless Addressing, Special Addresses, NAT, Subnetting, Supernetting, Delivery and Forwarding of IP Packet, Structure of Router, IPv4: Datagrams, Fragmentation, Options, Checksum, Security, IPsec, IPv6Addressing: Notations, Address Space, Packet Format, Transition from Ipv4 to IPv6		
Case Studies	**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 Link Layer Part- II Routing Algorithms**	**(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 Studies	**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 Studies	**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	**CO6**	

Outcomes for Unit VI	

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.

The CO-PO mapping for the course

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	3	2	-	-	-	-	-	-	-	-	-	2	-
CO2	-	3	-	-	-	-	-	-	-	-	-	1	-
CO3	-	-	-	-	3	-	1	-	-	-	-	2	-
CO4	-	3	3	-	-	-	-	-	-	-	-	2	-
CO5	-	-	-	-	2	3	-	-	-	-	-	3	-
CO6	-	-	2	-	-	-	-	2	-	-	-	3	-

Home

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

Teaching Scheme:	Credit	Examination Scheme
PR: 02Hr/week	01	PR : 25Marks TW : 25Marks

Prerequisites: Basic Electronics Engineering

Course Objectives :

1. To design & implement combinational and sequential circuits.
2. To manage and access computer system.
3. To learn to simulate digital system.

Course Outcomes :

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: Apply the basics of system management to access the resources of computer system.

CO4: Apply the basics of simulator tool & to simulate simple ALU / CPU.

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

Guidelines for Lab /TW Assessment

1. Examiners will assess the term work based on performance of students considering the

parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.

2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.
3. Appropriate knowledge of usage of necessary tools software and hardware such as ICs, memory elements, digital trainer kits, IC tester should be checked by the faculty member.

Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The instructor may set multiple sets ofassignments and distribute among batches of students. It is appreciated if the assignments are basedon real world problems/applications. Use of open source software is encouraged. The guidelines published by BOS time to time regarding conduction of laboratory assignments andPractical/Oral examination is mandatory.

Guidelines for Practical Examination

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

Suggested List of Laboratory Assignments

Group A

Combinational Logic Design

1. Design (using truth table, K-map) and implementation of 4-bitBCD to Excess-3 and Excess-3 to BCD Code converters.
2. Design (using truth table, K-map) and implementation of 4 bit BCD adder &subtractor usingIC7483.
3. Implementation of logic functions using multiplexer IC 74153 & decoder IC 74138.

(Verification, cascading & logic function implementation)

Group B

Sequential Logic Design

1. Design (State diagram, state table & K map) and implementation of 3 bit Up and Down Asynchronous and Synchronous Counter using master slave JK flip-flop IC 7476.
2. Design and implementation of Modulo 'n' counter with IC7490.

Group C

Computer system management and access based

1. Study of i7 motherboard (CPU, Chipset, RAM, SATA HDD, Ports, PCI Bus and BIOS).
2. Study of Linux OS architecture (BIOS, Kernel, Shell) Using Linux Virtual Machine.

3. Study of Linux Partitions and Boot Loader.
4. Study Linux File System-(extended ver/3).
5. Learn file management commands like-Is, mkdir, cd, mv, rm, chmod, grep, pipes and filters.

Group D

Computer organization

1. Find various specifications of PC using window/Linux commands & CPU-Z software: CPU specifications, clockrate, main memory, cache memory.
2. Design& simulate anyone using virtual lab simulator:i) ALU or ii) CPU design .

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

Practical examination will be based on the term work.

Questions will be asked during the examination to judge the understanding of the practical performed in the examination.

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

Note - Instructor should take care that datasheets of all the required ICs are available in thelaboratory& students are verifying the functionality of ICs being used.

Reference Books:

1. R.P. Jain, "Modern Digital Electronics", 3rd Edition,Tata McGraw-Hill, ISBN: 0-07-049492-4
2. Datasheets of digital IC's.
3. Peter Abel, Niyaz Nizamuddin, "IBM PC Assembly Language and Programming", Pearson Education
4. Ray Duncan, "Advanced MS DOS Programming", 2nd edition, BPB Publications
5. Intel 8086 Microprocessor manual.
6. Virtual Lab simulator Link http://vlabs.iitkgp.ac.in/coa/

The CO-PO mapping for the course

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	2	1	1	-	-	-	-	-	-	-	-	-	-
CO2	2	1	1	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	1	1	1	1	1	-	-	-	-	-	-	-

Home

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

Teaching Scheme	Credit	Examination Scheme
PR : 04 hr/week	02	TW: 25 Marks PR: 25Marks

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:

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

CO2:Understand different advanced abstract data type (ADT) and data structures and their implementations.

CO3: Understand different algorithm design techniques (brute -force, divide and conquer, greedy, etc.) and their implementation.

CO4:Apply and implement learned algorithm design techniques and data structures to solve problems.

CO5:Perform basic analysis of algorithms with respect to time and space complexity.

CO6: Use algorithmic foundations for solving problems and programming.

Guidelines for Instructor's Manual

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

The instructor's manual should include prologue, university syllabus, conduction & Assessment guidelines, topics under consideration-concept, objectives, outcomes, algorithm written in pseudo language, sample test cases and references.

Guidelines for Student's Lab Journal

1. The laboratory assignments are to be submitted by 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

6. 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.
7. 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.
8. 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.

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

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

Consider a student database of SEIT class. Database contains different fields of every student like Roll No, Name and SGPA.

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 according to name. (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.

(Students having same name 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 Circular Linked List. 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 using

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, CO6

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

10. FILE Handling – CO1, CO3, CO5, CO6

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.

The CO-PO mapping for the course

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	-	3	-	-	-	-	-	-
CO2	1	3	3	3	-	3	-	-	-	-	-	-
CO3	2	1	2	3	-	3	-	-	-	-	-	-
CO4	2	3	3	3	-	3	-	-	-	-	-	-
CO5	3	3	2	3	-	3	-	-	-	-	-	-
CO6	1	3	3	3	-	3	-	-	-	-	-	-

Home

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

Teaching Scheme	Credit	Examination Scheme
PR : 04 hr/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.
   Develop object oriented programming skills.

Course Outcomes:

CO1: Differentiate various programming paradigms and apply basic concepts of OOP.
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.
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 andParameterized 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 order Copies(). Magazine Class has orderQty, Currentissue, reciveissue().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 with Emp_name, Emp_id, Address, Mail_id, and Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor 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 figure. 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 were 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 student records database using File Handling.
Student has Student_id,name,Roll_no, Class, marks and address. Display the data for five students.
i) Create Database
ii)Display Database
iii) Clear Records
iv)Modify record
v)Search Record

9.Case Study: – CO2, CO5

Using concepts of Object Oriented programming develop solution for any one application

1) Banking solution contains following operations such as
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 contains following operations such as
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

Design and 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 TestFactoryPattern should be

1. Strategy Design Patten – CO6
Implement and apply Strategy Design pattern for simple Shopping Cart where three payment strategies are used such as Credit Card, PayPal, BitCoin. Create the 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
4. Java”, ISBN 978-1-84628-963-7
5. Erich Gamma,Richard Helm ,Ralph Johnson,JohnVlissides, “Design Patterns ,Eleements of
6. Reusable Object- Oriented Software” ISBN-13: 978-0201633610
7. RohitJoshi,”Java Design patterns, Reusable solutions to common problems” Java Code Geeks

The CO-PO mapping for the course

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	3	2	-	-	2	-	2
CO2	3	3	3	3	2	3	3	1	-	2	-	2
CO3	3	3	3	3	2	3	3	1	-	2	-	2
CO4	3	3	3	3	2	3	3	1	-	2	-	2
CO5	3	3	3	3	2	2	2	-	-	2	-	-
CO6	3	3	3	3	2	2	2	-	-	2	-	-

Home

Savitribai Phule Pune University Second Year Information Technology (2019 Course) 214449: Soft Skills Lab		
Teaching Scheme	**Credit**	**Examination Scheme**
PR: 02 hrs/Week	**01**	**TW : 25 Marks**

Prerequisites If any:

Course Outcomes:

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: Understand professional etiquette, present oneself confidently and successfully handle personal interviews
CO6: Function effectively in multi-disciplinary and heterogeneous teams through the knowledge of teamwork, Inter-personal relationships, conflict management and leadership quality.

COURSE CONTENT

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 hours)**
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, 5 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 hours)**

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 hours)**
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 PushpaLata― Communication Skills‖, Oxford University Press, ISBN 10:9780199457069.
4. Atkinson and Hilgard's ― 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 eg – 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 1 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.

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 counseling) about the choices written.

3. Public Speaking – (Choose any 2) [CO3, CO2]

a. Prepared Speech
   Topics are shared with students and they will be given 10 minutes to prepare and 3 minutes to deliver followed by Q&A from audience. Teacher can 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 are 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 can 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 can be divided into groups of 8 – 10 students in for a discussion lasting 10 minutes.
   Topics can be topical and non-controversial. After each group finishes its discussion, the teacher can 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 can 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 among students

Teacher can 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 can be divided into groups of 4-5 students in each group and an activity can be given to each group.

The activities chosen for each team should be competitive and should involve every student in the team. The activities can be conducted indoors or outdoors depending on infrastructure. *Advice* – While selecting the team ensure that each team has a mix of students who have varied skills so as to not give any one team an advantage. The teacher can 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, counseling, training, medical or corporate HR can 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 20 mins 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 this session and the teacher should seek the assistance of another faculty member / TPO Officer 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. Faculty can choose to give problems that students have to solve using their 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 warned 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:**	**Examination Scheme:**
01hr/week	**Audit Course**	**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:

CO1: Students will be able to get knowledge about global ethical principles and modern ethical issues.

CO2: Students will be able to understand the importance of ethics in the business relationships and ethical practices of IT users.

CO3: Students will be able to apply knowledge gained in implementing trustworthy computing to manage risk and security vulnerabilities.

CO4: The students will be able to analyze concerns of privacy, privacy rights in information-gathering practices in IT.

COURSE CONTENT

Unit -I	**An Overview of Ethics**	**03 Hrs**

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, Professional Codes of Ethics, IT professional 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**	**03 Hrs**

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 VirtualWorlds: 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 Studies**	**03 Hrs**

Case Study: Malware.

Case Study: Medical Implants.

Case Study: Abusive Workplace Behavior.

Case Study: Automated Active Response Weaponry.

Case Study: Malicious Inputs to Content Filters.

Mapping of Course Outcomes for Unit IV	**CO1, CO2, CO3, CO4**

Text Books:

1. Ethics in Information Technology 5th Edition by George Reynolds, Cengage learning
2. Professional Ethics by- R. Subramanian.

Reference Books:

1. An Introduction to Ethics, by William Lillie
2. Engineering Ethics by CHARLES B. FLEDDERMANN, Prentice Hall publication
3. Engineering Ethics &Human Values by: M.Govindarajan ,S.Natarajan&V.S.Senthilkumar PHI Learning Pvt. Ltd.
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

Home

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214450 (B)- Mandatory Audit Course 3: Quantitative Aptitude & Logical Reasoning

Teaching Scheme:	Credit:	Examination Scheme:
01hr/week	Audit Course	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: Understand the basic concepts of quantitative abilities

CO2: Understand the basic concepts of logical reasoning

CO3: Solve the problems related to quantitative abilities, logical and verbal reasoning

CO4: Compete in examinations like civil services, postgraduate admissions, industry placements 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:	CO 1, CO3, CO4

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, CO3, CO4

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, CO4

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, CO4

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	**CO3, CO4**	

Text Books:

1. Quantitative abilities by Arun Sharma
2. Quantitative Aptitude for Competitive Examinations by R S Agrawal
3. Verbal and Non-Verbal reasoning by R S Agrawal

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**	**Examination Scheme:**
01hr/week	**Audit Course**	**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 CO 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 CO 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 CO 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 CO 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 CO 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 CO for Unit VI	**CO4**	

E-Resources for Learning Support:

a. https://www.duolingo.com/enroll/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. EriBanno, 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)

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**	**Examination Scheme:**
01hr/week	Audit Course	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: analyze and evaluate the cyber security needs of an organization.

CO3: understand the importance of cyber laws and its practices.

CO4: Determine and analyze 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/Reference Books:
1. William Stallings, Computer Security: Principles and Practices, Pearson 6th Ed, ISBN: 978-0-13-335469-0 2. Nina Godbole, SunitBelapure , 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

SEMESTER - II

Home

Savitribai Phule Pune University, Pune Second Year Information Technology (2019 Course) 207003: Engineering Mathematics III		
Teaching Scheme:	**Credit**	**Examination Scheme:**
TH : 03 Hr/week **TUT : 01 Hr/ week**	**03** **01**	**Mid_Semester: 30Marks** **End_Semester: 70Marks** **TW : 25Marks**

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

Course Objectives:

To make the students familiarize with concepts and techniques in Linear differential equations, Fourier transform& Z-transform, Statistical methods, Probability theory and Numerical methods. 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:

At the end of this course, students 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 (LDE	08 Hrs

(08 Hours)

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 I	Transforms	08 Hr

Unit II: Transforms (08 Hours)

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 I	Statistics	07 Hrs

Unit III: (07 Hours)

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	07 Hrs

	Distributions	
Probability, Theorems on Probability, Bayes theorem, Random variables, Mathematical Expectation, Probability density function, Probability distributions: Binomial, Poisson, Normal and Hypergeo metric, Sampling distributions, Test of Hypothesis: Chi-Square test,t-test.		
Unit V	**Numerical Methods**	**08 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**	**08 Hrs**
Unit VI: Numerical Methods (08 Hours) Interpolation: Finite Differences, Newton's and Lagrange's Interpolation formulae, Numerical Differentiation. Numerical Integration: Trapezoidal and Simpson's rules, Bound of truncation error. Solution of Ordinary differential equations: Euler's, Modified Euler's, Runge- Kutta 4th order methods and Predictor-Corrector methods		
Text Books:		
1. Higher Engineering Mathematics by B.V. Ramana (Tata McGraw-Hill). 2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi).		
Reference Books:		
1. Advanced Engineering Mathematics, 10e, by Erwin Kreyszig (Wiley India). 2. Advanced Engineering Mathematics, 2e, by M. D. Greenberg (Pearson Education). 3. Advanced Engineering Mathematics, 7e, by Peter V. O'Neil (Cengage Learning). 4. Differential Equations, 3e by S. L. Ross (Wiley India). 5. Introduction to Probability and Statistics for Engineers and Scientists, 5e, by Sheldon M. Ross (Elsevier Academic Press). 6. Numerical Methods for Scientific and Engineering Computation, by M. K. Jain, S. R. K. Iyengar And R. K. Jain1, 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 perfo internal tests.		

Home

Savitribai Phule Pune University, Pune Second Year Information Technology (2019 Course) 214451: Processor Architecture		
Teaching Scheme:	**Credit**	**Examination Scheme:**
TH: 03hr/week	**03**	**Mid_Semester: 30Marks** **End_Semester: 70Marks**
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 :		
After completion of this course student will be able to: **CO1**:Understand architecture and memory organization of PIC 18 microcontroller. **CO2:** Learn and apply Embedded C programming for PIC 18. **CO3:** Explain timers and interrupts of PIC 18. **CO4:** Demonstrate real life applications using PIC 18. **CO5:** Understand 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 Part 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 Part 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 Part 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**	**(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. 'PIC Microcontroller and Embedded Systems: Using Assembly and C for PIC18' 4th Edition by Muhammad Ali Mazidi , Danny Causey, Rolin McKinlay, Pearson international edition.
2. 'ARM System Developer's Guide Designing and Optimizing System Software' byAndrew N. Sloss, Dominic Symes, Chris Wright, Morgan Kaufmann Publishers.

Reference Books:

1. 'Design with PIC Microcontroller' by Peatman, John B Pearson Education PTE.
2. 'Fundamentals of Microcontrollers and Applications In Embedded Systems' (with the PIC18 Microcontroller Family) by Ramesh Gaonkar.
3. Microchip's PIC18FXXX Data Sheet.
4. 'ARM Assembly Language Programming & Architecture' by Muhammad Ali Mazidi, Sarmad Naimi

The CO-PO mapping for the course												
PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	-	-	-	-	-	-	-	2
CO2	2	2	2	2	3	-	-	-	-	-	-	2
CO3	2	2	2	2	-	-	-	-	-	-	-	-
CO4	3	3	3	3	3	2	-	-	-	-	-	-
CO5	1	1	1	1	-	-	-	-	-	-	-	2

Home

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

Teaching Scheme:	Credit	Examination Scheme:
TH: 03hr/week	03	Mid_Semester: 30Marks End_Semester: 70Marks

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 Outcome: (COs)

After completion of this course student will be able to:

CO1: Define fundamental elements of database management systems

CO2: Describe the fundamental elements of relational database management systems and Design ER-models to represent simple database application scenarios.

CO3: Populate relational database and formulate SQL queries on data.

CO4: Improve the database design by normalization & to incorporate query processing

CO5: Illustrate ACID properties for transaction management & to describe concurrency control protocols.

CO6: Understand recent trends in database technology.

Unit I	Introduction to DBMS	6 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	6 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**	**6 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**	**6 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**	**6 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, Timestamping 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**	**6 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:

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

CO-PO Mapping for the course

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	-	1	-	-	1	-	-	-	2	3	1	-
CO2	2	1	2	-	2	-	-	1	2	-	-	2	3	2	2
CO3	2	-	1	-	-	-	-	1	-	-	-	2	3	-	-
CO4	2	-	-	-	-	-	-	1	-	-	-	2	3	-	-
CO5	2	-	-	-	2	-	-	1	-	-	-	2	3	-	-
CO6	3	-	-	-	1	-	-	1	-	-	-	2	3	1	-
AVG.	2.3	1.5	2	-	2.5	-	-	1	2	-	-	2	3	1.3	2

Home

Savitribai Phule Pune University, Pune Second Year Information Technology (2019 Course) 214453: Computer Graphics		
Teaching Scheme:	**Credit**	**Examination Scheme:**
TH: 03 Hr/week	**03**	**Mid_Semester: 30Marks** **End_Semester: 70Marks**

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 Outcome: (COs)

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

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

CO2: Explain and 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 the concepts of rendering, shading, animation, curves and fractals using computer graphics tools in design, development and testing of 2D, 3D modeling applications.

CO5:Develop the competency to understand the concepts related to Virtual reality

Course Contents

Unit – 1	Computer Graphics Basic, OpenGL and Line, Circle Drawing	06 Hours

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.

<table>
<tr><td colspan="3">Line Drawing: DDA Line – Mathematical Treatment and algorithm, Bresenhem Line - Mathematical Treatment and algorithm
Circle Drawing: Bresenhem – Mathematical Treatment and algorithm.
Character Generation: Stroke principle, starburst principle, bitmap method.Introduction to aliasing and anti-aliasing.</td></tr>
<tr><td>Case study</td><td colspan="2">Computer-generated imagery (CGI)</td></tr>
<tr><td>Mapping of Course Outcomes for Unit I</td><td colspan="2">CO1</td></tr>
<tr><td>Unit – 2</td><td>Polygons, 2D Transformations</td><td>06 Hours</td></tr>
<tr><td colspan="3">Polygons: Polygons and its types, inside test,
Polygon filling methods: 1. 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.</td></tr>
<tr><td>Case study</td><td colspan="2">Transformation of an Object in Computer Graphics: Mathematical Matrix Theory</td></tr>
<tr><td>Mapping of Course Outcomes for Unit II</td><td colspan="2">CO2</td></tr>
<tr><td>Unit – 3</td><td>Windowing, Clipping,3D Transformation, Projections</td><td>06 Hours</td></tr>
<tr><td colspan="3">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.</td></tr>
<tr><td>Case Study</td><td colspan="2">3D Rendering and Modelling</td></tr>
<tr><td>Mapping of Course Outcomes for Unit III</td><td colspan="2">CO2 & CO3</td></tr>
<tr><td>Unit – 4</td><td>Segments, Illumination models, colour models and shading</td><td>06 Hours</td></tr>
<tr><td colspan="3">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, YIQ, CMY, HSV, HLS color models.
Shading Algorithms: Constant intensity shading, Halftone, Gaurand and Phong Shading.</td></tr>
<tr><td>Case study</td><td colspan="2">Best practices in Daylighting & Passive Systems for Smaller Commercial Buildings</td></tr>
<tr><td>Mapping of Course Outcomes for Unit IV</td><td colspan="2">CO4</td></tr>
</table>

Unit – 5	Curves, fractals and Animation	06 Hours
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 – 6	**Virtual Reality**	**06 Hours**
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. Virtual Reality Technology by Grigore C. Burdea, Philippe Coiffet, second edition, Wiley India Edition, ISBN 81-265-0789-6

Reference books

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

CO-PO Mapping for the course

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	3	3	3	2	2	1	2	1	0	1	1	0
CO2	3	3	3	2	2	2	0	0	2	2	2	0
CO3	3	3	3	2	2	2	0	0	0	0	1	0
CO4	2	3	1	2	1	2	1	2	1	1	0	1
CO5	2	3	1	2	1	2	1	2	1	1	0	1

Home

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214455: Software Engineering

Teaching Scheme:	Credit	Examination Scheme:
TH: 03 hr/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, learner will be able to–

CO1: Identify various software application domains and classify software applications.
CO2: Analyze software requirements by applying various modeling techniques.
CO3: Translate the requirement models into design models.
CO4: Apply planning and estimation to any project.
CO5: Apply 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 Studies	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 Studies : Library Management system		
Mapping of Course Outcomes for Unit II	CO2	
Unit III	**Design Engineering**	**(06 Hrs)**
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**	**(06 Hrs)**
Project Planning: Project initiation, Planning Scope Management, Creating the Work Breakdown Structure, scheduling: Importance of Project Schedules, Developing the Schedule using Gantt Charts, 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 or JIRA		
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 Studies: software testing tool like selenium		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**Formal Methods Recent Trends In Software Engineering**	**(06 Hrs)**
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 Studies: CASE software/ HP Quality Center (QC) / Jira		

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

Books & Other Resources:

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

Web Resources:

1. Udemy 2. Coursera 3. LinkedIn Learning Modules

The CO-PO mapping for the course

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1		-	1	-	-	-	-	-	1
CO2	2	2	-	1	-	-	-	-	1	2	-	1
CO3	2	2	2	1	2	-	-	1	1	1	1	1
CO4	2	2	-	1	-	1	1	2	1	1	-	1
CO5	1	1	2	1	1	1	1	2	1	1	-	1
CO6	1	1	1	-	2	1	1	1	1	-	-	1

Home

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

Teaching Scheme:	Credit	Examination Scheme
TH:02Hr/week	01	TW: 25Marks PR: 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 :

CO1 : After completion of this course student will be able to
CO2 : Students will learn concepts related to embedded C programming.
CO3 : Students will be able to write and execute embedded C program to perform array addition, block transfer, sorting operations
CO4 : Students will be able to learn interfacing of real world input and output devices to PIC18FXXX microcontroller.
CO5 : Students will learn open 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 and references etc.

Guidelines for Student's Lab Journal

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

Guidelines for Lab /TW Assessment

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

3. Necessary knowledge of usage of software and hardware of PIC18FXXX microcontrollers and its interfacing kits should be checked by the concerned faculty members.

Guidelines for Laboratory Conduction

1. The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications.
2. The guidelines published by BOS time to time regarding conduction of laboratory assignments and Practical/Oral examination is mandatory.

Guidelines for Practical Examination

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

Suggested List of Laboratory Assignments

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

Mapping of Course Outcomes for Group A : CO1 , CO2

1. Write an Embedded C program to add array of n numbers.
2. 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
3. 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
4. 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

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

Group C (Any two) :

Mapping of Course Outcomes for Group C : CO3

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

Group D :

Mapping of Course Outcomes for Group D : CO4

12. Study of Arduino board and understand the OS installation process on Raspberry-pi .

13. 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&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

The CO-PO mapping for the course

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	1	3	-	2	-	-	-	-	2
CO2	1	3	3	2	2	2	2	-	-	-	-	2
CO3	1	2	3	3	2	1	2	-	-	-	-	2
CO4	1	1	2	2	3	-	1	1	-	-	1	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Home

Savitribai Phule Pune University, Pune Second Year Information Technology (2019 Course) 214456: Database Management System LAB		
Teaching Scheme:	**Credit**	**Examination Scheme**
Pr:04Hr/week	**02**	**PR: 25Marks** **TW: 25Marks**

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 programme PL/SQL including stored procedures, stored functions, cursors and packages.

Course Outcomes :

After completion of this course student will be able to

CO1 : To install and configure database systems.

CO2 : To analyze database models & entity relationship models.

CO3 : To design and implement a database schema for a given problem-domain

CO4 : To understand the relational database systems.

CO5 : To populate and query a database using SQL DDL / DML / DCL commands.

CO6 : To 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 handwritten journal 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 Oral /Practical Assessment

1. **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. **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. **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. Try to update the base table using its corresponding view. Also consider restrictions on updatable views and perform view creation from multiple tables.

Group C: 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 your project, do the following: 1. Form teams of around 3 to 4 people 2. Create a requirements document with the following information; 1. Give a one or two paragraph description of your goals for the topic(s). 2. List all what all types of users will be accessing your application (e.g., for moodle, the types are teachers, students, teaching assistants, and a few more types). 3. List the various functionalities that your application will support. Explain each in about a paragraph worth of detail. 4. List the hardware and software requirements at the backend and at the front end. 5. 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: 978-93-5023-918-6.Jay Kreibich, Using SQLite, SPD, ISBN: 978-93-5110-934-1, 1st edition.

Web Resources:

1. Udemy 2. Coursera 3. SQL TutorialsPoint

The CO-PO mapping for the course

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	-	2	-	-	2	2	-	-	2
CO2	2	3	2	-	2	-	-	-	1	-	-	-
CO3	2	2	3	1	-	-	-	-	1	-	1	1
CO4	2	-	3	2	3	2	-	2	-	-	-	-
CO5	2	-	3	-	3	-	-	-	-	-	-	-
CO6	3	3	3	3	3	2	1	-	3	-	1	1
	2.3	**1.5**	**2**	**-**	**1.5**	**-**	**-**	**1**	**2**	**-**	**-**	**2**

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

Home

Teaching Scheme:	Credit	Examination Scheme
Practical:02Hr/week	02	TW: 25Marks PR 25Marks

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 :

After completion of this course student will be able to

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

CO2: Apply and implement polygon filling methods for the object

CO3: Apply and implement polygon clipping algorithms for the object

CO4: Apply and implement 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 handwritten journal 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 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.

Guidelines for Laboratory Conduction

1. All the assignments should be implemented in C++ with OpenGL libraries.
2. Assignment 1 (week 1) should 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 in chit and student will have to perform any one.
2. All the problem statements carry equal weightage.

Suggested List of Laboratory Assignments

1. Install and explore the OpenGL (1 week, 2 hrs) - **CO1**

2. Implement DDA and Bresenham line drawing algorithm to draw (2 week, 4 hrs)
   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 +ve, -ve, >1,<1

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 (1 week, 2 hrs) -**C02**

4. Implement the following polygon filling methods (1 week, 2 hrs)
i) Flood fill / Seed fill
ii) Boundary fill

using mouse click, keyboard interface and menu driven programming-**CO4**

5. Implement Cohen Suterland polygon clipping method to clip the polygon with respect the viewport and window. Use mouse click, keyboard interface (1 week, 2 hrs) - **CO4**

6. Implement following 2D transformations on the object with respect to axis (1 week, 2 hrs) – **CO5**
a. Scaling
b. Rotation about arbitrary point
c. Reflection

7. Generate fractal patterns using (1 week, 2 hrs)
a. Bezier b. Koch Curve

8. Implement animation principles for any object (2 week, 4 hrs) -**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. J. Foley, V. Dam, S. Feiner, J. Hughes, "Computer Graphics Principles and Practice", 2nd Edition, Pearson Education, 2003, ISBN 81 – 7808 – 038 – 9
2. D.Hearn, M. Baker, "Computer Graphics – C Version", 2nd Edition, Pearson Education, 2002, ISBN81 – 7808 – 794 – 4
3. D. Rogers, J. Adams, "Mathematical Elements for Computer Graphics", 2nd Edition, Tata McGraw-Hill Publication, 2002, ISBN 0 – 07 – 048677 – 8
4. Zhigang Xiang, Roy Plastock, "Computer Graphics", Schaum's Series outlines
5. Shirley, Marschner, "Fundamentals of Computer Graphics", Third Ed, A K Peters SPD
6. 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 Edu

The CO-PO mapping for the course

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	2	1	-	-	-	-	-	-
CO2	3	2	-	-	2	1	-	-	-	-	-	-
CO3	3	2	-	-	2	1	-	-	-	-	-	-
CO4	3	2	-	-	2	1	-	-	-	-	-	-
CO5	3	2	-	-	2	1	-	-	-	-	-	-
CO6	2	2	2	-	3	-	-	-	-	-	-	-

Home

Savitribai Phule Pune University, Pune Second Year Information Technology (2019 Course) 214458: Project Based Learning		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Lab: 04hrs. / week	**02**	**TW : 50Marks**

Prerequisite Courses, if any:

1. The primary objective of project-based learning course is to develop critical thinking and engineering problem solving skills by exploring and proposing sustainable solutions to real-world problems.
2. PBL requires continuous mentoring by faculty throughout the semester for successful completion of the tasks selected by the students per batch. While assigning the teaching workload a load of 2 Hrs./week/batch needs to be considered for the faculty involved. This course specifically utilizes Project Based Learning (PBL) to engage students in a semester long process of analyzing, evaluating, and creating solutions to an engineering real-world problem. These projects assist students in learning important domain knowledge, technical content, and develop needed skills in critical thinking, teamwork, peer evaluation, and communications.
3. Students will work on their project from a first week to a semester end – that engages them in solving a real-world problem or answering a complex question. The Batch needs to be divided into sub-groups of 3 to 6 students. Assignments / activities / models/ projects etc. under project based learning is carried throughout semester and Credit for PBL has to be awarded on the basis of internal continuous assessment and evaluation at the end of semester. A mentor will assign to every team who will be guided them to build their projects.

Companion Course, if any: Online courses relevant to the project, along with expert lecture on Intellectual right and patients.

Course Objectives :

After completing PBL course, the student will be able to:

1. Know about project and project based learning
   - Experience the concept of learning by doing,
   - Experience advanced and efficient learning model
2. Understand the various processes involved in project based learning and the importance of team work in project based learning
   - develop projects for various real life situations,
   - work in realistic contextualized problem-solving environments,
   - realize the success of a project by experiencing the desired output
3. Apply knowledge and understanding of project based learning processes in new situations
   - improve communication skills,
   - enhance self-confidence,
   - build up teamwork and leadership skills

4 Model to meet the societal and educational demands

- Solving challenges of society through technology

Probable solution for various problems coming from various Hackathon competitions

Course Outcomes:

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

CO1: Students will gain knowledge of how to provide solution to real life problems and analyze its concerns
through shared cognition.

CO2: Students will be able to understand concepts of various disciplines and apply them in practical way.

CO3: Learning by doing approach in PBL will promote long-term retention of material and replicable skill.

CO4: Becoming well prepared for the labor market.

CO5: Student will motivate to collaborate with external partners and engage in interdisciplinary learning environments

Course Contents

Group Structure:

Working in supervisor/mentor –monitored groups. The students plan, manage and complete a task/project / activity, which addresses the stated problem.

1. There should be 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 process

Selection of Project/Problem:

The project-based project model begins with the identifying of a real-world problem, often growing out of a question or "wondering". The formulated problem will then stands as the starting point for learning. Students will be designed and analyze the problem within an articulated interdisciplinary or subject frame. A problem statement can be theoretical, practical, social, technical, symbolic, cultural and/or scientific and grows out of students' wondering within different disciplines and professional environments. A chosen problem has to be exemplary. The problem may involve an interdisciplinary approach in both the analysis and solving phases.

By exemplarity, a problem needs to refer back to a particular practical, scientific, social and/or technical domain. The problem should stand as one specific example or manifestation of more general learning outcomes related to knowledge and/or modes of inquiry.

There are no commonly shared criteria for what constitutes an acceptable project. Projects vary greatly in the depth of the questions explored, the clarity of the learning goals, the content and structure of the activity.

1. A few hands-on activities that may or may not be multidisciplinary
2. Use of technology in meaningful ways to help them investigate, collaborate, analyze synthesize and present their learning.
3. Activities may include- Solving real life problem , investigation /study and Writing reports of in depth study, fieldwork

4. Reports of in depth study, fieldwork

Assessment:

The department should committed to assessing and evaluating both student performance and program effectiveness.

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. PBL is to be monitored and continuous assessment should be done by mentor and authorities.

Students must maintain an institutional culture of authentic collaboration, self- motivation, peer-learning and personal responsibility. 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:

Project Based Learning is an instructional approach that emphasizes critical-thinking, collaboration and personalized learning. These projects are based on problems, which are real-life oriented, curriculum-based, and often interdisciplinary. 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. Throughout this process, the teacher's role is to guide and advise students, rather than to direct and manage student work.

It is recommended that the all activities are to be recorded, regular assessment of work to be done and proper documents are to be maintained at college end by both students as well as mentor (you may call it PBL work book).

Continuous Assessment Sheet (CAS) is to be maintained by all mentors/department and institutes. 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 patient **(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%).**

PBL workbook will serve the purpose and facilitate the job of students, mentor and project coordinator. This workbook will reflect accountability, punctuality, technical writing ability and work flow of the work undertaken

References:

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

Home

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

Teaching Scheme:	Credit	Examination Scheme:
1 Hr/ week	Non Credit Course	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. To understand the need of conservation of rain water and its applications
4. To 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: Ascertain the quality of water as per BIS and select the appropriate treatment method required for the water source

CO3: Study & Establish the suitable distribution system for a locality and know the appurtenances used

CO4: Identify and 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	2 Hr

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 Unit I	CO1

Unit II	Quality And Treatment Of Water	2 Hr

QUALITY OF WATER: Impurities of water - organic and inorganic classification and examination of water. Physical - temperature, colour, turbidity, taste and odour. Chemical - pH Value, TotalSolids, 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 (no design) Disinfection of water, Chlorination		
Mapping of Unit II	CO2	
Unit III	**Water Distribution System**	2 Hr
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 Unit III	**CO3**	
Unit IV	**Water Supply In Buildings**	**2 Hr**
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 water heaters.		
Mapping of Unit IV	**CO4**	
Unit V	**Water Conservation**	**2 Hr**
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 Unit V	CO5	
Unit VI	**Water Pollution And Pollution control**	**2 Hr**
WATER POLLUTION AND CONTROL: Sources of water pollution, types and itseffects,Preventionandcontrolmeasuresofwaterpollution,Legalaspectsregarding water pollution control.		
Mapping of VI	**CO6**	

Reference Books:

1. S.K. Garg, Water Supply Engineering Vol-I,Khanna Publishers
2. G.S.Birdie,WaterSupply&SanitaryEngineering-includingEnvironmental Engineering ,water and air pollution aws and Ecology, Dhanpat Raiand Sons publishers,ISBN:81-87433-31-0.
3. Dr. P.N. Modi, Environmental Engg.-Vol-I, Standard Book House.

A.K.Chatterji,WaterSupply,WasteDisposalandEnvironmentalPollution Engineering, Khanna publishers.

Web Resources:

1.Udemy 2.Coursera 3.NPTEL

SUGGESTED LIST OF CASE STUDIES/STUDENTACTIVITIES

1. Collect the information about biotic and abiotic components 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 init.
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: Mandatory Audit Course -4B: Language Study Japanese: Module-II		
Teaching Scheme:	**Credit**	**Examination Scheme:**
1 Hr/ week	**Audit Course**	**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 +04 Hrs 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**	**(04 Hrs +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	**CO2, CO3**	

Outcomes for Unit III		
Unit IV	**Japanese – English Translation**	**(04 Hrs +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 Self Study)**
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/enroll/ja/en/Learn-Japanese
2. https://www.freejapaneselessons.com/
3. https://minato-jf.jp/ (Japan Foundation)

Text Books:

1. Eri Banno, 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)

Home

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

Teaching Scheme:	Credit	Examination Scheme:
1 Hr/ Week	Audit 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	2 Hr

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	2 Hr

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	2 Hr

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**	**2 Hr**
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**	**2 Hr**
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**	**2 Hr**
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
3. 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 2013Available online free edition:

Reference Book:

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

Home

Savitribai Phule Pune University, Pune Second Year Information Technology (2019 Course) 214459: Mandatory Audit Course-4 D:Intellectual Property Rights		
Teaching Scheme:	**Credit**	**Examination Scheme:**
01 hr/week	**Audit Course**	**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**	**(2Hrs)**
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		

<table>
<tr><td colspan="3">procedure - Rights of holder and assignment and licensing of marks - Infringement</td></tr>
<tr><td>Mapping of Course Outcomes for Unit IV</td><td colspan="2">CO3</td></tr>
<tr><td>Unit V</td><td>Advances in IP Laws and Government policies</td><td>(02 Hrs)</td></tr>
<tr><td colspan="3">Amendments and India`s New National IP Policy, Promoting IPR policy for Start-ups, Career Opportunities in IP - IPR in current scenario</td></tr>
<tr><td>Mapping of Course Outcomes for Unit V</td><td colspan="2">CO4</td></tr>
<tr><td colspan="3">Text Books:</td></tr>
<tr><td colspan="3">1. Niraja Pandey, Khushdeep Dharni (2014), “Intellectual Property Rights”, PHI
2. Nithyananda K V. (2019). Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td colspan="3">Reference Books</td></tr>
<tr><td colspan="3">1. Mishra, “An introduction to Intellectual property Rights”, Central Law Publications</td></tr>
<tr><td colspan="3">2. Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis</td></tr>
</table>

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)

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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 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 socialissues 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, 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 Informatior Technology in analysis, design, development and management of informatior 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)

HOME

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

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 of formal 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 Pushdown Automata machine for the Context Free Language.

CO5: Design and analyze Turing machines for formal languages.

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/

HOME

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

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: Explain the role of Modern Operating Systems.

CO2: Apply the concepts of process and thread scheduling.

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

CO4: Implement the concepts of various memory management techniques.

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

CO6: Understand Importance 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, Thread programming 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, Requirements for 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
3. D. M. Dhamdhere, "Systems Programming and Operating Systems", Tata McGraw-Hill, ISBN 13:978-0-07-463579-7, Second Revised Edition.

Reference Books:
1. Tom Adelstein and Bill Lubanovic, Linux System Administration, O'Reilly Media, ISBN-10: 0596009526, ISBN-13: 978-0596009526. **2.** Harvey M. Deitel, Operating Systems, Prentice Hall, ISBN-10: 0131828274, ISBN-13: 978-0131828278. **3.** Thomas W. Doeppner, Operating System in depth: Design and Programming, WILEY, ISBN: 978-0-471-68723-8. **4.** Mendel Cooper, Advanced Shell Scripting, Linux Documentation Project. **5.** Andrew S. Tanenbaum & Herbert Bos, Modern Operating System, Pearson, ISBN-13: 9780133592221, 4th Edition. **6.** J. J. Donovan, Systems Programming, McGraw-Hill, ISBN 13:978-0-07-460482-3, Indian Edition.
E- Books / E- Learning References :
E-learning references: **1. https://repository.dinus.ac.id/docs/ajar/Operating_System.pdf** **NPTEL video lecture link:** **1.** https://nptel.ac.in/courses/106/102/106102132/# **2.** https://nptel.ac.in/courses/106/106/106106144/

HOME

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

Prerequisite Courses:

1. Basics of Statistics **2.** Linear Algebra **3.** Calculus **4.** Probability

Companion Course:

1. Artificial Intelligence **2.** 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, Definition, Real life applications, Learning Tasks- Descriptive and Predictive Tasks**,** Types of Learning: Supervised Learning Unsupervised Learning, Semi-Supervised Learning, Reinforcement Learning.

Features: Types of Data (Qualitative and Quantitative), Scales of Measurement (Nominal, Ordinal, Interval, Ratio), Concept of Feature, Feature construction, Feature Selection and Transformation, Curse of Dimensionality.

Dataset Preparation: Training Vs. Testing Dataset, Dataset Validation Techniques – Hold-out, k-fold Cross validation, Leave-One-Out Cross-Validation (LOOCV).

Mapping of Course Outcomes for Unit I	CO1

Unit II	CLASSIFICATION	(06 hrs)

Binary Classification: Linear Classification model, Performance Evaluation- Confusion Matrix, Accuracy, Precision, Recall, ROC Curves, F-Measure

Multi-class Classification: Model, Performance Evaluation Metrics – Per-class Precision and Per-Class Recall, weighted average precision and recall -with example, Handling more than two classes, Multiclass Classification techniques -One vs One, One vs Rest

Linear Models: Introduction, Linear Support Vector Machines (SVM) – Introduction, Soft Margin SVM, Introduction to various SVM Kernel to handle non-linear data – RBF, Gaussian, Polynomial, Sigmoid.

Logistic Regression – Model, Cost Function.

Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**REGRESSION**	**(06 hrs)**

Regression: Introduction, Univariate Regression – Least-Square Method, Model Representation, Cost Functions: MSE, MAE, R-Square, Performance Evaluation, Optimization of Simple Linear Regression with Gradient Descent - Example. Estimating the values of the regression coefficients

Multivariate Regression: Model Representation

Introduction to Polynomial Regression: Generalization- Overfitting Vs. Underfitting, Bias Vs. Variance.

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, Entropy, Tree Pruning -ID3/C4.5, Advantages and Limitations

Probabilistic Models: Conditional Probability and Bayes Theorem, Naïve Bayes Classifier, Bayesian network 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), Neighbors and Examples, K-Nearest Neighbour for Classification and Regression, Clustering as Learning task: K-means clustering Algorithm-with example, k-medoid 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, Confidence, Lift.

Mapping of Course Outcomes for Unit V	**C05**	
Unit VI	**INTRODUCTION TO ARTIFICIAL NEURAL NETWORK**	**(6 hrs)**

Perceptron Learning– Biological Neuron, Introduction to ANN, McCulloch Pitts Neuron, Perceptron and its Learning Algorithm, Sigmoid Neuron, Activation Functions: Tanh, ReLu
Multi-layer Perceptron Model – Introduction, Learning parameters: Weight and Bias, Loss function: Mean Square Error
Introduction to 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

<table>
<tr><td colspan="3">Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)
314444: Human Computer Interaction</td></tr>
<tr><td>Teaching Scheme:</td><td>Credit Scheme:</td><td>Examination Scheme:</td></tr>
<tr><td>Theory (TH) : 3 hrs/week</td><td>03 Credits</td><td>Mid_Semester : 30 Marks
End_Semester : 70 Marks</td></tr>
</table>

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.

<table>
<tr><td colspan="3">COURSE CONTENTS</td></tr>
<tr><td>Unit I</td><td>INTRODUCTION</td><td>(06 hrs)</td></tr>
<tr><td colspan="3">What is HCI?, Disciplines involved in HCI, Why HCI study is important? The psychology of everyday things Donald A. Norman, Principles of HCI, User-centered Design. Measurable Human factors.</td></tr>
<tr><td>Mapping of Course Outcomes for Unit I</td><td colspan="2">CO1</td></tr>
<tr><td>Unit II</td><td>UNDERSTANDING THE HUMAN and HUMAN INTERACTION</td><td>(06 hrs)</td></tr>
<tr><td colspan="3">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.</td></tr>
</table>

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 wrist watch, 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 and Practice.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 a MultidisciplinaryScience. 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

HOME

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

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: Differentiate relational and object-oriented databases.

CO2: Illustrate parallel & distributed database architectures.

CO3: Apply concepts of NoSQL Databases.

CO4: Explain concepts of data warehouse and OLAP technologies.

CO5: Apply data mining algorithms and various software tools.

CO6: Comprehend 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 Information Systems; 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

HOME

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

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 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"

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 New Ideasin 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: Theory and 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/

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

HOME

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

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 should be made available to students and laboratory instructor/Assistant.

Guidelines for Student's Lab Journal

1. Student should submit term work in the form of handwritten journal based on specified list of assignments.
2. Practical Examination will be based on the term work.
3. Candidate is expected to know the theory involved in the experiment.
4. The practical examination should be conducted if and only if the journal of the candidate is complete in all 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 on standard 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 the Linux kernel by the compilation of this kernel (any kernel source, any architecture and any Linux kernel distribution) and demonstrate the use of this embedded system call using C program in user space.

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.

HOME

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

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 clustering with K-Means 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-sources 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
Group A

1. **Data preparation:**

   Download heart dataset from following link.
   https://www.kaggle.com/zhaoyingzhu/heartcsv
   Perform following operation on given dataset.

   a) Find Shape of Data
   b) Find Missing Values
   c) Find data type of each column
   d) Finding out Zero's
   e) Find Mean age of patients
   f) Now extract only Age, Sex, ChestPain, RestBP, Chol. Randomly divide dataset in training (75%) and testing (25%).

   Through the diagnosis test I predicted 100 report as COVID positive, but only 45 of those were actually positive. Total 50 people in my sample were actually COVID positive. I have total 500 samples.

   Create confusion matrix based on above data and find

   I. Accuracy
   II. Precision
   III. Recall
   IV. F-1 score

2. **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.

3. **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.

4. **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.

5. **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

6. 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

7. 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

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Savitribai Phule Pune University, Pune

Third Year Information Technology (2019 Course)

314448 (A) : Laboratory Practice-I (Design and Analysis of 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: 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 of assignments.
2. Practical Examination will be based on the term work.
3. Candidate is expected to know the theory involved in the experiment.
4. The practical examination should be conducted if and only if the journal of the candidate is complete in all respects.

Guidelines for Lab /TW Assessment

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

   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, Universities Press, ISBN : 9788173716126

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

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: Apply advanced Database Programming Languages.

CO2: Apply the 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 STUDY

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:
    a. Find and find One (specific values)
    b. Query criteria (Query conditionals, OR queries, $not, Conditional semantics) Type-specific queries (Null, Regular expression, Querying arrays)
    c. $ where queries
    d. 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**

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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.

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

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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 'soilparameter 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

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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**

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**

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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 o 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

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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: Do basic communication**.**

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

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

CO4: 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

<table>
<tr><td>Mapping of Course Outcomes for Unit I</td><td colspan="2">CO1</td></tr>
<tr><td>Unit II</td><td colspan="2">JAPANESE SCRIPT</td></tr>
<tr><td colspan="3">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</td></tr>
<tr><td>Mapping of Course Outcomes for Unit II</td><td colspan="2">CO2</td></tr>
<tr><td>Unit III</td><td>BASIC JAPANESE GRAMMAR</td><td>(3 hrs Lecture + 3 hrs Self-study)</td></tr>
<tr><td colspan="3">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</td></tr>
<tr><td>Mapping of Course Outcomes for Unit III</td><td colspan="2">CO3</td></tr>
<tr><td>Unit IV</td><td>JAPANESE FOR DAILY COMMUNICATION</td><td>(3 hrs Lecture + 3 hrs Self-study)</td></tr>
<tr><td colspan="3">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</td></tr>
</table>

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

CO2: Apply concepts of wireless network and different wireless standards.

CO3: Recognize the Adhoc Network's MAC layer, routing protocol and Sensor network architecture. **CO4:** Implement 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:** ArchitectureLayers, operational states, **IEEE 802.16 WiMax:** Services, Architecture, Layers, comparison between 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, PearsonEducation, 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, Protocols and 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

HOME

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

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:** Flajole 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 data visualization tools, Techniques for visual data representations, Types of data visualization, Visualizing Big Data, Tools used in data visualization, Propriety Data Visualization tools, Open – source data visualization tools, **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, 1stEdition.
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& Backend 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, CRUD 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.Hiren Joshi, 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.

HOME

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**

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: Apply the fundamental concepts of Artificial Intelligence

CO2: Choose appropriate search strategies for any AI problem

CO3: Illustrate 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)		

<table>
<tr><td>Mapping of Course Outcomes for Unit IV</td><td colspan="2">CO4</td></tr>
<tr><td>Unit V</td><td>INTRODUCTION TO GAME THEORY</td><td>(06 hrs)</td></tr>
<tr><td colspan="3">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.</td></tr>
<tr><td>Mapping of Course Outcomes for Unit V</td><td colspan="2">CO5</td></tr>
<tr><td>Unit VI</td><td>RECENT AND FUTURE TRENDS IN AI</td><td>(06 hrs)</td></tr>
<tr><td colspan="3">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, Tumkur monitoring using Computer Vision, Text to Speech Conversion using APIs</td></tr>
<tr><td>Mapping of Course Outcomes for Unit VI</td><td colspan="2">CO6</td></tr>
<tr><td colspan="3">Text Books:</td></tr>
<tr><td colspan="3">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</td></tr>
<tr><td colspan="3">Reference Books:</td></tr>
<tr><td colspan="3">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</td></tr>
<tr><td colspan="3">E- Books / E- Learning References</td></tr>
<tr><td colspan="3">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/</td></tr>
</table>

HOME

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**

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 forensics andcrypto 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 of the 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: 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

HOME

<table>
<tr><td colspan="3">Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)
314454 (C): Elective-II- (Cloud Computing)</td></tr>
<tr><td>Teaching Scheme:</td><td>Credit Scheme:</td><td>Examination Scheme:</td></tr>
<tr><td>Theory (TH) : 3 hrs/week</td><td>03 Credit</td><td>Mid_Semester : 30 Marks
End_Semester : 70 Marks</td></tr>
</table>

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.

<table>
<tr><td colspan="3">COURSE CONTENTS</td></tr>
<tr><td>Unit I</td><td>FUNDAMENTALS Of CLOUD COMPUTING</td><td>(06 hrs)</td></tr>
<tr><td colspan="3">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.</td></tr>
<tr><td>Mapping of Course Outcomes for Unit I</td><td colspan="2">CO1</td></tr>
<tr><td>Unit II</td><td>CLOUD-ENABLING TECHNOLOGY AND VIRTUALIZATION</td><td>(06 hrs)</td></tr>
</table>

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)

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. Database Management 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: 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: Illustrate architectural design principles and guidelines in the various type of applicationdevelopment.

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, Modelling based 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

<table>
<tr><td>Mapping of Course
Outcomes for Unit I</td><td colspan="2">CO1</td></tr>
<tr><td>Unit II</td><td>OBJECT ORIENTED ANALYSIS</td><td>(06 hrs)</td></tr>
<tr><td colspan="3">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</td></tr>
<tr><td>Mapping of Course Outcomes for Unit II</td><td colspan="2">CO2</td></tr>
<tr><td>Unit III</td><td>INTERACTION AND BEHAVIOR MODELING</td><td>(06 hrs)</td></tr>
<tr><td colspan="3">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.</td></tr>
<tr><td>Mapping of Course Outcomes for Unit III</td><td colspan="2">CO3</td></tr>
<tr><td>Unit IV</td><td>OBJECT ORIENTED DESIGN PROCESS</td><td>(hrs)</td></tr>
<tr><td colspan="3">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.</td></tr>
</table>

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.

HOME

Savitribai Phule Pune University, Pune Third Year Information Technology (2019 Course) **314455: Internship**		
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 the development 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: Develop professional competence through industry internship.

CO2: Apply academic knowledge in a personal and professional environment

CO3: Build the professional network and expose students to future employees.

CO4: Apply professional and societal ethics in their day-to-day life.

CO5: Become a responsible professional having social, economic and administrative considerations.

CO6: 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 contactIndustrial 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

HOME

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

Prerequisites:

1. Fundamentals of Computer Networks.

Course Objectives:

1. To design and implement small size network and to understand various networking commands.
2. To 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

HOME

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

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 assignmentsthat 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

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

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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.

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)

HOME

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

HOME

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

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/

HOME

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**

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 MemorySkills 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; OxfordPublishers.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

HOME

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

<table>
<tr><td>Mapping of Course Outcomes for Unit I</td><td colspan="2">CO1</td></tr>
<tr><td>Unit II</td><td colspan="2">INTERACTIVE JAPANESE</td></tr>
<tr><td colspan="3">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</td></tr>
<tr><td>Mapping of Course Outcomes for Unit II</td><td colspan="2">CO2</td></tr>
<tr><td>Unit III</td><td>FORMAL JAPANESE</td><td>(3 hrs Lecture + 3 hrs Self-study)</td></tr>
<tr><td colspan="3">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</td></tr>
<tr><td>Mapping of Course Outcomes for Unit III</td><td colspan="2">CO3</td></tr>
<tr><td>Unit IV</td><td>LIFE IN JAPAN</td><td>(3 hrs Lecture + 3 hrs Self-study)</td></tr>
<tr><td colspan="3">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'tsin 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</td></tr>
<tr><td>Mapping of Course Outcomes for Unit IV</td><td colspan="2">CO4</td></tr>
<tr><td colspan="3" align="center">Text Books:</td></tr>
<tr><td colspan="3">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)</td></tr>
</table>

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/

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

Curriculum for
Final Year of Information Technology
(2019 Course)
(With effect from AY 2022-23)

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Savitribai Phule Pune University
Final Year of Information Technology (2019 Course)
(With effect from Academic Year 2022-23)

Semester VII

Course Code	Course Name	Teaching Scheme(Hours/week)			Examination Scheme and Marks						Credit Scheme			
		Lecture	Practical	Tutorial	Mid-Sem	End-Sem	Termwork	Practical	Oral	Total	Lecture	Practical	Tutorial	Total
414441	Information and Storage Retrieval	03	-	-	30	70	-	-	-	100	3	-	-	3
414442	Software Project Management	03	-	-	30	70	-	-	-	100	3	-	-	3
414443	Deep Learning	03	-	-	30	70	-	-	-	100	3	-	-	3
414444	Elective III	03	-	-	30	70	-	-	-	100	3	-	-	3
414445	Elective IV	03	-	-	30	70	-	-	-	100	3	-	-	3
414446	Lab Practice III	-	04	-	-	-	25	-	25	50	-	2	-	2
414447	Lab Practice IV	-	02	-	-	-	25	25	-	50	-	1	-	1
414448	Project Stage-I	-	-	02	-	-	50	-	-	50	-	-	2	2
414449	Audit Course7													
										Total Credit	15	03	02	20
	Total	15	06	02	150	350	100	25	25	650	15	03	02	20

Elective III:

- Mobile Computing
- High Performance Computing
- Multimedia Technology
- Smart Computing

Elective IV:

- Bioinformatics
- Introduction to DevOps
- Computer Vision
- Wireless Communications

Lab Practice-III:

It is based on subjects:

- Information and Storage Retrieval

Lab Practice-IV:

It is based on subjects:

- Deep Learning

Audit Courses 7:

- 414449A: Copyrights and Patents
- 414449B: Stress Management by Yoga
- 414449C: English for Research Paper Writing

Savitribai Phule Pune University
Final Year of Information Technology (2019Course)
(With effect from Academic Year2022-23)

Semester VIII

Course Code	Course Name	Teaching Scheme (Hours/week)			Examination Scheme and Marks						Credit Scheme			
		Lecture	Practical	Tutorial	Mid-Sem	End-Sem	Teamwork	Practical	Oral	Total	Lecture	Practical	Tutorial	Total
414450	Distributed Systems	03	-	-	30	70	-	-	-	100	03			03
414451	Elective V	03	-	-	30	70	-	-	-	100	03			03
414452	Elective VI	03	-	-	30	70	-	-	-	100	03			03
414453	Startup and Entrepreneurship	-	-	03	-	-	50	-	-	50	-	-	03	03
414454	Lab Practice V	-	04	-	-	-	50	25	-	75		02		02
414455	Lab Practice VI	-	02	-	-	-	25	-	50	75		01		01
414456	Project Stage II	-	10	-	-	-	100	-	50	150		05		05
414457	AuditCourse8													
										Total Credit	09	08	03	20
	Total	09	16	03	90	210	225	50	75	650	09	08	03	20

Elective V:

- Software Defined Networks
- Social Computing
- Natural Language Processing
- Soft Computing
- Game Engineering

Elective VI:

- Ethical Hacking and Security
- Augmented and Virtual Reality
- Business Analytics and Intelligence
- Blockchain Technology

Lab Practice V:

It is based on subjects:

- Distributed Systems

Lab Practice VI:

It is based on subjects:

- Elective VI

Audit Courses 8:

- 414457A: Functional Programming in Haskell
- 414457B: Cyber Laws and Use of Social Media
- 414457C: Constitution of India

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 higherstudies 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 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 software or a software /hardware system, component, or process to meet desired needs within realistic constraints.
PO4	Conduct Investigation of Complex Problems	An ability to identify, formulate, and provide essay schematic 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, 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 – VII

Savitribai Phule Pune University, Pune Final Year Information Technology (2019 Course) 414441: Information Storage and Retrieval		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory (TH): 03 hrs/week	**03 Credits**	**Mid_Semester: 30 Marks** **End_Semester: 70 Marks**

Prerequisite Courses,

1. Data Structures and Files.
2. Database management systems.

Companion Course, if any: Lab Practice III

Course Objectives:

1. To understand the concepts of information retrieval.
2. To understand the role of clustering in information retrieval.
3. To learn different indexing structures and searching techniques.
4. To evaluate the performance of the IR system and understand user interfaces for searching.
5. To understand information sharing on the web.
6. To understand the various applications of information retrieval giving emphasis to multimedia and distributed IR, web Search.

Course Outcomes:

On completion of the course, students will be able to

CO1. Understand the concept of Information retrieval and to apply clustering in information retrieval.
CO2. Use an indexing approach for retrieval of text and multimedia data.
CO3. Evaluate performance of information retrieval systems.
CO4. Apply the concepts of multimedia and distributed information retrieval.
CO5. Use appropriate tools in analyzing the web information
CO6. Simulate the working of a search engine and recommender system.

COURSE CONTENTS

Unit I	**Introduction to Information Retrieval**	**(06 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 Weighting, Probabilistic Indexing, Automatic Classification. Measures of Association, Different Matching Coefficients, Cluster Hypothesis, **Clustering Techniques: Rocchio's** Algorithm, Single pass algorithm, Single Link algorithm.

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

Unit II	**Indexing and Searching Techniques**	**(06 hrs)**

Indexing: Inverted file, Suffix trees & suffix arrays, Signature Files, Scatter storage or hash addressing.
Searching Techniques: Boolean Search, sequential search, Serial search, cluster-based retrieval, Query languages, Types of queries, Patterns matching, structural queries.
IR Models: Basic concepts, Boolean Model, Vector Model, Probabilistic Model.

Mapping of Course Outcomes for Unit II	**CO2**

Unit III	Evaluation and Visualization of Information Retrieval System	(06 hrs)
Performance evaluation: Precision and recall, MRR, F-Score, NDCG, user-oriented measures. **Visualization in Information System:** Starting points, Query Specification, document context, User relevance judgment, Interface support for search process.		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Distributed and Multimedia IR**	**(06 hrs)**
Distributed IR: Introduction, Collection Partitioning, Source Selection, Query Processing, **Multimedia IR:** Introduction, Data Modeling, Query Language, Background-Spatial Access Method, A Generic Multimedia Indexing Approach, One Dimensional Time Series, Two-Dimensionalcolor Images, Automatic Feature Extraction, Trends and Research Issue.		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**Web Searching**	**(06 hrs)**
Introduction, Challenges, Web Characteristics, **Search Engines:** Centralized Architecture, Distributed Architecture, User Interfaces, Ranking, Crawling the web, Indices, Browsing, Meta-searchers, Searching using Hyperlinks, Trends and Research Issues, **Introduction to Web Scraping:** Python for web scraping, Request, HTML parsing, Beautiful Soup.		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**Advanced Information Retrieval**	**(06hrs)**
XML Retrieval: Basic XML concepts, Challenges in XML retrieval, Vector space model for XML retrieval, Evaluation of XML retrieval, Text-Centric vs. Data-Centric XML retrieval. **Recommendation system:** Collaborative Filtering and Content Based Recommendation of Documents and Products. Introduction to Semantic Web.		
Mapping of Course Outcomes for Unit VI	**CO6**	

Textbooks:

1. Ricardo Baeza-Yates, Berthier Riberio–Neto, Modern Information Retrieval, Pearson Education, ISBN: 81-297-0274-6.
2. C.J. Rijsbergen, Information Retrieval, (www.dcs.gla.ac.uk), Second Edition ISBN:978-408709293.
3. Ryan Mitchell, Web Scraping with Python, O'reilly, second Edition, ISBN: 9781491985571.
4. Ricci F, Rokach L, Shapira B, Kantor P, Recommender Systems Handbook, Springer, ISBN:978-0-387-85819-7.
5. Norbert Fuhr, MouniaLalmas, Saadia Malik, Gabriella Kazai, Advances in XML Information Retrieval and Evaluation, Springer New York Publisher.

Reference Books:

1. ChabaneDjeraba, Multimedia mining: A highway to intelligent multimedia documents, Kulwer Academic Publisher, ISBN: 1-4020-7247-3.
2. V. S. Subrahamanian, Satish K. Tripathi, Multimedia information System, Kulwer Academic Publisher.
3. Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schütze, An Introduction to Information Retrieval, Cambridge University Press, 2008.
4. Marek Kowalkiewicz, Maria E. Orlowska, Tomasz Kaczmarek, Witold Abramowicz, Web Information Extraction and Integration, Springer New York Publisher.
5. David Grossman, Ophir Frieder, Information Retrieval - Algorithms and Heuristics, Springer International Edition, ISBN: 978-1-4020-3004-8.
6. Hang Li, Learning to Rank forInformation Retrieval and Natural Language. 7. Processing, Morgan
7. & Claypool, ISBN: 9781608457076.
8. Robert Korfhage, Information Storage and Retrieval, John Wiley & Sons, First Edition,ISBN: 9788126507702.
9. Zhang, Jin, Visualization for Information Retrieval, Springer-Verlag Berlin Heidelberg,1st Edition, ISBN: 978-3-642-09442-2.

E Books / E Learning References:

1. https://web.stanford.edu/class/cs276/handouts/EvaluationNew-handout-1-per.pdf.
2. https://www.coursera.org/learn/text-retrieval

<table>
<tr><td colspan="4">Savitribai Phule Pune University, Pune
Final Year Information Technology (2019 Course)
414442: Software Project Management</td></tr>
<tr><td>Teaching Scheme:</td><td colspan="2">Credit Scheme:</td><td>Examination Scheme:</td></tr>
<tr><td>Theory (TH): 3 hrs/week</td><td colspan="2">03 Credits</td><td>Mid_Semester:30 Marks
End_Semester:70 Marks</td></tr>
<tr><td colspan="4">Prerequisite Courses: Software Engineering</td></tr>
<tr><td colspan="4">Course Objectives:
1. To discuss the fundamentals of Software Project Management
2. To explain Project Design and Project Evaluation.
3. To acquire skill in Activity Planning and to deal with Risk Management
4. To provide platform to understand through different tools about Project Tracking, Monitoring & Control.
5. To discuss Staff Selection Process and the issues related to Staff Management.
6. To provide exposure to modern tools used for Software Project Management.</td></tr>
<tr><td colspan="4">Course Outcomes:
On completion of the course, students will be able to–
CO1. Apply the practices and methods for successful Software Project Management
CO2. Create Design and Evaluate Project
CO3. Analyze Project Schedule and calculate Risk Management with help of tools.
CO4. Demonstrate different tools used for Project Tracking, Monitoring & Control.
CO5. Identify Staff Selection Process and the issues related to Staff Management.
CO6. Discuss and use modern tools for Software Project Management.</td></tr>
<tr><td colspan="4">COURSE CONTENTS</td></tr>
<tr><td>Unit I</td><td colspan="2">Introduction to Software Project Management</td><td>(6hrs.)</td></tr>
<tr><td colspan="4">Introduction to Software Project Management: Why is Software Project Management important? What is a Project? Contract Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, Some Ways of Categorizing Software Projects, Stakeholders, Setting Objectives, Business Case, Project Success, and Failure, what is Management? Management Control, Traditional versus Modern Project Management Practices.
Case study: Online Shopping System.</td></tr>
<tr><td>Mapping of Course Outcomes for Unit I</td><td colspan="3">CO1</td></tr>
<tr><td>Unit II</td><td colspan="2">Project Design and Evaluation</td><td>(6 hrs.)</td></tr>
<tr><td colspan="4">Project Design: Overview of UML diagrams: Use case, Class, Activity, State, Sequence, Deployment
Project Evaluation: What is Project Evaluation? Importance of Project Evaluation, Cost Benefit Evaluation Techniques
Process Evaluation and Improvement: The Process Improvement Process: The Process Improvement Cycle, Process Measurement: The GQM Paradigm, Process Analysis: Techniques of Process Analysis, Process change: The Process Change Process
Case study: Online Shopping System, Perform Cost-Benefit Analysis using Microsoft Excel</td></tr>
</table>

Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**Activity Planning & Risk Management**	**(6 hrs.)**
Objectives of Activity planning – Project schedules – Activities – Sequencing and Scheduling, Network Planning Models – Formulating Network Model – Forward Pass & Backward Pass Techniques. Risk Management- Introduction, Risk Management, Risk Assessment, Risk identification, Risk Prioritization, Risk Planning, Risk control, Risk Strategies, Evaluating Risk to the schedule Study Risk Management Tools - SpiraPlan by Inflectra, Risk Management Studio, GRC Cloud **Case study:** Online Shopping System		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Project Tracking, Monitoring & Control**	**(6hrs.)**
Introduction: Project Tracking and Control, Monitoring and Control Processes, Collection of Project data, Partial Completion Reporting. **Data Collection Methods:** Phone vs. Online vs. In-Person Interviews, Visualizing Progress, Visual Project Management, Kanban Boards, Project Calendars, Cost Monitoring, Four Steps in Project Cost Management, Earned Value Analysis, Project Tracking, Effective Approach to Track Projects, Status Report: Four features of a Good Status Report, Change Control, Different factors of Change Control Process, Change Process Flow-Diagram, Software Configuration Management, Tasks in SCM Process, Participant of SCM Process. **Software Configuration Management Tools:** Git, Team Foundation Server, Ansible, Managing Contracts, The Stages of Contract Management, Challenges of Contract Management, Benefits of Contract Management, Types of Contracts in Software Project Management **Case study:** Online Shopping System, track different versions of a software using Git tool		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**Managing People and Organizing Teams**	**(6 hrs.)**
Understanding Behavior-Organizational Behavior- Selecting the Right Person for the Job-Instruction in the Best Methods-Motivation-The Oldham-Hackman Job Characteristics Model- Stress-Health and Safety- Ethical and Professional Concerns-Becoming a team-Decision Making-Organization and Team Structures-Coordination Dependencies-Dispersed and Virtual Teams-Communication Genres and plans-Leadership. **Case study:** Team Buildingin Project Management with reference to academic project work.		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**Applications of Software Project Management in Industry**	**(6 hrs.)**

Agile Project Management with Azure DevOps: An Overview of Application Lifecycle Management & Azure DevOps, Traceability, Visibility, Collaboration, and Extensibility. Difference between Microsoft TFS and Azure DevOps.

Metrics in Agile Practice: Introduction to Metrics inAgile Practice, Metrics for Project Management, Agile Project Management in Azure DevOps and TFS.

Case study: Online Shopping System.

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

Textbooks:

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – FifthEdition, Tata McGraw Hill, New Delhi. - ***(for Unit 1, 3, 5)***
2. A Guide to the Project Management Book of Knowledge-Seventh Edition. ***(For Unit 4)***
3. Walker Royce, "Software Project Management" a unified approach. Addison Wesley ISBN 0-20130958-0. ***(For Unit 6)***

Reference Books:

1. JackMarchewka," Information Technology-Project Management", Wiley Student Version, 4th Edition, 2013.
2. Lan Somerville, Software Engineering, Fifth Edition, Addison Wesley Publications, 1996. *(For Unit 2)*
3. JIM Arlow, Ila Neustadt, UML 2 and the Unified Process, Pearson, Second Edition, ISBN:9788131700549 Tom Pender, UML 2 Bible, Wiley India, ISBN: 9788126504527. *(For Unit 2)*
4. James P Lewis, "Project Planning, Scheduling & Control", McGraw Hill, 5th Edition, 2011.
5. PankajJalote," Software Project Management in Practice", Pearson Education, 2002.
6. Gopalaswamy Ramesh, "Managing Global Software Projects" – McGraw Hill Education (India), Fourteenth Reprint 2013.
7. Joachim Rossberg "Agile Project Management with Azure DevOps" Apress. *(For Unit 6)*
8. Robert K. Wyzocki, Rudd McGary, Effective Project Management, WILEYDreamtech India Pvt. Ltd., 2000.

Books / E Learning References:

1. https://www.inflectra.com/SpiraPlan/(for Unit 3)
2. https://www.techtarget.com/searchsecurity/definition/governance-risk-management-and-compliance-GRC(for Unit 3)
3. https://www.softwaretestinghelp.com/risk-management-tools/#3_Risk_Management_Studio (For Unit 3)
4. NPTEL: https://nptel.ac.in/courses/106101061/29
5. https://onlinecourses.nptel.ac.in/noc17_mg01/preview
6. Coursera: https://www.coursera.org/learn/uva-darden-project-management
7. http://managementhelp.org/evaluation/program-evaluation-guide.htm.
8. https://nptel.ac.in/courses/106105218 (NPTEL)
9. Virtual Labs:- Software Engineering- **1) http://vlabs.iitkgp.ernet.in/se/3/** **2) http://vlabs.iitkgp.ernet.in/se/5/** **3) http://vlabs.iitkgp.ernet.in/se/6/** **4) http://vlabs.iitkgp.ernet.in/se/7/**

<table>
<tr><td colspan="3">Savitribai Phule Pune University, Pune
Final Year Information Technology (2019 Course)
414443: Deep Learning</td></tr>
<tr><td>Teaching Scheme:</td><td>Credit Scheme:</td><td>Examination Scheme:</td></tr>
<tr><td>Theory (TH): 3 hrs/week</td><td>03 Credits</td><td>Mid_Semester : 30 Marks
End_Semester : 70 Marks</td></tr>
</table>

Prerequisite Courses:1. Machine Learning 2. Mathematics

Companion Course: Artificial Intelligence Soft computing

Course Objectives:

1. To introduce the theoretical foundations, algorithms, methodologies, and application of neural networks and deep learning.
2. To design and develop an application-specific deep learning model.
3. To provide the practical knowledge handling and analyzing real world applications.

Course Outcomes:

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

CO1. Understand the theoretical foundations, algorithms, and methodologies of Deep Learning.
CO2. Apply the concepts of Convolution Neural Networks and use of popular CNN architectures.
CO3. Compare Feed Forward Neural Network and Recurrent Neural Network and learn modeling the time dimension using RNN and LSTM.
CO4. Elaborate unsupervised deep learning algorithms like Autoencoders.
CO5. Explore Representation Learning and Transfer Learning techniques using variants of CNN architecture.
CO6. Evaluate the performance of deep learning algorithms and to provide solution for various real-world applications.

<table>
<tr><td colspan="3">COURSE CONTENTS</td></tr>
<tr><td>Unit I</td><td>Fundamentals of Deep Learning</td><td>(06 hrs)</td></tr>
<tr><td colspan="3">What is Deep Learning?, Multilayer Perceptron ,Feed forward neural, Back propagation, Gradient descent, Vanishing gradient problem, Activation Functions: RELU, LRELU, ERELU, Optimization Algorithms, Hyper parameters: Layer size, Magnitude (momentum, learning rate),Regularization (dropout, drop connect, L1, L2)</td></tr>
<tr><td>Mapping of Course Outcomes for Unit I</td><td colspan="2">CO1</td></tr>
<tr><td>Unit II</td><td>Convolutional Neural Network:</td><td>(06 hrs)</td></tr>
<tr><td colspan="3">Introduction to CNN, Convolution Operation, Parameter Sharing, Equivariant Representation, Pooling, Variants of the Basic Convolution Function, The basic Architecture of CNN, Popular CNN Architecture – AlexNet.</td></tr>
<tr><td>Mapping of Course Outcomes for Unit II</td><td colspan="2">CO2</td></tr>
<tr><td>Unit III</td><td>Recurrent Neural Networks</td><td>(06 hrs)</td></tr>
</table>

Recurrent Neural Networks: Types of Recurrent Neural Networks, Feed-Forward Neural Networks vs Recurrent Neural Networks, Long Short-Term Memory Networks (LSTM), Encoder Decoder architectures, Recursive Neural Networks		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Autoencoders**	**(06 hrs)**
Undercomplete Autoencoders, Regulraized Autoencoders-Sparse Autoencoders, Stochastic Encoders and Decoders, Denoising Autoencoders, Contractive Autoencoders, Applications of Autoencoders.		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**Representation Learning**	**(06 hrs)**
Greedy Layerwise Pre-training, Transfer Learning and Domain Adaption, Distributed Representation, Variants of CNN: DenseNet.		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**Applications of Deep Learning**	**(06 hrs)**
Overview of Deep Learning Applications: Image Classification, Social N/w/ analysis, Speech Recognition, Recommender system, Natural Language Processing.		
Mapping of Course Outcomes for Unit VI	**CO6**	

Textbooks:

1. Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017
2. Ian Goodfellow, YoshuaBengio and Aaron Courville, “Deep Learning”, MIT Press, 2017.
3. Nikhil Buduma, "Fundamentals of Deep Learning Designing Next-Generation Machine Intelligence Algorithms" O'Reilly

Reference Books:

1. Umberto Michelucci “Applied Deep Learning. A Case-based Approach to Understanding.
2. Deep Neural Networks” Apress, 2018.
3. Kevin P. Murphy "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012.
4. Giancarlo Zaccone, Md. Rezaul Karim, Ahmed Menshawy "Deep Learning with TensorFlow: Explore neural networks with Python", Packt Publisher, 2017.
5. Antonio Gulli, Sujit Pal "Deep Learning with Keras", Packt Publishers, 2017.
6. Francois Chollet "Deep Learning with Python", Manning Publications, 2017.

E Books / E Learning References :

1. Michael Nielsen, “Neural Networks and Deep Learning”, Online book, 2016 (http://neuralnetworksanddeeplearning.com/)
2. Deep Learning for Visual Computing https://onlinecourses.nptel.ac.in/noc22_ee54
3. Deep Learning - IIT Kharagpur https://onlinecourses.nptel.ac.in/noc22_cs22
4. Deep Learning - IIT Ropar https://onlinecourses.nptel.ac.in/noc22_cs35/
5. Introduction to Deep Learning : https://www.coursera.org/learn/introduction-to-deep-learning-boulder
6. Deep Learning Specialization : https://www.coursera.org/specializations/deep-learning

Savitribai Phule Pune University, Pune Final Year Information Technology (2019 Course) 414444: Elective – III (Mobile Computing)		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory (TH):3 hrs/week	**03 Credits**	**Mid_Semester: 30 Marks** **End_Semester: 70 Marks**

Prerequisite Courses :

Companion Course:

Course Objectives:

1. To understand the basic concepts of mobile computing.
2. To learn the basics of mobile telecommunication system.
3. To understand the Generations of Mobile Communication Technologies.
4. To be familiar with the network layer protocols and Ad-Hoc networks.
5. To know the basis of transport and application layer protocols.
6. To gain knowledge about different mobile platforms and application development.

Course Outcomes:

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

CO1. understand the basic concepts of mobile computing, MAC and different multiplexing technics.

CO2. understand Protocols, Connection Establishment, Frequency Allocation, Routing of mobile telecommunication system like GSM, GPRS, UMTS.

CO3. understand the Generations of Mobile Communication Technologies

CO4. learn mobile IP , Adhoc – Network, Reactive Routing protocols, Multicast Routing.

CO5. obtaining knowledge of transport layer protocol TCP, File System, and different application layer protocols.

CO6. gain knowledge about different mobile platforms**,** operating Systems, Software Development Kit, Security Issues.

COURSE CONTENTS

Unit I	Introduction	(06 hrs)

Introduction to Mobile Computing: Applications of Mobile Computing, A short history of wireless communication,

Medium Access Control: Motivation for a specialized MAC: Hidden and Exposed terminals. Near and Far terminals.

SDMA, FDMA, TDMA: Fixed TDM, Classical Aloha, Slotted Aloha, Carrier sense multiple access, Demand assigned multiple access, PRMA packet reservation multiple access, Reservation TDMA, Multiple access with collision avoidance, Polling, Inhibit sense multiple access.

CDMA: Spread Aloha multiple access.

Mapping of Course Outcomes for Unit I	CO1

<table>
<tr><th>Unit II</th><th>Mobile Telecommunication System</th><th>(06 hrs)</th></tr>
<tr><td colspan="3">Introduction to Cellular Systems, GSM: Services &Architecture, Protocols, Connection Establishment, Frequency Allocation, Routing, Mobility Management, Security, GPRS, UMTS: Architecture, Handover, Security.</td></tr>
<tr><td>Mapping of Course Outcomes for Unit II</td><td colspan="2">CO2</td></tr>
<tr><th>Unit III</th><th>Generations of Mobile Communication Technologies.</th><th>(06 hrs)</th></tr>
<tr><td colspan="3">First Generation Wireless Networks, Second Generation (2G) Wireless Cellular Networks, Major 2G standards, 2.5G Wireless Networks, Third Generation 3G Wireless Networks, Fourth Generation 4G wireless networks, Fifth Generation 5G wireless networks</td></tr>
<tr><td>Mapping of Course Outcomes for Unit III</td><td colspan="2">CO3</td></tr>
<tr><th>Unit IV</th><th>Mobile Network Layer</th><th>(06 hrs)</th></tr>
<tr><td colspan="3">Mobile IP: Goals, assumptions and requirements, Entities and Terminology, IP packet delivery, Agent advertisement and discovery, Registration, Tunnelling and Encapsulation, Optimizations, Reverse tunnelling,
IPv6:DHCP, AdHoc networks: Routing, Proactive protocol-DSDV, Reactive Routing Protocols: DSR, AODV, Hybrid routing –ZRP, Multicast Routing: ODMRP, Vehicular Ad Hoc networks (VANET) MANET Vs VANET Security.</td></tr>
<tr><td>Mapping of Course Outcomes for Unit IV</td><td colspan="2">CO4</td></tr>
<tr><th>Unit V</th><th>Mobile Transport Layer</th><th>(06 hrs)</th></tr>
<tr><td colspan="3">Traditional TCP: Congestion control, Slow start, Fast retransmit/fast recovery, Implications on mobility; Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission/time-out freezing, Selective retransmission, Transaction oriented TCP.
Support for Mobility: File systems: Consistency, Examples.
World Wide Web: Hypertext transfer protocol, Hypertext markup language, some approaches that might help wireless access, System architectures
Wireless application protocol: Architecture, Wireless datagram protocol, Wireless transport layer security, Wireless transaction protocol, Wireless session protocol, Wireless application environment, Wireless markup language, WML script, Wireless telephony application, Examples Stacks with WAP, Mobile databases, Mobile agents.</td></tr>
<tr><td>Mapping of Course Outcomes for Unit V</td><td colspan="2">CO5</td></tr>
<tr><th>Unit VI</th><th>Mobile Platforms and Applications</th><th>(06 hrs)</th></tr>
<tr><td colspan="3">Mobile Device Operating Systems, Special Constrains & Requirements, Commercial Mobile Operating Systems.
Software Development Kit: Ios, Android, Blackberry, Windows Phone,
M Commerce, Structure, Pros &Cons, Mobile Payment System, Security Issues.</td></tr>
</table>

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

Textbooks:

1. Yi Bang lin : "Wireless and mobile Network Architectures" Wiley publications
2. William c.y. Lee: "Mobile Communications and Design Fundamentals" Wiley publications

Reference Books:

1. Jochen Schiller, —Mobile Communications, PHI, Second Edition, 2003.
2. Prasant Kumar Pattnaik, Rajib Mall, —Fundamentals of Mobile Computing‖, PHI Learning Pvt.Ltd, New Delhi – 2012
3. C.K.Toh, —AdHoc Mobile Wireless Networks‖, First Edition, Pearson Education, 2002.
4. Principles of Mobile Computing, 2nd Edition, Uwe Hansmann, LotharMerk, Martin Nicklous, Thomas Stober, Springer
5. Mobile Computing, Tomasz Imielinski, Springer

Savitribai Phule Pune University, Pune Final Year Information Technology (2019 Course) 414444: Elective – III (High Performance Computing)		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory (TH): 3 hrs/week	**03 Credits**	**Mid_Semester: 30 Marks** **End_Semester : 70 Marks**

Prerequisite Courses, if any:

Computer Organization, Processor Architecture, Operating Systems

Companion Course, if any:

Course Objectives:

1. To study parallel computing and Parallel Programming Platforms
2. To be conversant with performance of parallel algorithm design
3. To understand the Basic Communication Operations
4. To analyze parallel programming using analytical modeling
5. To understand CUDA architecture
6. To know parallel algorithms for high performance computing

Course Outcomes:

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

CO1. Understand concepts of parallel computing, its application areas and parallel computing platforms
CO2. Apply different Parallel programming paradigm and Decomposition Techniques.
CO3. Correlate various communication calls.
CO4. Analyze and Measure different Performance Metrics.
CO5. Perform CUDA Programming.
CO6. Build the logic to develop parallel algorithms for high performance computing.

COURSE CONTENTS

Unit I	Introduction to Parallel Computing	(6 hrs)

Introduction: What is parallel computing? Motivating Parallelism, Scope of Parallel Computing, Parallel Computing - Grand Challenges and Advantages, Dichotomy of Parallel Computing Platforms (Flynn's Classifications, Distributed Memory Architecture, Shared Memory Architecture, Hybrid Architecture), Communication Costs in Parallel Machines, Interconnection Networks and Routing Mechanisms. Impact of Process-Processor Mapping and Mapping Techniques.

Mapping of Course Outcomes for Unit I	CO1

Unit II	Principles of Parallel Algorithm Design	(6 hrs)

Parallel programming paradigm (Task forming, Pipelining, divide and conquer),
Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Parallel Algorithm Models, Accelerator based computing (Introduction to CUDA and OpenACC)

Mapping of Course Outcomes for Unit II	CO2

Unit III	Basic Communication	(6 hrs)

Message passing paradigm: Synchronous and asynchronous communication calls. Blocking Vs Nonblocking, Introduction to MPI: Point to point communication, Collecting Communication: One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter and Gather, All-to-All Personalized Communication, Circular Shift, Shared memory programming and synchronisation.		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Analytical Modeling of Parallel Programs**	**(6 hrs)**
Sequential execution time, parallel execution time and Sources of Overhead in Parallel Programs , Performance Metrics for Parallel Systems(Speedup, efficiency, Amdahl's law, Gustafson's law) , The effect of Granularity on performance , Scalability of parallel systems , Minimum execution time and minimum cost-optimal execution time, Asymptotic Analysis of parallel programs , other scalability metrics.		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**Shared Memory Programming**	**(6 hrs)**
CUDA Architecture, CUDA Programming (Kernels, synchronization, Memory Contention and Device to Host Communications), OpenMP Programming		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**Parallel Algorithms and Applications**	**(6 hrs)**
Dense Matrix Algorithms (Canon's Algorithm): Matrix-Vector Multiplication, Matrix-Matrix Multiplication, Monto Carlo Simulation (Calculation of PI), Parallel Sorting Algorithms(Bubble Sort and its Variants, Parallelizing Quick sort) Parallel graph (All-Pairs Shortest Paths, Algorithm for sparse graph) Parallel search algorithms (Depth-First Search, Best-First Search)		
Mapping of Course Outcomes for Unit VI	**CO6**	

Textbooks:

1. Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, "Introduction to Parallel Computing", 2nd edition, Addison-Wesley, 2003, ISBN: 0-201-64865-2

2. Jason sanders, Edward Kandrot, "CUDA by Example", Addison-Wesley, ISBN-13: 978-0- 13-138768-3

Reference Books:

1. Kai Hwang," Scalable Parallel Computing", McGraw Hill 1998, ISBN:0070317984

2. Shane Cook, "CUDA Programming: A Developer's Guide to Parallel Computing with GPUs", Morgan Kaufmann Publishers Inc. San Francisco, CA, USA 2013 ISBN: 9780124159884

3. David Culler Jaswinder Pal Singh," Parallel Computer Architecture: A Hardware/Software Approach", Morgan Kaufmann,1999, ISBN 978-1-55860-343-1

E Books / E Learning References:
https://www.geeksforgeeks.org/introduction-to-cuda-programming/
http://cuda.ce.rit.edu/tutorials/tutorials.htm

Savitribai Phule Pune University, Pune Final Year Information Technology (2019 Course) 414444: Elective – III (Multimedia Technology)		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory (TH): 3hrs/week	**03 Credits**	**Mid_Semester: 30 Marks** **End_Semester : 70Marks**

Prerequisite Courses:

1.Data Structures and Files

2. Computer Graphics

Companion Course, if any: Not Applicable

Course Objectives:

1. To describe basic components of multimedia (text, image, audio, video, and animation).
2. To state text and image file formats and apply different compression techniques.
3. To classify different audio and video file formats.
4. To define animation techniques and use open-source authoring tools.
5. To express virtual reality and VR devices used in various applications.
6. To identify emerging trends and practice various tools.

Course Outcomes:

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

CO1. Understand basic building block and applications of Multimedia.
CO2. Solve and analyze different algorithms for text and image compression.
CO3. Classify different audio and video file formats of Multimedia.
CO4. Apply open-source authoring tools of animation.
CO5. List various devices used in virtual reality and its use in daily life.
CO6. Recognize emerging trends in Multimedia.

COURSE CONTENTS

Unit I	**Introduction to Multimedia**	**(6hrs)**

Goals, objectives, and characteristics of multimedia, what is Multimedia, Multimedia and Hypermedia, **Multimedia building blocks:** text, image, audio, video, animation, Overview of Multimedia Software Tools, Multimedia Applications, Multimedia architecture, Evolving Technologies for Multimedia Systems, Some useful editing, and Authoring tools

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

Unit II	**Text and Image Processing**	**(6hrs)**

Text: Text file formats: TXT, DOC; RTF, PDF, PS, EPS, OXPS **Text compression:** Huffman coding, LZ & LZW **Image:** Image Data Representation, Image File formats - BMP, TIFF, JPEG, GIF, PNG **Image processing:** Acquisition, Storage, Communication, Display, Enhancement **Types of Compression:** Lossless: RLE, Shannon - Fano algorithm, Arithmetic coding. **Lossy:** Vector quantization, Fractal Compression Technique, Transform coding and Hybrid: JPEG-DCT		
Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**Audio and Video Processing**	**(6 hrs)**
Audio: Nature of sound waves, characteristics of sound waves, Use of audio in computer applications, psycho-acoustic, MIDI, Digital audio file formats: AIFF, VOC, AVI, WMA, OGG, PCM,MP3,AAC Audio compression techniques: DM, ADPCM and MPEG. **Video:** video signals formats, Video transmission standards: EDTV, CCIR, CIF, SIF, HDTV, Video file formats: AVI, MOV,RM,WAV,FLV,3GP,Video editing, Video Compression: H-261,H-263, MPEG		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Animation**	**(6hrs)**
Animation: Historical Background, Uses of Animation, Traditional Animation, Principal of Animation, Techniques of animation, Computer based Animation, Animation on the Web,3D Animation, Rendering Algorithms, Animation File formats, Animation **tools:** Autodesk Maya		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**Virtual Reality**	**(6hrs)**
Architecture of VR, Concept and History of VR, Human Physiology and Perception, Forms of VR, VR applications, **VR devices:** Hand Gloves, Head mounted tracking system, VR chair, CCD, VCR, 3D Sound System, Head mounted display, Touchable Holograms, **Case Study:** Virtual Reality in education and health care		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**Trends in Multimedia**	**(6hrs)**
Multimedia networking, Quality of data transmission, Multimedia over IP, Media on Demand, Multimedia in Android: Android Multimedia Framework Architecture, Multimedia Databases: storage, retrieval, organization, Multimedia application development: software life cycle overview, Features of Multimedia (text, Image, audio and video) processing software, **Gaming:** Facial Recognition, Voice Recognition,GestureControl,High-DefDisplays,Augmented Reality, Mobile Gaming, Cloud Gaming On-Demand Gaming. **VFX:** Visual Effect and Special Effect, why use Visual Effect, Blender VFX software.		
Mapping of Course Outcomes for Unit VI	**CO6**	

Textbooks:

1. Ralf Steinmetz and Klara Nahrstedt "Multimedia Computing, Communication and Applications ",Pearson Education.
2. Ranjan Parekh,"Principlesof Multimedia",2/E, TataMcGraw-Hill,ISBN:1259006506
3. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016

Reference Books:

1. Ze-Nian Li, Marks S. Drew, "Fundamentals of Multimedia", Pearson Education.
2. Prabhat K. Andleigh, KiranThakrar, “Multimedia Systems Design”, Pearson Education Unit I
3. Gerard Jounghyun Kim, “Designing Virtual Systems: The Structured Approach”, 2005.
4. Foley, Dam, Feiner, Hughes," Computer Graphics Principles & Practice", 2nd Ed, Pearson Education
5. Gonzalez,Woods,"DigitalImageProcessing" Addison Wesley.
6. AlanH.Watt and Mark Watt,"Advanced Animation and Rendering Techniques :Theory and Practice",Addison-Wesley, ACMPress, ISBN:0201544121.
7. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig,Morgan Kaufmann Publishers, San Francisco, CA, 2002.
8. J.R.Parker,“IntroductiontoGameDevelopmentUsingProcessing”,Mercury Learning & Information ;Pap/Comedition.
9. Jeffrey A. Okun& Susan Zwerman, The VES Handbook of Visual Effects: Industry Standard VFX Practices and Procedures, Publisher: Focal Press 2010.

E Books / E Learning References:

1. http://lavalle.pl/vr/book.html
2. https://nptel.ac.in/courses/106/106/106106138
3. https://www.coursera.org/learn/introduction-virtual-reality
4. https://wethegeek.com/technology-trends-in-future-gaming-industry
5. https://docs.blender.org/manual/en/latest/grease_pencil/visual_effects/index.html

<table>
<tr><td colspan="3">SavitribaiPhule Pune University, Pune
Final Year Information Technology (2019 Course)
414444: Elective – III (Smart Computing)</td></tr>
<tr><td>Teaching Scheme:</td><td>Credit Scheme:</td><td>Examination Scheme:</td></tr>
<tr><td>Theory (TH) : 03 hrs/week</td><td>03 Credits</td><td>Mid_Semester:30 Marks
End_Semester: 70 Marks</td></tr>
</table>

Prerequisite Courses, if any:

1. Human Computer Interaction.
2. Basics of Computer Network
3. Processor architecture and interfacing
4. Computer Network and Security

Companion Course, if any:

Course Objectives:

1. To describe smart computing, its properties applications and architectural design.
2. To explain various smart devices and services used in ubiquitous computing.
3. To be acquainted with interfacing of sensors and actuators with microprocessor.
4. To understand Internet of Things and its usefulness for society.

Course Outcomes:

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

CO1. Demonstrate the knowledge of design of smart computing and its applications.

CO2. Describe different generations of mobile and mobile computing projects

CO3. Demonstrate the knowledge of design of Ubicomp and its applications.

CO4. Explain smart devices and services used Ubicomp.

CO5. Implement interfacing of various sensors, actuators to the development boards

CO6. Compare various IoT communication technologies and smart computing applications.

COURSE CONTENTS

<table>
<tr><td>Unit I</td><td>Introduction to Smart Computing</td><td>(06 hrs)</td></tr>
<tr><td colspan="3">What is smart Computing? Bartel’s definition of smart computing, The Five A’s Of Smart Computing, Examples of smart computing, smartphone and mobile computing, Introduction to smartphones, tablet, PDA, or other digital mobile devices, Introduction to smartphone system architecture, Convergence of sensing Computing and Communication, Pervasive Computing or ubiquitous computing, Emerging Mobile Technologies and Applications.</td></tr>
<tr><td>Mapping of Course Outcomes for Unit I</td><td colspan="2">CO1</td></tr>
<tr><td>Unit II</td><td>Mobile Computing</td><td>(06hrs)</td></tr>
<tr><td colspan="3">Evolution of Cellular Networks and Cell Phones (1G,2G,3G,4G and 5G),Vision of mobile computing, Convergence of Mobile Access, Pervasiveness of Mobile Intelligence, Mobile Computing Challenges, study of notable mobile computing projects (oxygen, smart dust, AURA, Wireless GRID)</td></tr>
<tr><td>Mapping of Course Outcomes for Unit II</td><td colspan="2">CO2</td></tr>
<tr><td>Unit III</td><td>Ubiquitous Computing</td><td>(06 hrs)</td></tr>
</table>

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.		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Smart Devices and Services**	**(06 hrs)**
Smart Devices and Service properties, Smart mobile devices and Users, Mobile code, Smart Card Devices and Networks, Service Architecture Models. Service Provision Lifecycle. Virtual Machines and Operating Systems, OS for Mobile Computers and Communicator Devices.		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**Sensors, Actuators and interfacing**	**(06 hrs)**
Sensors: Roles of Sensors & Actuators, Types of sensors, Working of Sensors: Position, occupancy and motion, velocity and acceleration, force, pressure, flow, Acoustic, Humidity, light camera etc. **Development boards:** Types of boards - Arduino, Raspberry pi, Beagle bone, ESP8266, Interfacing of sensors with development boards. Micro- Electro-Mechanical Systems (MEMS), Embedded Systems and Real-Time Systems. Programmable and PID type control system, Robots.		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**Applications of Smart Computing**	**(06 hrs)**
Introduction of IoT: Definition and characteristics of IoT, Technical Building blocks of IoT, Device, Communication Technologies, Data, Physical design of IoT, IoT enabling technologies. **Case studies:** **Smart Home:** Characteristics of Smart Home - Smart Home Energy Management, Smart Appliances, Communication Technologies for Smart Homes, maintenance, security, challenges. **Smart Agricultural:** characteristics and applications -Scarecrow, Smart Irrigation System, Crop Water Management, Integrated Pest Management, Sensor-based field and resource mapping, Remote equipment monitoring)		
Mapping of Course Outcomes for Unit VI	**CO6**	
Textbooks:		
1. Smart Phone and Next Generation Mobile Computing (Morgan Kaufmann Series in Networking), PeiZheng, Lionel Ni **2.** Stefan Poslad, Ubiquitous Computing, Wiley, Student Edition, ISBN:9788126527335John Krumm, Ubiquitous Computing Fundamentals **3.** ArshdeepBahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, ISBN: 0: 0996025510, 13: 978-0996025515.		

Reference Books:
1. Principles Of Mobile Computing, Hansmann, LotharMerk, Martin Niclous, Stober **2.** Mobile Computing, Tomasz Imielinski, Springer **3.** Laurence T. Yeng, EviSyukur and Seng W. Loke, Handbook on Mobile and UbiquitousComputing, CRC, 2nd Edition, ISBN: 9781439848111 **4.** Lyla B. Das, “Embedded Systems: An Integrated Approach” Pearson, ISBN: 9332511675, 9789332511675 **5.** Smart Internet of things projects AgusKurniawanPackt - Sep 2016 978-1- 78646- 651-8 2 The Internet of Things Key Olivier Willy Publication 2nd Edition 978-
E Books / E Learning References
1. White Paper on Smart Computing Drives the New Era Of IT Growth by Andrew H. Bartels for Vendor Strategy Professionals.

<table>
<tr><td colspan="3">Savitribai Phule Pune University, Pune
Final Year Information Technology (2019 Course)
414445: Elective – IV (Bioinformatics)</td></tr>
<tr><td>Teaching Scheme:</td><td>Credit Scheme:</td><td>Examination Scheme:</td></tr>
<tr><td>Theory (TH):3 hrs/week</td><td>03 Credits</td><td>Mid_Semester:30 Marks
End_Semester: 70 Marks</td></tr>
<tr><td colspan="3">Prerequisite Courses:
Basics of biology, Design and Analysis of Algorithms Basic concepts of Data Mining and Machine Learning</td></tr>
<tr><td colspan="3">Companion Course: biotechnology, drug designing and development, bio-analytics, proteomics</td></tr>
<tr><td colspan="3">Course Objectives:
1. To introduce basic concepts and functions of bioinformatics and its applications
2. To study and Understand concept of biological databases, to study different Pattern Matching Techniques and algorithms for knowledge discovery in Bioinformatics databases through sequence alignment algorithms.
3. To analyze various simulation tools and algorithms in Bioinformatics for fast pairwise sequence alignment
4. To study Protein Structure Modeling and simulation and Drug discovery process and Anatomy of Proteins
5. To study Recent Trends in Bioinformatics such as Environmental Biotechnology, Application of nanotechnology, Genetic engineering etc.</td></tr>
<tr><td colspan="3">Course Outcomes:
On completion of the course, students will be able to–
CO1. Integrate biological concepts with information technologies to study the biological system.
CO2. Study Gene structure, various biological database, and methods to manage the different types of biological data.
CO3. Describe principles and algorithms of pairwise and multiple alignments.
CO4. Study various bioinformatics tools and Algorithm.
CO5. Understand modeling and simulation in bioinformatics, drug discovery process. and Protein Structure.
CO6. To Gain awareness in field of System Biology and Human Disease.</td></tr>
<tr><td colspan="3">COURSE CONTENTS</td></tr>
<tr><td>Unit I</td><td>Basic of Bioinformatics</td><td>(06 hrs)</td></tr>
<tr><td colspan="3">What is Bioinformatics and its relationship with molecular biology, Information Theory and Central Dogma of Molecular Biology, Bioinformatics Scope, Challenges and Bioinformatics Applications, Features and Major Databases in Bioinformatics, Interdisciplinary nature of Bioinformatics, Major Bioinformatics databases and tools.</td></tr>
<tr><td>Mapping of Course Outcomes for Unit I</td><td colspan="2">CO1</td></tr>
<tr><td>Unit II</td><td>Biological database and Gene Structure</td><td>(06hrs)</td></tr>
</table>

Types of biological Database, Primary, Secondary and Structural data bases, tools for web search, data retrieval tools **Protein primary databases** - PIR, SWISS-PROT; Composite protein sequence database -NRDB, OWL, **Protein secondary databases** - PROSITE, Profiles; Database on protein structures – PDB, Genome databases - human (HGP) **What is a Gene?** Structural Genes, Genome Sequencing and Applications of Genetics Maps		
Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**Sequence Alignment and Data Visualization**	**(06 hrs)**
Introduction to Sequence alignments and dynamic programming; Local alignment and Global Alignment. Methods of Sequence Alignments, Scoring Matrix: PAM and BLOSUM Sequence Visualization, Sequence maps, Structure Visualization and rendering tools, Statistical Concepts Microarray.		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Bioinformatics Algorithm and Tools**	**(06 hrs)**
Biological algorithm vs. computer algorithms, Clustering, and classification algorithms FASTA Algorithm, BLAST Algorithm and its comparison, Hidden Markov Models, Graph and Genetics Algorithm.		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**Drug Discovery and Protein structure determination techniques**	**(06hrs)**
What is Drug and Drug discovery process? Modelling and Simulation Process, Applications of Bioinformatics in Drug Discovery Process. **Proteins:** Principles of protein structure; anatomy of proteins – Hierarchical organization of protein **structure –** Primary. Secondary, Super secondary, Tertiary and Quaternary structure.		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**Recent Trends in Bioinformatics**	**(6hrs)**
Environmental Biotechnology, Application of nanotechnology, Genetic engineering, and therapeutic application of stem cell. Future of medicine		
Mapping of Course Outcomes for Unit VI	**CO6**	

Textbooks:
1. S.C.Rastogi, N.Mendiratta, P.Rastogi 'Bioinformatics-Methods & Application Genomics, Proteomics and Drug Discovery', Third Edition, Prentice Hall of India. **2.** Bryan Bergeron, 'Bioinformatics Computing', Pearson Education **3.** OrpitaBosumSimminder Kaur Thukral 'Bioinformatics: Databases, Tools and Algorithms', Oxford press. **4.** Neil C. Jones and Pavel A. Pevzner, "An Introduction to Bioinformatics Algorithms", MIT Press, First IndianReprint 2005
Reference Books:
1. SupratimChoudhuri , "BIOINFORMATICS FOR BEGINNERS Genes, Genomes, Molecular Evolution, Databases and Analytical Tools", Academic Press is an imprint of Elsevier **2.** Baxevanis, A. D. and Ouellette. B. F. F. 2004. Bioinformatics: A practical guide to theanalysis of genes and proteins. Wiley Inter-science. New York. 560 p.
E Books / E Learning References:
1. www.Bioinformatics.org **2.** www.bioinfo.mbb.yale.edu/mbb452a/intro/

Savitribai Phule Pune University, Pune Final Year Information Technology (2019 Course) 414445: Elective – IV (Introduction to DevOps)		
Teaching Scheme	**Credit Scheme**	**Examination Scheme**
Theory (TH): 3 hrs/week	**03 Credits**	**Mid_Semester: 30 Marks** **End_Semester: 70 Marks**

Prerequisite Courses: Software Engineering and Project Management, Cloud Computing

Companion Course, if any:

Course Objectives:

1. To understand the need of DevOps as a software engineering practice.
2. To understand the background of DevOps Evolution.
3. To know and understand the concept of Continuous Integration Continuous Delivery (CICD).
4. To learn the concept of continuous deployment and test strategies.
5. To learn the monitoring system and reliability engineering.
6. To explore the emerging tools used in the DevOps lifecycle.

Course Outcomes:

On completion of the course, students will be able –

CO1. Understand the fundamental concepts of DevOps

CO2. Link the background of DevOps with other technologies

CO3. Comprehend the concept of continuous integration and continuous delivery

CO4. Compare various stages of continuous deployment and test strategies

CO5. Justify the importance of monitoring system and reliability engineering

CO6. Use the latest tools in DevOps

COURSE CONTENTS

Unit I	Introduction to DevOps and the Culture	(6 hrs)

What is DevOps? Role of DevOps Engineer, Developer responsibility, Introduction to Continuous Integration and Continuous Delivery Policies, DevOps Culture: Dilution of barriers in IT departments, Process automation, Agile Practices, Reason for adopting DevOps, What and Who Are Involved in DevOps? Changing the Coordination, Introduction to DevOps pipeline phases , Defining the Development Pipeline, Centralizing the Building Server, Monitoring Best Practices, Best Practices for Operations.

Mapping of Course Outcomes for Unit I	CO1

Unit II	Microservices Architecture and Cloud Native Development	(6 hrs)

Monolithic applications, Introduction to microservice architecture, Implementing a microservices Architecture, Pros and Cons of a microservice Architecture, Characteristics of microservice architecture, Monolithic applications and microservices compared, microservices best practices, Deployment strategies, Introduction to cloud computing, cloud computing deployment models, service models, why to use cloud, Principle of container based application design, Introduction to Docker, Serverless computing, orchestration, Difference between orchestration and automation

Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**Continuous Integration and Test-Driven Development**	**(6 hrs)**
Introduction to continuous integration, time to market and quality, Build in a Continuous Integration Scenario, Code Repository Server, Continuous Integration Server, Introduction to Continuous Delivery and chain, Differentiate Continuous Integration and Continuous Delivery, Strategies for Continuous Delivery, Benefits of Continuous Integration and Continuous Delivery, Designing a CI and CD System, Building Continuous Integration and Continuous Delivery Pipelines, Continuous Database Integration, Preparing the Build for Release, Identifying the Code in the Repository, Creating Build Reports, Putting the Build in a Shared Location, Releasing the Build		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Continuous Deployment and Orchestration**	**(6 hrs)**
Implementing a testing Strategy: Types of Tests, Integration testing, managing defect backlogs, what is Continuous Deployment? Changes moving through the deployment pipeline, Trade-offs in the deployment pipeline, Basic Deployment pipeline, Deployment pipeline practices & Commit stage, Automated Acceptance Test Gate, Subsequent test stages, preparing to release, Implementing a deployment pipeline		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**Continuous Monitoring and Site Reliability**	**(6 hrs)**
What is a monitoring system? Factors involved in monitoring systems, why monitoring is important, white-box and black-box monitoring, building a monitoring system, monitoring infrastructure and applications, collecting data, logging, creating dashboard, behavior driven monitoring, what is site reliability engineering? SRE and DevOps, roles, and responsibilities of SRE, common tools used by SREs		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**DevOps Tooling and Case Studies**	**(6 hrs)**
Continuous Development/ Version Control: Git, Serverless orchestration: Kubernetes, Container Technology: Docker, Continuous Integration: Jenkins, Continuous delivery: Jenkins, Continuous Deployment: Ansible, Continuous Testing: Selenium, Monitoring: Prometheus, Bug tracking tool: Jira, elk stack. Case study: Spotify: Using Docker, Bank of New Zealand, EtSy.		
Mapping of Course Outcomes for Unit VI	**CO6**	
Textbooks:		
1. PierluigiRiti, “Pro DevOps with Google Cloud Platform”, Apress, ISBN: 978-1-4842-3896-7. **2.** Katrina Clokie, “A Practical Guide to Testing in DevOps”, Lean Publishing published on 2017-08-01 **3.** Jez Humble and David Farley, “Continuous Delivery”, Pearson Education, Inc, ISBN: 978–0–321–60191–9		

Reference Books:
1. Viktor Farcic, “The DevOps 2.0 Toolkit: Automating the Continuous Deployment Pipeline with Containerized Microservices” **2.** Jennifer Davis and Katherine Daniels, “Effective DevOps: Building a Culture of Collaboration, Anity, and Tooling at Scale”, O’Reilly Media, Inc., ISBN: 978-1-491-92630-7 **3.** Sanjeev Sharma and Bernie Coyne, “DevOps for Dummies”, John Wiley & Sons, Inc., 2nd IBM Limited Edition, ISBN: 978-1-119-04705-6
Web Links:
1. https://www.redhat.com/en/resources/cloud-native-container-design-whitepaper **2.** https://www.redhat.com/en/topics/cloud-native-apps/what-is-serverless **3.** https://www.redhat.com/en/topics/automation/what-is-orchestration **4.** https://www.atlassian.com/continuous-delivery/continuous-integration **5.** https://www.flagship.io/glossary/site-reliability-engineer/ **6.** https://docs.microsoft.com/en-us/learn/paths/intro-to-vc-git/ **7.** https://www.javatpoint.com/kubernetes **8.** https://www.javatpoint.com/docker-tutorial **9.** https://www.javatpoint.com/jenkins **10.** https://www.javatpoint.com/jenkinss **11.** https://www.javatpoint.com/ansible **12.** https://www.javatpoint.com/selenium-tutorial **13.** https://prometheus.io/docs/introduction/overview/ **14.** https://www.javatpoint.com/jira-tutorial **15.** https://www.geeksforgeeks.org/what-is-elastic-stack-and-elasticsearch/

<table>
<tr><td colspan="3" align="center">Savitribai Phule Pune University, Pune
Final Year Information Technology (2019 Course)
414445: Elective – IV (Computer Vision)</td></tr>
<tr><td>Teaching Scheme</td><td>Credit Scheme</td><td>Examination Scheme</td></tr>
<tr><td>Theory (TH): 3 hrs/week</td><td>03 Credits</td><td>Mid_Semester: 30 Marks
End_Semester: 70 Marks</td></tr>
</table>

Prerequisite Courses:
1. Students should know vectors, linear algebra (i.e., matrix operations, solution of linear equations).
2. Programming language (e.g., C, Matlab, Python etc).

Companion Course, if any:

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 Feature extraction techniques.
5. To study some applications of computer vision algorithms.

Course Outcomes:

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

CO1. Implement fundamental image processing techniques required for computer vision.
CO2. Apply feature extraction techniques.
CO3. Apply Hough Transform for line, circle, and ellipse detections.
CO4. Understand three-dimensional analysis techniques.
CO5. Develop skills to develop applications using computer vision techniques.

COURSE CONTENTS

Unit I	**Fundamentals of Digital Image Processing**	**(6 hrs)**

Introduction to Computer Vision?, Fundamentals Of Image Formation, **Review of Digital image processing:** Introduction, Origin, Applications and Examples of Digital Image Processing, Fundamental steps in Digital Image Processing, Components of Digital Image Processing, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Basic Relationship between pixels, **image processing techniques:** classical filtering operations, Thresholding techniques, edge detection techniques, corner and interest point detection, texture Analysis

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

Unit II	**Shapes and Regions**	**(6 hrs)**

Binary shape analysis, Connectedness, object labelling and counting, size filtering, distance functions and their uses, skeletons and thinning, Other Measures for Shape Recognition, Boundary pattern analysis: Boundary Tracking Procedures, Centroidal Profiles, Tackling the Problems of Occlusion, Accuracy of Boundary Length Measures, Object segmentation and shape models, Active Contours, Shape Models

Mapping of Course Outcomes for Unit II	**CO2**

Unit III	**Feature Detection and Matching**	**(6 hrs)**

Points and patches: Feature detectors, Feature descriptors, Feature matching, Feature tracking Application: Performance-driven animation, **Edges:** Edge detection, Edge linking, Application: Edge editing and enhancement, Vanishing points, **Application:** Rectangle detection		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Hough Transform**	**(6 hrs)**
Line detection – Hough Transform (HT) for line detection, the foot-of-normal method, Using RANSAC for Straight Line Detection, Hough-Based Schemes for Circular Object Detection, The Problem of Unknown Circle Radius, Overcoming the Speed Problem, Ellipse Detection, Applications, and case study: Human Iris Location, The Generalized Hough Transform (GHT), Use of the GHT for Ellipse Detection, A Graph-Theoretic Approach to Object Location, Possibilities for Saving Computation, Using the GHT for Feature Collation		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**3D Vision and Motion**	**(6 hrs)**
The three-dimensional world, Methods for 3D vision, projection schemes for 3D vision, Shape from X : shape from shading, Photometric Stereo, Shape from texture, Share from focus, The Assumption of Surface Smoothness, Shape from Texture, Use of Structured Lighting, 3D Reconstruction, active range finding, surface representations, point-based representation, volumetric representations, Structure from motion: triangulation, bundle adjustment, Dense motion estimation: translational alignment, parametric motion, spline based motion, Optical flow layered motion		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**Computer Vision Applications**	**(6 hrs)**
Application: Photo album – Object detection, Face detection, Pedestrian detection, Face recognition: Eigen faces, Active appearance and 3D shape models, Application: Personal Photo Collections, Category Recognition, Intelligent Photo Editing, Image Search, **Application: Surveillance** – The basic geometry, foreground-background separation, particle filters, Chamfer Matching, Tracking, and Occlusion, combining views from multiple cameras, License Plate Location, Occlusion Classification for Tracking, Human Gait Analysis, In-vehicle vision system: Locating the Roadway, Location of Road Markings, Location of Road Signs, Location of Vehicles, Locating Pedestrians		
Mapping of Course Outcomes for Unit VI	**CO6**	

Textbooks:

1. Simon J. D. Prince, "Computer Vision: Models, Learning, and Inference", Cambridge University Press, 2012.
2. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", 3rdEdition, Pearson, ISBN: 978-81-317-2695-2

Reference Books:

1. R. Davies, "Computer & Machine Vision", Fourth Edition, Academic Press, 2012.
2. R. Szeliski, "Computer Vision: Algorithms and Applications", Springer 2011.
3. Mark Nixon and Alberto S. Aquado, "Feature Extraction & Image Processing for Computer Vision", Third Edition, Academic Press, 2012.
4. D. L. Baggio et al., "Mastering OpenCV with Practical Computer Vision Projects", Packt Publishing, 2012.
5. Jan Erik Solem, "Programming Computer Vision with Python: Tools and algorithms for analyzing images", O'Reilly Media, 2012.
6. Sudha Challa, "Fundamentals of Object Tracking", Cambridge University Press, 2011.

Online references:

1. http://kercd.free.fr/linksKCD.html
2. http://www.cs.ubc.ca/spider/lowe/vision.html
3. http://www.visionscience.com/
4. https://www.fritz.ai/object-detection/
5. https://viso.ai/deep-learning/object-tracking/
6. https://www.pearson.com/us/higher-education/program/Gonzalez-Digital-Image-Processing-4th-Edition/PGM241219.html?tab=resources

Savitribai Phule Pune University, Pune
Final Year Information Technology (2019 Course)
414445: Elective – IV (Wireless Communication)

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

Prerequisite Courses: Basic Computer Networks, Computer Networks and Security, Mobile Computing

Companion Course :NA

Course Objectives:

1.To learn fundamental knowledge of wireless communication and generation of cellular network.

2. To understand basic fundamentals of cellular system and LTE Technology.

3. To study various multiple access techniques to access the shared channel.

4.To learn various protocols and applications in wireless communication system.

5. To understand security issues, challenges and tools in wireless communication system.

6. To study recent trends and technologies in wireless communication.

Course Outcomes:

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

CO1: Articulate the fundamental concept of cellular system.

CO2: Analyse the fundamentals of cellular systems.

CO3: Illustrate multiple access technique for effective utilization of spectrum.

CO4: Design and analyse the WAP Programming Model in networking environment.

CO5: Learn and understand security issues, challenges and tools in wireless communication.

CO6: Explore the emerging trends and applications in wireless communication.

COURSE CONTENTS

Unit I	Introduction to Wireless Communication	(6hrs)

Evolution of mobile communications, Types of Wireless Communication: Satellite Communication, Microwave Communication, Infrared, Generation of Cellular network, 2G/3G/4G/5G/6G.

Unit II	Fundamentals of Cellular and LTE Technology	(6hrs)

Cellular system, hexagonal geometry cell and concept of frequency reuse, Need of LTE Long Term Evolution (LTE) Technology fundamentals: Architecture features. **4G:** LTE communication protocol: Protocol model, Air Interface Transport Protocols, Fixed Network Transport Protocols, User Plane Protocols , Signalling Protocols

Unit III	Multiple Access Techniques	(6hrs)

Overview of TDMA (Time Division Multiple Access), and CDMA (Code Division Multiple Access), SDMA (Space Division Multiple Access), IDMA (Interleave Division Multiple Access).
Latest access technologies: MIMO (Multiple Input Multiple Output), OFDM (Orthogonal Frequency Division Multiplexing).

Unit IV	Wireless Communication Protocols	(6 hrs)

Wireless Application Protocol, The WAP Programming Model, WAP Architecture, Traditional WAP Networking Environment, Wi-Fi Direct, Li-Fi, NFC, SigFox, Z-Wave, LoRaWAN, Thread (based on IEEE 802.15.4), RT Wi-Fi, RTCP, RTSP, SPEED.

Unit V	Security in Wireless Communication	(6 hrs)

Security Issue and challenges in GSM, 1G, 2G, 3G, 4G.
Multimedia security in 5G and 6G, post-quantum cryptography, Molecular communication, visible light communication (VLC), and distributed ledger (DL). UMTS Security, Bluetooth Security, WEP, WPA2.
Wireless Security Tools: Kismet, URH (Universal Radio Hacker).

Unit VI	Recent Trends and Applications in Wireless Technology	(6 hrs)

5G NR (New Redio): Working, Benefits.
Holographic MIMO Surfaces for 6G Wireless Networks, Simultaneous Transmission and Reflection (STAR) for 360° Coverage, Quantum technology for 5G/6G Wireless Networks.
Applications of Wireless Technology.

Textbooks:

1. Wireless Communications, T.L. Singal, McGraw Hill Education.
2. Wireless Communications and Networking, Vijay Garg, Morgan Kaufmann Publishers.
3. Wireless Mobile Internet Security, 2nd Edition, Man Young Rhee, A John Wiley & Sons, Ltd., Publication.
4. Principles of Modern Wireless Communication Systems Theory and Practice, 1st Edition, Aditya Jagannatham.
5. 5G Outlook–Innovations and Applications,RamjeePrasad,River Publishers Series in Communications.
6. Designing for Cisco Internetwork Solutions, 2nd Edition, CCDA, Diane Teare, Cisco Press

Reference Books:

1. Cellular Communications: A Comprehensive and Practical Guide, Nishith Tripathi, Jeffery H Reed, Wiley.
2. Wireless Communications- Principles &Practice,Theodore S. Rappaport, Prentice Hall Series.
3. Wireless Communications and Networks", William Stallings, Pearson / Prentice Hall.
4. Adhoc& Sensor Networks Theory and Applications, Carlos de MoraisCordeiro,Dharma Prakash Agrawal, World Scientific,2nd Edition.
5. Wireless Networks, Nicopolitidia, M S Obaidat, GI Papadimitriou, Wiley India (Student Edition, 2010).
6. Wireless Communications, Andrea Goldsmith, Cambridge University Press, 1st South Asian Edition 2009.
7. https://pcefet.com/common/library/books/50/2784_[Christopher_Cox]_An_Introduction_to_LTE_LTE,_LTE(b-ok.org).pdf
8. https://www.techtarget.com/whatis/definition/5G-New-Radio-NR.

Savitribai Phule Pune University, Pune Final Year Information Technology (2019 Course) 414446: Lab Practice III		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical (PR): 04 hrs/week	**02 Credits**	**OR: 25 Marks** **TW: 25 Marks**

Prerequisites:

1. Data Structures and Files.
2. Database management systems.

Course Objectives:

1. To understand the concepts of information retrieval.
2. To understand the role of clustering in information retrieval.
3. To study indexing structures for information retrieval.
4. To evaluate the performance of the IR system and understand user interfaces for searching.
5. To understand information sharing on the web.
6. To understand the various applications of information retrieval giving emphasis to multimedia and distributed IR, web Search.

Course Outcomes:

On completion of the course, students will be able to

CO1. Understand the concept of Information retrieval and to apply clustering in information retrieval.

CO2. Use appropriate indexing approach for retrieval of text and multimedia data. Evaluate performance of information retrieval systems.

CO3. Apply appropriate tools in analyzing the web information.

CO4. Map the concepts of the subject on recent developments in the Information retrieval field.

Guidelines for Instructor's Manual
The faculty member should prepare the laboratory manual for all the laboratory assignments, and it should be made available to the students and laboratory instructor/Assistant.
Guidelines for Student's Lab Journal
1. Students should submit term work in the form of journals. The Journal consists of prologue, certificate, table of contents, handwritten write-up of each assignment (Title, Objectives, Problem Statement, Theory concept, Outcomes, Conclusion), and 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 in the form CD/DVD and should be maintained by the batch teacher. **2.** Oral Examination will be based on the ISR theory and practical assignments. **3.** Students are expected to know the theory involved in the experiment. **4.** The oral examination should be conducted if and only if the journal of the candidate is complete in **5.** All respects and certified by concerned faculty and head of the department. **6.** All the assignments mentioned in the list 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 completion 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 concept by asking the questions related to theory & laboratory assignments. **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
All the assignments should be conducted on 64-bit open-source software. C/C++/Java programming language can be used for implementation of assignments if not mentioned. 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's 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 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 question asked. 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. Implement Conflation algorithm to generate document representative of a text file.
2. Implement Single-pass Algorithm for clustering of files.(Consider 4 to 5 files)
3. Implement a program for retrieval of documents using inverted files.

Group B: CO3, 5

1. Implement a program to calculate precision and recall for sample input. (Answer set A, Query q_1, Relevant documents to query q_1- Rq_1)
2. Write a program to calculate harmonic mean (F-measure) and E-measure for above example.
3. Implement a program for feature extraction in 2D color images (any features like color, texture etc. and to extract features from input image and plot histogram for the features.

Group C: CO4, 5

1. Build the web crawler to pull product information and links from an e-commerce website. (Python)
2. Write a program to find the live weather report (temperature, wind speed, description, and weather) of a given city. (Python).
3. Case study on recommender system for a product / Doctor / Product price / Music.

Textbooks:

1. Ricardo Baeza-Yates, Berthier Riberio–Neto, Modern Information Retrieval, Pearson Education, ISBN: 81-297-0274-6.
2. C.J. Rijsbergen, Information Retrieval, (www.dcs.gla.ac.uk), Second Edition ISBN:978-408709293.
3. Ryan Mitchell, Web Scraping with Python, O'reilly.
4. Ricci, F, Rokach, L. Shapira, B.Kantor, Recommender Systems Handbook.

Reference Books:

1. ChabaneDjeraba, Multimedia mining: A highway to intelligent multimedia documents, Kulwer Academic Publisher, ISBN: 1-4020-7247-3.
2. V. S. Subrahamanian, Satish K. Tripathi, Multimedia information System, Kulwer AcademicPublisher.
3. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze, An Introduction to Information Retrieval, Cambridge University Press, 2008.
4. Marek Kowalkiewicz, Maria E. Orlowska, Tomasz Kaczmarek, Witold Abramowicz, WebInformation Extraction and Integration, Springer New York Publisher.
5. David Grossman, Ophir Frieder, Information Retrieval - Algorithms and Heuristics, Springer,International Edition, ISBN: 978-1-4020-3004-8.
6. Hang Li, Learning to Rank for Information Retrieval and Natural Language. 7. Processing, Morgan& Claypool, ISBN: 9781608457076.
7. Robert Korfhage, Information Storage and Retrieval, John Wiley & Sons, First Edition,ISBN: 9788126507702.
8. https://web.stanford.edu/class/cs276/handouts/EvaluationNew-handout-1-per.pdf.

Virtual Laboratory:

1. http://nlp-iiith.vlabs.ac.in/

Savitribai Phule Pune University, Pune
Final Year Information Technology (2019 Course)
414447: Lab Practice IV

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

Prerequisites: Python programming language

Course Objectives:

The objective of the course is

1. To be able to formulate deep learning problems corresponding to different applications.
2. To be able to apply deep learning algorithms to solve problems of moderate complexity.
3. To apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

Course Outcomes:

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

CO1. Learn and Use various Deep Learning tools and packages.
CO2. Build and train a deep Neural Network models for use in various applications.
CO3. Apply Deep Learning techniques like CNN, RNN Auto encoders to solve real word Problems.
CO4. Evaluate the performance of the model build using Deep Learning.

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

Guidelines for Lab /TW Assessment

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

List of Laboratory Assignments

Mapping of course outcomes for Group A assignments: CO1, CO2,CO3,CO4

1. Study of Deep learning Packages: Tensorflow, Keras, Theano and PyTorch. Document the distinct features and functionality of the packages.

Note: Use a suitable dataset for the implementation of following assignments.

2. Implementing Feedforward neural networks with Keras and TensorFlow
   - **a.** Import the necessary packages
   - **b.** Load the training and testing data (MNIST/CIFAR10)
   - **c.** Define the network architecture using Keras
   - **d.** Train the model using SGD
   - **e.** Evaluate the network
   - **f.** Plot the training loss and accuracy

3. Build the Image classification model by dividing the model into following 4 stages:
   - **a.** Loading and preprocessing the image data
   - **b.** Defining the model's architecture
   - **c.** Training the model
   - **d.** Estimating the model's performance

4. Use Autoencoder to implement anomaly detection. Build the model by using:
   - **a.** Import required libraries
   - **b.** Upload / access the dataset
   - **c.** Encoder converts it into latent representation
   - **d.** Decoder networks convert it back to the original input
   - **e.** Compile the models with Optimizer, Loss, and Evaluation Metrics

5. Implement the Continuous Bag of Words (CBOW) Model. Stages can be:
   - **a.** Data preparation
   - **b.** Generate training data
   - **c.** Train model
   - **d.** Output

6. Object detection using Transfer Learning of CNN architectures

a. Load in a pre-trained CNN model trained on a large dataset
b. Freeze parameters (weights) in model's lower convolutional layers
c. Add custom classifier with several layers of trainable parameters to model
d. Train classifier layers on training data available for task
e. Fine-tune hyper parameters and unfreeze more layers as needed

Reference Books:

1. Hands-On Deep Learning Algorithms with Python: Master Deep Learning Algorithms with Extensive Math by Implementing Them Using TensorFlow
2. Python Deep Learning, 2nd Edition by Ivan Vasilev , Daniel Slater , GianmarioSpacagna,, Peter Roelants, Valentino Zocca
3. Natural Language Processing with Python Quick Start Guide by Mirant Kasliwal

Virtual Laboratory:

SPIT's Virtual Labs for AI and Deep Learning: https://vlab.spit.ac.in/ai/

Savitribai Phule Pune University, Pune
Final Year Information Technology (2019 Course)
414448: Project Stage I

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Tutorial (TUT): 02 hrs/week	02 Credits	Term Work: 50 Marks

Prerequisite Courses, if any: PBL, Seminar, Basic Knowledge of Latest Technologies in IT.

Companion Course, if any: NOT APPLICABLE

Course Objectives:

1. To build up their practical experience with implementation and hence develops self-confidence.
2. To generate the opportunities to experience practically the facts learned in various fields together.
3. To improve overall communication skill, Teamwork and Leadership Qualities, professionalism.
4. To apply the knowledge for solving realistic problems.
5. To evaluate alternative approaches and justify the use of selected tools and methods.

Course Outcomes:

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

CO1. To apply knowledge of mathematics, science, and engineering to formulate the Problem statement.
CO2. To design and conduct experiments, as well as to analyze and interpret data.
CO3. Understand the professional and ethical responsibility.
CO4. To communicate effectively.
CO5. Get broad education which is necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
CO6. Recognition of the need for, and an ability to engage in life-long learning.
CO7. To use the techniques, skills, and modern engineering tools necessary for engineering practices.
CO8. To design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

Introductory Information:

BE Project can be application oriented and/or will be based on some innovative work in recent technologies like IoT, Cloud Computing, Web Technologies, Bio-inspired Algorithms, Artificial Intelligence, Machine Learning, Natural Language Processing, Theoretical Computer Science fundamentals. 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. 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 based on their internship or Guide can suggest based on recent technologies / Industrial Applications.

Guidelines to Faculty and Students:

1) The Head of the department / Project coordinator shall constitute a review committee (preferably same committee needs to carry throughout the year) for project group; project guide would be one member of that committee by default.
2) For sponsored projects, an employee of the sponsoring organization may be one of the member of review committee.
3) There shall be **TWO** reviews in Project phase –I (in semester-I) by the review committee.
4) The Project Review committee will be responsible for evaluating the timely progress of the projects. It is suggested to evaluate the skills learned by the students in their PBL (in their previous years).
5) Student should identify project of enough complexity, which has at least 4-5 major functionalities.
6) Student should adopt skills learned in Software Engineering / Software Architecture to identify stakeholders, actors, Architectural Styles etc... and write detail problem statement for the system.
7) Review committee should finalize the scope of the project.
8) 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 which should be approved by review committee.
9) Every student of the project group shall make presentation on the progress made by them before the committee during each review. Each student/group is required to give presentation as part of review for 10 to 15 minutes followed by a detailed discussion and query session.
10) Students need to note down the queries raised during review(s) and comply the same in the next review session.
11) The record of the remarks/suggestions of the review committee (project dairy) should be properly maintained and should be made available at the time of university examination.
12) Project group needs to present / publish TWO papers (One in each semester, at least one paper should be in **UGC – Care journal**).
    a) Paper must be checked for Plagiarism by any open software.
    b) One paper during first semester which includes Literature Survey and Detailed design components of the Project Statement.
    c) One paper during second semester which includes Methodologies / Algorithms implemented, Results obtained, Analysis of results and conclusion.
13) Project report must also be checked for Plagiarism.
14) The examinee will be assessed by a panel of examiners of which one is necessarily an external examiner. The assessment will be broadly based on work undergone, content delivery, presentation skills, documentation, question-answers, and report.

Review 1: Synopsis –

Points to be covered:

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

Review 2: Requirement and Design Specification

Points to be covered:

1) User and System Requirements.
2) Functional and Non-functional Requirements.
3) SRS Document, Writing structures SRS as per Problem Statement.
4) Requirement Analysis / Models.
5) UML/ER Diagrams.
6) Detail architecture / System design/ Algorithms with analysis / Methods / Techniques.
7) Need to discuss Design models and Component level designs.
8) Detailed Design (DFD levels as per the problem statement).
9) At least 30-40% coding documentation with at least 3 to 4 working modules.
10) Identification of test to be essential and appropriate (to be implement later).
11) Project plan.

Evaluation Criteria:

Following criteria and weightage is suggested for evaluation of Project-Phase I Term Work.

1) Originality of Problem Statement: 10% (05 Marks)
2) Depth of Understanding the Problem Statement: 10% (05 Marks)
3) Concreate Literature Survey with identified gaps in all referred papers: 10% (05 Marks)
4) Design and Analysis of Algorithm / Model / Architecture / System: 40% (20 Marks)
5) Representation of results using suitable tools like tabulation, graph etc: 10% (05 Marks)
6) Presentation Skill: 10% (05 Marks)
7) Report preparation and Paper publication: 10% (05 Marks)

Project report contains the details as Follows:

Project report must have:

- **i.** Certificate from the institute
- **ii.** Certificate sponsoring organization (If any)
- **iii.** Acknowledgement
- **iv.** Abstract
- **v.** Contents
- **vi.** List of Abbreviations (As applicable)
- **vii.** List of Figures (As applicable)
- **viii.** List of Graphs (As applicable)
- **ix.** List of Tables (As applicable)
  1. Introduction and aims/motivation and objectives.
  2. Literature Survey (with proper citation).
  3. Problem Statement/definition.
  4. Software Requirement Specification (In SRS Documentation only).
  5. Flowchart
  6. Project Requirement specification.
  7. Proposed system Architecture.
  8. High level design of the project (DFD,UML, ER Diagrams).
  9. System implementation-code documentation: Algorithm style, Description of detailed methodologies, protocols used etc..as applicable.
  10. Test cases.
  11. Proposed GUI/Working modules/Experimental Results (Module wise if available) in suitable format.
  12. Project Plan.
  13. Conclusions.
  14. Bibliography in IEEE format.

Appendices:

- **A.** Plagiarism Report of Paper and Project report from any open-source tool.
- **B.** Base Paper(s) [If any].
- **C.** Tools used / Hardware Components specifications [If any].
- **D.** Published Papers and Certificates.

Use appropriate plagiarism tools, reference managers, Latex for efficient and effective project writing.

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, Pune B.E Information Technology (2019 Course) 414449A: Audit Course 7 Copyrights and Patents		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory(TH): 01 hrs/week	**Non-Credit**	**Audit Course**

Prerequisite Courses, if any:

Course Objectives:

1. To introduce fundamental aspects of Intellectual Property Rights (IPR)
2. To study the awareness about Copyrights, Trademark and Trade Secrets.

Course Outcomes:

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

CO1. Understand the concepts of Intellectual Property Rights.
CO2. Understand the knowledge about Copyrights and Trademark.
CO3. Understand the knowledge how to protect trade secrets.

COURSE CONTENTS

Unit I	**Introduction to Intellectual Property Law**	**(03 hrs)**
The Evolutionary Past - The IPR Tool Kit- Para -Legal Tasks in Intellectual Property Law – Ethical obligations in Para Legal Tasks in Intellectual Property Law. Introduction to Cyber Law – Innovations and Inventions Trade related Intellectual Property Right		
Mapping of Course Outcomes for Unit I	**CO1**	
Unit II	**Trademark**	**(03 hrs)**
Trademark Registration Process – Post registration Procedures – Trade mark maintenance - Transfer of Rights - Inter partes Proceeding – Infringement - Dilution Ownership of Trade mark – Likelihood of confusion - Trademarks claims – Trademarks Litigations – International Trademark Laws.		
Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**Copyrights**	**(03 hrs)**
Principles of Copyright Principles -The Subjects Matter of Copy right – The Rights Afforded by Copyright Law – Copy right Ownership, Transfer, and duration – Right to prepare Derivative works – Rights of Distribution – Rights of Perform the work Publicity Copyright Formalities and Registrations - Limitations - Copyright disputes and International Copyright Law – Semiconductor Chip Protection Act		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Introduction to Trade Secret**	**(03 hrs)**

Maintaining Trade Secret – Physical Security – Employee Limitation - Employee confidentiality agreement - Trade Secret Law - Unfair Competition – Trade Secret Litigation – Breach of Contract – Applying State Law	
Mapping of Course Outcomes for Unit IV	**CO4**

Textbooks:

1) DebiragE.Bouchoux: "Intellectual Property". Cengage learning, New Delhi
2) M.Ashok Kumar and Mohd.Iqbal Ali: "Intellectual Property Right" Serials Pub.
3) Cyber Law. Texts & Cases, South-Western's Special Topics Collections
4) Prabhuddha Ganguli: 'Intellectual Property Rights" Tata Mc-Graw –Hill, New Delhi
5) https://nptel.ac.in/courses/109105112

Evaluation

Students should select any one of the topics in a group of 3 to 5. Students should submit a written Report. Make a presentation on the topic. Report will be evaluated by the faculty as per rubrics defined by them at start of course.

Savitribai Phule Pune University, Pune B.E Information Technology (2019 Course) 414449B: Audit Course 7 Stress Management By Yoga		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory(TH): 01 hrs/week	**Non-Credit**	**Audit Course**
Prerequisite Courses, if any:		

Course Objectives:

To achieve overall health of body and mind

Course Outcomes:

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

CO1. Understand the reasons for Stress.

CO2. Understand the role of Yoga.

CO3. Develop healthy mind in a healthy body.

CO4. Develop overall efficiency.

COURSE CONTENTS

Unit I	Introduction to Stress	(03 hrs)
Meaning and Definition of Stress. Types: Eutress, Distress, Anticipatory Anxiety, Intense Anxiety and Depression. Meaning of Management – Stress Management. Physiology of Stress on: Autonomic Nervous System.		
Mapping of Course Outcomes for Unit I	**CO1**	
Unit II	**Introduction to Yoga**	**(03 hrs)**
Meaning and definition of Yoga – aims & objectives of yoga, Definitions of Eight parts of yog. (Ashtanga), Concept of Stress according to Yoga.		
Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**Asan and Pranayam**	**(03 hrs)**
Asan - Various yog poses and their benefits for mind & body. Pranayam - Regularization of breathing techniques and its effects-Types of pranayam.		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Effect of Yoga**	**(03 hrs)**
Impact of Yoga on Muscular system, Respiratory System, Circulatory system,Nervous system, Digestive system and Endocrine system		
Mapping of Course Outcomes for Unit IV	**CO4**	

1. **Textbooks:**
2. 'Yogic Asanas for Group Tarining-Part-I": Janardan Swami Yogabhyasi Mandal, Nagpur **3.** "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (PublicationDepartment), Kolkata **4.** Iyengar, BKS., (2003). The Art of Yoga. New Delhi: Harper Collins Publishers. **5.** Ravishankar.N.S., (2001). Yoga for Health. New Delhi: Pustak Mahal. **6.** https://nptel.ac.in/courses/121105009 **7.** https://onlinecourses.swayam2.ac.in/aic19_ed29/
Evaluation
Students should select any one of the topics in a group of 3 to 5. Students should submit a written Report. Make a presentation on the topic. Report will be evaluated by the faculty as per rubrics defined by them at start of course.

Savitribai Phule Pune University, Pune B.E Information Technology (2019 Course) 414449C: Audit Course 7 English for Research Paper Writing		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory(TH): 01 hrs/week	**Non-Credit**	**Audit Course**

Prerequisite Courses, if any:

Course Objectives:

1. To improve writing skills and level of readability.
2. Learn about what to write in each section.
3. Summarize the skills needed when writing a research paper.
4. To study the good quality of paper at very first-time submission.

Course Outcomes:

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

CO1. Understand that how to improve writing skills and level of readability.
CO2. Identify and categorize about what to write in each section.
CO3. Ensure the good quality of paper at very first-time submission.

COURSE CONTENTS

Unit I	**Introduction to Research Paper Writing**	**(03hrs)**
Planning and Preparation, Word Order, breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.		
Mapping of Course Outcomes for Unit I	**CO1**	
Unit II	**Presentation Skills**	**(03 hrs)**
Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction.		
Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**Writing Problem Solution - Texts**	**(03 hrs)**
Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, and skills are needed when writing the Conclusions.		
Mapping of Course Outcomes for Unit III	**CO2, C03**	
Unit IV	**VERIFICATION SKILLS**	**(03 hrs)**
Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first- time submission.		

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

Textbooks:

1) Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press Model Curriculum of Engineering & Technology PG Courses [Volume -II]
2) Goldbort R (2006) Writing for Science, Yale University Press
3) Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.
4) Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht HeidelbergLondon, 2011
5) https://nptel.ac.in/courses/110105091

Evaluation

Students should select any one of the topics in a group of 3 to 5. Students should submit a written research Report /paper or make a presentation on the topic. Report/Presentation will be evaluated by the faculty as per rubrics defined by them at start of course.

SEMESTER – VIII

Savitribai Phule Pune University, Pune Final Year Information Technology (2019 Course) **414450: Distributed Systems**		
Teaching Scheme: 03 Hrs/Week	**Credit Scheme:**	**Examination Scheme:**
Theory (TH): 03 hrs/week	**03 Credits**	**Mid_Semester:30 Marks** **End_Semester: 70 Marks**

Prerequisite Courses:
Operating System, Computer Network, Data Structure and Algorithm

Companion Course, if any:
NA

Course Objectives:

1. To learn the principles, architectures and programming models used in distributed systems.
2. To understand the fundamentals and knowledge of the Middleware of distributed systems
3. To gain knowledge of working components and fault tolerance of distributed systems.
4. To understand the significance of agreement, fault tolerance and recovery protocols in Distributed Systems.
5. To make students aware about distributed and multimedia file systems and web systems.
6. Create an awareness of Emerging trends in distributed computing.

Course Outcomes:

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

CO1. Demonstrate the core concepts of distributed systems.
CO2. Understand the concept of middleware of distributed systems.
CO3. Understand Inter-process communication methods and analyze different coordination algorithms.
CO4. Comprehend the importance of replication to achieve fault tolerance in distributed systems.
CO5. Analyze the design and functioning of existing distributed file systems, distributed multimedia, and distributed web-based systems.
CO6. Understand various Recent Trends in distributed systems.

COURSE CONTENTS

Unit I	Introduction to Distributed Systems	(6 hrs)

Introduction: Network operating System VS Distributed operating systems, Characteristics, Design goals, challenges of Distributed Systems, Examples of Distributed Systems, Trends in Distributed systems: Pervasive networking and the modern Internet, Mobile and ubiquitous computing, Focus on resource sharing

Distributed Computing Models: Physical, Architecture and Fundamental models

- **Case Study:** WWW 1.0,2.0, 3.0

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

Unit II	Middleware	(6 hrs)

Introduction to middleware, middleware Framework, Role of middleware, Examples of Middleware, Origins of middleware, Architecture vs Middleware, RMI, CORBA, General Approaches to adaptive software, Types of middleware-messages oriented middleware, intelligent middleware, content centric middleware, middleware protocol, middleware Services, Distributed computing Environment (DCE), middleware Issues, middleware Analyst **Case Study: -** XML Based middleware		
Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**Inter-Process Communication**	**(6 hrs)**
IPC: Introduction, Layered protocols, API for internet protocols, IPC through shared memory, external data representation and marshaling, Types of communication, inter process communication, multicast communication, message-oriented communication, MPI, network virtualization, overlay networks **Coordination:** Clock synchronization, logical clocks, mutual exclusion, election algorithms, Gossip based coordination **Case Study:** IBM WebSphere Message Queuing		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Replication and Fault Tolerance**	**(6 hrs)**
Replication: Reasons for replication, Replica management – Finding the best server location, Content replication and placement, Content distribution, Managing replicated objects Consistency protocols: Primary based protocols, replicated write protocols **Fault Tolerance:** Introduction to fault tolerance, Reliable client server communication, Reliable group communication, distributed commit, Recovery – Check pointing, Message logging **Case Study:** Caching and replication in web		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**Distributed Files, Multimedia and Web Based System**	**(6 hrs)**
Distributed Files: Introduction, File System Architecture, Sun Network File System and HDFS. **Distributed Multimedia Systems:** Characteristics of Multimedia Data, Quality of Service Management, Resource Management **Distributed Web Based Systems:** Architecture of Traditional Web-Based Systems, Apache Web Server, Web Server Clusters, Communication by Hypertext Transfer Protocol, Synchronization, Web Proxy Caching **Case Study:** The Global Name Service, The X.500 Directory Service, BitTorrent		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**Recent Trends in Distributed Systems**	**(6 hrs)**

Recent Trends: Introduction, Portable and handheld Devices, Wearable devices, Devices embedded in appliances, Parallel Virtual Machine (PVM), Jini, Service Oriented Architecture, The Future of Recent Trends.

Tools for Distributed System Monitoring: Prometheus, Zabbix, Nagios

• **Case Studies:** Mach, Chorus

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

Textbooks:

1. Distributed Systems: Concepts and Design by George Coulouris, J Dollimore and Tim Kindberg,
2. Pearson Education, ISBN: 9789332575226, 5th Edition, 2017.
3. Distributed Systems, Maarten van Steen, Andrew S. T,ThirdeditionVersion.
4. Andrew S. Tanenbaum, Maarten van Steen, PHI ,2nd Edition, ISBN: 978-0130888938
5. Distributed Operating Systems: Concepts and Design by P. K. Sinha, PHI, ISBN: 978-0780311190

Reference Books:

1. Distributed Computing, Sunita Mahajan and Seema Shah, Oxford University
2. Distributed Computing, Fundamentals, Simulations and Advanced topics, 2nd Edition,
3. HagitAttiya and Jennifer Welch, Wiley India
4. Tool for Distributed Systems Monitoring, Łukasz KUFEL, Foundation of Computing and Decision Sciences, Vol 41(4), 2016, e-ISSN 2300-3405, DOI:10.1515/fcdc-2016-0014

E Books / E Learning References:

1. http://home.mit.bme.hu/~meszaros/edu/oprendszerek/segedlet/elosztott/distributed-systems-survey.pdf
2. http://home.mit.bme.hu/~meszaros/edu/oprendszerek/segedlet/elosztott/DisSysUbiCompReport.html

Savitribai Phule Pune University, Pune Final Year Information Technology (2019 Course) 414451: Elective-V (Software Defined Network)		
Teaching Scheme:	**Credit:**	**Examination Scheme:**
Theory (TH):03 hrs/week	**03 Credits**	**Mid_Sem : 30 Marks** **End_Sem : 70 Marks**

Prerequisite Courses:

Prior knowledge of fundamentals of Computer Network and Cloud Computing.

Course Objectives:

1. To understand the Need, History of SDN and Methods of API in SDN.
2. To understand role of Open Flow protocol and SDN Controllers and Use cases.
3. Acquire knowledge of Virtualization and its basic principles and understand role of Cloud Computing using SDN
4. To learn concept of data centre in SDN
5. To learn about security issues and challenges in SDN.
6. To learn applications and future of SDN.

Course Outcomes:

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

CO1. Acquire fundamental knowledge of SDN exploring the need, characteristics, and architecture of SDN and methods of API's in SDN.

CO2. Recognize Open Flow protocols and its forwarding, pipeline model and use cases of SDN controller.

CO3. Demonstrate virtualization and Cloud computing services of SDN.

CO4. Comprehend IT Infrastructure and understand the data center in SDN.

CO5. Analyse various security issues and challenges in SDN.

CO6. Comprehend SDN application areas and future.

COURSE CONTENTS

Unit I	Introduction to Software Defined Networking (SDN)	(6hrs)

Introduction of SDN -Definition, Need of SDN, History of Software Defined Networking (SDN), Fundamental characteristics of SDN, Advantages and Disadvantages of SDN, Distributed control planes, Load Balancing, Centralized control planes, The Evolution of Networking Technology.

Alternate SDN Methods- SDN via Existing APIs, SDN via Hypervisor-Based Overlay Networks. Traditional Switch Architecture-Roles and Separation of data, control and management Planes, SDN API's (Northbound API's, Southbound API's), SDN Devices.

Unit II	Open Flow & SDN Controllers	(6hrs)

Definition, OpenFlow architecture, Flow & Group Table types, Hybrid Approaches, The OpenFlow forwarding and pipeline model, OpenFlow Advantages and Limitations, OpenFlow Protocol.

SDN Controllers -SDN OpenFlow Controllers: Open-Source Controllers - NOX, POX, Use Case: FloodLight, Mininet, Implementing software-defined network (SDN) based firewall.

Unit III	Virtualization and Cloud Computing	(6hrs)

Virtualized Network Functions -Background and Motivation for NFV, Virtual Machines, NFV Concepts - NFV Reference architecture, NFV Infrastructure, Virtualized Network Functions (NFV) - Management and Orchestration, Comparison between SDN and NFV, NFV Use Cases - SDN and NFV.
Cloud Computing -Cloud Computing and Resource Virtualization, SDN Applications in Network Virtualization, Cloud Network Virtualization using SDN- Synergy between SDNs and clouds, Integration Architectures, Network as a Service (NaaS) supported by SDN, Security as a Service (SecaaS) using SDN.

Unit IV	SDN in Data Center	(6hrs)

Data Center- Definition, Data Center Demands, Tunneling Technologies for the Data Center, Path technologies in data centers, Ethernet fabrics in Data centers, SDN Use Cases in the Data Center, Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network

Unit V	SDNsecurity	(6hrs)

Security Characteristics of SDN, Security Analysis and Potential attacks in SDN,Security Principles of SDN, Solutions to the security issues in SDN, Network Security enhancement using the SDN Framework – Issues and Challenges, Threats to SDN -Networks, Controllers, Applications.

Unit VI	SDN Applications and SDN Future	(6hrs)

SDN applications-Reactive versus Proactive Applications, Analysing Simple SDN Applications, A Simple Reactive Java Application, Using the Floodlight Controller, Using the Open Daylight Controller, Access Control for the Campus, Traffic Engineering for Service Providers.
SDN Future -Potential Novel Applications of Open SDN-Managing Non-traditional Physical Layer Links, Applying Programming Techniques to Networks, Security Applications, Roaming in Mobile Networks, Traffic Engineering in Mobile Networks.

Textbooks:

1. Paul Goransson and Chuck Black, "Software Defined Networks: A Comprehensive Approach", Morgan Kaufmann, 2014, ISBN: 9780124166752, 9780124166844.
2. SiamakAzodolmolky, "Software Defined Networking with Open Flow, Packt Publishing, 2013, ISBN: 9781849698726.
3. Thomas D. Nadeau, Ken Gray, "SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies", 2013, ISBN : 10:1-4493-4230-2, 978-1-4493-4230-2.

Reference Books:

1. Vivek Tiwari, "SDN and OpenFlow for Beginners", Digital Services, 2013, ISBN: 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, 2014, ISBN: 10: 1466572094.
3. Open Networking Foundation (ONF) Documents, https://www.opennetworking.org, 2015.

E Books / E Learning References:

1. https://www.sdxcentral.com/sdn/definitions/software-defined-networking-tutorial/
2. http://sbrc2015.ufes.br/wp-content/uploads/Ch1.pdf
3. http://pure.qub.ac.uk/files/16066743/SDN_Security_Survey_FinalFile.pdf

<table>
<tr><td colspan="3" align="center">Savitribai Phule Pune University, Pune
Final Year Information Technology (2019 Course)
414451: Elective- V (Social Computing)</td></tr>
<tr><td>Teaching Scheme:</td><td>Credit Scheme:</td><td>Examination Scheme:</td></tr>
<tr><td>Theory (TH): 3 hrs/week</td><td>03 Credits</td><td>Mid_Semester: 30 Marks
End_Semester: 70 Marks</td></tr>
</table>

Prerequisite Courses:

- Basic Knowledge of Graphs
- Networking
- Data Mining and Analytics

Course Objectives:

1) To understand foundations of Social Media Analytics.
2) To understand network measures for social data.
3) To Visualize and understand the data mining aspects in social networks.
4) To understand social similarities in social groups
5) To understand behavioral part of web applications for Analysis.
6) To analyze the data available on any social media applications.

Course Outcomes:

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

CO1. Understand basics of Social Media Analytics
CO2. Correlate Network Measures for Social Media Data
CO3. Visualize mining in social media data
CO4. Discuss the Social Similarities
CO5. Interpret social media behavior
CO6. Apply Social Media Computations for Google+

<table>
<tr><td colspan="3" align="center">COURSE CONTENTS</td></tr>
<tr><td>Unit I</td><td>Introduction to social media</td><td>(6 hrs)</td></tr>
<tr><td colspan="3">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.</td></tr>
<tr><td>Mapping of Course Outcomes for Unit I</td><td colspan="2">CO1</td></tr>
<tr><td>Unit II</td><td>Network Measures</td><td>(6hrs)</td></tr>
<tr><td colspan="3">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
Information Diffusion in social media: Herd Behaviour, Information Cascades, Diffusions in Cascades, Epidemics</td></tr>
<tr><td>Mapping of Course Outcomes for Unit II</td><td colspan="2">CO2</td></tr>
<tr><td>Unit III</td><td>Mining in social media</td><td>(6 hrs)</td></tr>
</table>

Data Mining in Social Media: Motivations for Datamining in Social Media, Data mining Methods for Social Media, Data Representation, Data mining- A Process, Examples- Social Networking Sites, The Blogosphere
Text mining in Social Networks: Keyword Search, Query Semantics and Answer Ranking, Keyword search over XML and relational data, Keyword search over graph data, Classification Algorithms, Clustering Algorithms, Transfer Learning in Heterogenous Networks

Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Influence and Homophily**	**(6 hrs)**
Influence and Homophily: Measuring Assortativity, Influence, Homophily, Distinguishing Influence and Homophily: Shuffle test, Edge-Reversal Test, Randomization Test		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**Social Media Behavior**	**(6 hrs)**
Recommendation in social media: Challenges, Classical Recommendation Algorithms, Recommendation using Social Context, Evaluating Recommendations, Behaviour Analytics: Individual Behaviour, Collective Behaviour		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**Case Study**	**(6 hrs)**
Mining Google+: Overview, Exploring Google+ API, A Whiz bang Introduction to TF-IDF, Query human Language Data with TF-IDF Mining Web pages: Scraping, Parsing, and crawling Web, Discovering Semantics by Decoding syntax, Entity-Centric Analysis, Quality of Analysis for Processing Human Language Data		
Mapping of Course Outcomes for Unit VI	**CO6**	

Textbooks:

1. Alex Gonçalves: Social Media Analytics Strategy, Using Data to Optimize Business Performance, Apress
2. Raza Zafarani, Mohammad Ali Abbasi, Huan Liu: Social Media Mining, Cambridge University Press April 2014
3. Mathew A Russell, Mining the Social Web, Data Mining, Facebook, Twitter, LinkedIn, Google+, GITHUB and More, 2nd Edition, OReilly.

Reference Books:
1. Charu C. Aggarwal, Social Network Data Analytics, Springer, ISBN: 978-1-4419-8461-6. 2. Marshall Sponder, Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics, McGraw Hill Education, 978-0-07-176829-0. 3. Matthew A. Russell, Mining the Social Web, O'Reilly, 2nd Edition, ISBN:10: 1449367615. 4. 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. 5. Bing Liu, Web Data Mining: Exploring Hyperlinks, Contents and Usage Data, Springer, 2 nd Edition, ISBN: 978-3-642-19459-7.
E Books / E Learning References:
https://emplifi.io/resources/blog/social-media-analytics-the-complete-guide

<table>
<tr><td colspan="3" align="center">Savitribai Phule Pune University, Pune
Final Year Information Technology (2019 Course)
414451: Elective V (Natural Language Processing)</td></tr>
<tr><td>Teaching Scheme:</td><td>Credit Scheme:</td><td>Examination Scheme:</td></tr>
<tr><td>Theory (TH):03hrs/week</td><td>03 Credits</td><td>Mid_Semester: 30 Marks
End_Semester: 70 Marks</td></tr>
<tr><td colspan="3">Prerequisite Courses, if any: Theory of Computer Science</td></tr>
<tr><td colspan="3">Companion Course, if any:</td></tr>
<tr><td colspan="3">Course Objectives:
This course will enable students to
1. Learn the techniques in natural language processing.
2. Be familiar with the natural language generation.
3. Be exposed to Text Mining.
4. Understand the information retrieval techniques</td></tr>
<tr><td colspan="3">Course Outcomes:
On completion of the course, students will be able to–
CO1. Understand and analyze the natural language text and model.
CO2. Analyze the natural language syntactically.
CO3. Analyze and study natural language logically.
CO4. Process the natural language text based on relations and knowledge.
CO5. Evaluate the natural language text using models and apply modeling techniques for automatic document separation and text mining.
CO6. Apply information retrieval techniques.</td></tr>
<tr><td colspan="3" align="center">COURSE CONTENTS</td></tr>
<tr><td>Unit I</td><td>Introduction to NLP</td><td>(6hrs)</td></tr>
<tr><td colspan="3">Overview and language modelling: Overview: Origins and challenges of NLP- Language and Grammar-Processing Indian Languages- NLP Applications Information Retrieval. Language Modelling: Various Grammar- based Language. Models-Statistical Language Model.</td></tr>
<tr><td>Mapping of Course Outcomes for Unit I</td><td colspan="2">CO1</td></tr>
<tr><td>Unit II</td><td>Word Level Analysis and Syntactic Analysis</td><td>(6 hrs)</td></tr>
<tr><td colspan="3">Word Level Analysis: Regular Expressions- Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging.
Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing,</td></tr>
<tr><td>Mapping of Course Outcomes for Unit II</td><td colspan="2">CO2</td></tr>
<tr><td>Unit III</td><td>Semantic Analysis</td><td>(6hrs)</td></tr>
</table>

Introduction, Meaning Representation, Lexical Semantics, Ambiguity, Word Sense Disambiguation Discourse Processing: Introduction, Cohesion, Reference Resolution, Discourse Coherence and Structure		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Text Processing: Relations and Knowledge**	**(6hrs)**
Extracting Relations from Text: From Word Sequences to Dependency Paths: Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation. Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labelling, Learning to Annotate Cases with Knowledge Roles and Evaluations. **A Case Study in Natural Language Based Web Search:** In Fact System Overview, The GlobalSecurity.org Experience.		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**Document Processing and Text Mining**	**(6hrs)**
Automatic Document Separation: A Combination of Probabilistic Classification and Finite-State Sequence **Modelling:** Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping Problem, Results. Evolving Explanatory Novel Patterns for Semantically Based Text Mining: Related Work, A Semantically Guided Model for Effective Text Mining		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**Information retrieval and lexical resources**	**(6hrs)**
Information Retrieval: Design features of Information Retrieval Systems-Classical, non-classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame Net-Stemmers-POS Tagger- Research Corpora. **Model:** Introduction to iSTART		
Mapping of Course Outcomes for Unit VI	**CO6**	

Textbooks:

1. U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.
2. Anne Kao and Stephen R. Poteet (Eds), “Natural LanguageProcessing and Text Mining”, Springer-Verlag London Limited 2007.

Reference 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 1stAddition, ISBN 9789332518414
3. Hobson Lane, Cole Howard, Hannes Hapke. 2019. Natural Language Processing in Action. Live Book

E Books / E Learning References:
1. https://onlinecourses.nptel.ac.in/noc20_cs87/preview 2. https://onlinecourses.nptel.ac.in/noc19_cs56/preview 3. Virtual Lab :- (Natural Language Processing Lab) http://nlp-iiith.vlabs.ac.in/

<table>
<tr><td colspan="3" align="center">Savitribai Phule Pune University, Pune
Final Year Information Technology (2019 Course)
414451: Elective-V (Soft Computing)</td></tr>
<tr><td>Teaching Scheme:</td><td>Credit Scheme:</td><td>Examination Scheme:</td></tr>
<tr><td>Theory (TH):3 hrs/week</td><td>03 credits</td><td>Mid_Semester:30 Marks
End_Semester: 70 Marks</td></tr>
<tr><td colspan="3">Prerequisite Courses, if any: Linear Algebra and Calculus, Probability Theory</td></tr>
<tr><td colspan="3">Companion Course, if any: -</td></tr>
<tr><td colspan="3">Course Objectives:
The objective of this course is to
1. Get familiarize with soft computing concepts
2. Understand use of Neural networks, fuzzy logic, GA, Hybrid Systems for problem solving</td></tr>
<tr><td colspan="3">Course Outcomes:
On completion of the course, students will be able to–
CO1. Learn soft computing techniques and their roles in problem solving.
CO2. Understand and Analyze various Artificial neural network techniques
CO3. Understand and define the fuzzy systems for problem solving.
CO4. Understand and apply the concepts of genetic algorithms for problem solving.
CO5. Identify and select a suitable Soft Computing method to solve the problem
CO6. Identify and understand the role of soft computing models in various applications</td></tr>
<tr><td colspan="3" align="center">COURSE CONTENTS</td></tr>
<tr><td>Unit I</td><td>Introduction</td><td>(6 hrs)</td></tr>
<tr><td colspan="3">Basic concept of Soft Computing, Historical Development, Definitions, Soft Computing characteristics, advantages and disadvantages, Constitutes of Soft Computing : Fuzzy Logic and Computing, Neural Computing, Evolutionary Computing, Genetic Algorithms, Probabilistic Reasoning.</td></tr>
<tr><td>Mapping of Course Outcomes for Unit I</td><td colspan="2">CO1</td></tr>
<tr><td>Unit II</td><td>Artificial Neural Networks</td><td>(8 hrs)</td></tr>
<tr><td colspan="3">Fundamentals: Biological Neurons and Artificial neural network, model of artificial neuron.
Neural Network Architectures, Neural Network models: Perceptron, Adaline, and Madaline networks; single layer network; Back propagation and multi-layer networks.
Learning Methods: Hebbian, competitive, Boltzman etc.,
Competitive learning networks: Kohonenself-organizing networks, Hebbian learning; Hopfield Networks.</td></tr>
<tr><td>Mapping of Course Outcomes for Unit II</td><td colspan="2">CO2</td></tr>
<tr><td>Unit III</td><td>Fuzzy Logic and Fuzzy Systems</td><td>(6hrs)</td></tr>
</table>

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, Fuzzy modeling and decision making, Neuro-fuzzy modeling.		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Genetic Algorithms**	**(6 hrs)**
Introduction, Encoding, Operators of Genetic Algorithm, Basic Genetic Algorithm, Simple GA, crossover and mutation, Multi-objective Genetic Algorithm (MOGA) Applications of Genetic Algorithm: genetic algorithms in search and optimization, GA based clustering Algorithm, Image processing and pattern Recognition.		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**Hybrid Systems**	**(6 hrs)**
Introduction, Neuro-Fuzzy modeling: Genetic Algorithm based Back-propagation Network, Fuzzy –Backpropagation, Fuzzy Logic Controlled Genetic Algorithms, Simplified Fuzzy ARTMAP, Case studies.		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**Applications Of Soft Computing Techniques**	**(6 hrs)**
Applications of fuzzy in pattern recognition-character recognition. Applications of evolutionary computing in Image processing and computer vision, soft computing in mobile ad-hoc networks, soft computing in Information Retrieval and Semantic web, Soft Computing in Software Engineering, Simulated Annealing, Tabu search, Ant colony optimization (ACO), Particle Swarm Optimization (PSO).		
Mapping of Course Outcomes for Unit VI	**CO6**	

Textbooks:

1. S. N. Sivanandam, S. N. Deepa, Principles of Soft Computing, Wiley publications, 2nd Edition.
2. J. S. R. Jang, C. T. Sun, E. Mizutani, 'Neuro-Fuzzy and Soft Computing- A computational approach to Learning and Machine Intelligence' PHI

Reference Books:

1. David E. Goldberg, Genetic Algorithms - Pearson Education, 2006
2. Satish Kumar, "Neural Networks - A Classroom Approach", Tata McGraw,Hill
3. Timothy J. Ross, "Fuzzy Logic with Engineering Applications," 3rd ed. Wiley India.
4. Samir Roy, Udit Chakroborthy, —Introduction to soft computing - neuro-fuzzy and genetic algorithm, Pearson Education, 2013

E-Resources

1. Introduction to Soft Computing: NPTEL- https://onlinecourses.nptel.ac.in/noc20_cs17/preview
2. Virtual Lab (Soft Computing Tools in Engineering lab) :- http://vlabs.iitkgp.ac.in/scte/

Savitribai Phule Pune University, Pune Final Year Information Technology (2019 Course) 414451: Elective V (Game Engineering)		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory (TH):3 hrs/week	**03 credits**	**Mid_Semester:30 Marks** **End_Semester: 70 Marks**

Prerequisite Courses: Discrete Structures.

Companion Course, if any:

Course Objectives:

1. To develop strong conceptual underpinnings of games.
2. To understand complete structure of a computer game and the major components of a game engine.
3. To develop creativity and individuality in problem solving and performing tasks.
4. To learn how to design challenges, rules and feedbacks when implementing and aligning the game activities with goals.
5. To develop competences necessary for graduate students to be employed in the game development industry.

Course Outcomes:

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

CO1. Describe fundamentals of game engineering and the social- ethical issues in game development.
CO2. Develop creative and critical thinking skills for designing compelling games.
CO3. Apply game mechanics to make game more enjoyable.
CO4. Analyze Games over Networks and Peer Effects.
CO5. Demonstrate an understanding of various tools that are used in game development.
CO6. Apply mathematical and game programming knowledge and skills to solve development tasks.

COURSE CONTENTS

Unit I	An Introduction to Games and Gaming	(6 hrs)

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

Mapping of Course Outcomes for Unit I	**CO1, CO2, CO6**

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 Study: Wordle

Mapping of Course Outcomes for Unit II	**CO1, CO2,CO6**

Unit III	Game Mechanism	(6 hrs)
Reclaiming Opposition: Counter gamification, Gamed Agencies: Affectively Modulating Our Screen-and App-Based Digital Futures, Remodelling design, Game Mechanics: Designing for Engagement, Game Mechanics and dynamic. Case Study: Cricket League		
Mapping of Course Outcomes for Unit III	**CO1, CO2, CO3,CO6**	
Unit IV	**Rules of Play - Game Design Fundamentals**	**(6 hrs)**
Rules of Play: Defining Rules, Rules on Three Levels, The Rules of Digital Games Network effects and games over networks: Positive and negative externalities, Utility-based resource allocation, Selfish routing, Wardrop and Nash equilibrium, partially optimal routing, Network pricing, Competition and implications on network performance, Strategic network formation, Price of anarchy.		
Mapping of Course Outcomes for Unit IV	**CO1, CO2, CO3, CO4,CO6**	
Unit V	**Game Designing: Tools and Techniques**	**(6hrs)**
Godot 3.2, Construct 2, Unity: Game Engine, LOVE 2D: Framework, GameMaker: Studio, Clickteam Fusion 2.5,GameFroot ,Sploder, Stencyl, Flowlab, GameSalad, Scratch,Instant Gamification Platforms: Mambo.io, Installation and use of BigDoor, ngageoint/gamification-server.		
Mapping of Course Outcomes for Unit V	**CO1, CO2, CO3, CO4, CO5,CO6**	
Unit VI	**Applications and Case Studies**	**(6 hrs)**
Applications:esports, Ads, healthcare, teaching-learning. **Case studies:**Counter-Strike, PUBG New State, Minecraft, Nike Plus: Making Fitness Fun,Yahoo! Gamifies Questions,Axie Infinity: blockchain-based game, An Interactive Museum Touch-Screen Game		
Mapping of Course Outcomes for Unit VI	**CO1, CO2, CO3, CO4, CO5,CO6**	

Textbooks:

1. Gabe Zechermann, Christopher Cunningham, Gamification by Design, Oreilly media, First, ISBN: 978-1-449-39767-8.
2. Mathias Fuchs, Sonia Fizek, Paolo Ruffino, NiklasSchrape, Rethinking Gamification
3. Katie SalenTekinbas , Eric Zimmerman, “Rules of PlayGame Design Fundamentals”, The MIT Press
4. Martin Osborne, An Introduction to Game Theory, Oxford University Press, 2003
5. http://meson.press/books/rethinking-gamification, Meson Press, First Edition,ISBN:978-3-95796-001-6.

Reference Books:

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

E Books / E Learning References :

1) https://godotengine.org/, 2) https://mambo.io/, 3) https://unity.com/, 4) https://gamemaker.io/

Savitribai Phule Pune University, Pune
Final Year Information Technology (2019 Course)
414452: ElectiveVI (Ethical Hacking and Security)

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

Prerequisite Courses: Computer Network: OSI Model, TCP/IP Protocol Suite, Fundamentals of Cyber Security, Fundamentals of Windows, and Linux Operating System

Companion Course: Certified Ethical Hacking (EC Council), Ethical Hacking NPTEL

Course Objectives:

1. Understand Importance of Ethical Hacking and legalities of penetration Testing
2. Apply Foot printing techniques with realistic approach
3. Analyze Meta sploit tool with Kali Linux for penetration testing
4. Analyze Privilege Escalation techniques in Windows and Linux
5. Create awareness about web application security and Hacking
6. Apply WiFi Hacking and security Techniques

Course Outcomes:

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

CO1. Identify Ethical hacking processes and become acquainted with Penetration testing.
CO2. Recognize Foot printing techniques and apply in real time applications
CO3. Build knowledge about Meta sploit tool with Kali Linux
CO4. Differentiate Privilege Escalation in Windows and Linux
CO5. Construct Secure Web Applications to understand Hacking Techniques.
CO6. Recognize Wifi Hacking and Security techniques.

COURSE CONTENTS

Unit I	Introduction to Basics of Ethical Hacking and Penetration Testing	(6 hrs)

Introduction to basic Terminologies of Ethical Hacking, CIA(confidentiality, Integrity Availability , Types of Hackers , Ethical Hacking Process, Different tools for Ethical Hacking, Introduction to Kali Linux, What Is a Penetration Test, Vulnerability Assessments versus Penetration Test,Types of Penetration Testing:Network Penetration Test, Web Application Penetration Test,Mobile Application Penetration Test, Social Engineering Penetration Test, Physical Penetration Test

Mapping of Course Outcomes for Unit I	CO1

Unit II	Foot printing & Port Scanning	(6 hrs)

Foot printing: Introduction to foot printing, Understanding the information gathering methodology Introduction to fingerprinting in Ethical Hacking, Introduction to Reconnaissance, Reconnaissance types, Tools used for the reconnaissance phase, Port Scanning - Introduction, using port scanning tools, ping sweeps, Scripting, Enumeration-Introduction, Enumerating windows OS & Linux OS.

Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**System Security and Hacking**	**(6hrs)**
Introduction to Metasploit ,Reconnaissance with Metasploit , Port Scanning with Metasploit , Compromising a Windows Host with Metasploit ,Client Side Exploitation Methods , E– Mails with Malicious Attachments ,Creating a Custom Executable , Creating a Backdoor with SET – PDF Hacking – Social Engineering Toolkit – Browser Exploitation – Post– Exploitation Introduction :Cracking Passwords – Password Cracking Websites – Password Guessing – Password Cracking Tools – Password Cracking Countermeasures – Escalating Privileges –Executing Applications – Keyloggers and Spyware		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Privilege Escalation in Windows and Linux**	**(6hrs)**
Introduction Windows Privileges, Horizontal vs. Vertical Privilege Escalation, Windows Privilege Escalation Techniques- Windows Authentication Bypass, Windows Privacy Policy Settings, Access Token Manipulation, DLL Search Order Hijacking, Privilege Escalation Attack Vectors- Credential Exploitation, Vulnerabilities and Exploits, Misconfigurations, Malware, Social Engineering. Linux Privilege Escalation- Introduction, Linux File Permission, Sudo Bypass, NFS, Passwords on Files, Kernel Exploits, LXD Linux Container.		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**Web Application Hacking and Security**	**(6hrs)**
Introduction to Hacking Web Applications, Cross-Site Scripting (XSS), Cross-Site Request Forgery (CSRF), XML External Entity (XXE), Injections: SQL Injection& Code Injection, Denial of Service (DoS), Exploiting Third-Party Dependencies Web Application Security: Securing Modern Web Applications, Secure Application Architecture, OWASP Top 10 Web Application Security Risks and tools		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**Wi-Fi Hacking and Security**	**(6 hrs)**
Wi-Fi Security: Introduction to Wireless Security, Working, Types of Security, Protocols- WEP, WPA, WPA2 cracking, Threats to Wi-Fi Security, Secure Home and Business Wi-Fi Network, Stronger Wi-Fi Security, Updating WiFi Security Settings for Home WiFi Networks. Wi-Fi Hacking: Essential Tools for Hacking Wireless Networks, Evil Twin attack, Network Sniffing and social engineering		
Mapping of Course Outcomes for Unit VI	**CO6**	

Textbooks:

1. Rafay Baloch, "Ethical Hacking and Penetration Testing Guide", CRC Press, 2014.
2. Andrew Hoffman, Web Application Security-Exploitation and Countermeasures for Modern Web Applications, O'Reilly publication
3. Marcus Pinto, DafyddStuttard, The Web Application Hacker's Handbook: Discovering and Exploiting Security Flaws, Wiley Publication
4. Alexis Ahmed, "Privilege Escalation Techniques, O'Reilly Media Company. Packt publishing. 2021

Reference Books:

1. Hacking: The Art of Exploitation by Jon Erickson
2. Basics of Hacking and Penetration testing: Made Easy by Patrick Engebreston
3. Penetration Testing: A Hands-on Introduction to Hacking by Georgia Weidman

E Books / E Learning References:

1. https://assets.ctfassets.net/kvf8rpi09wgk/5Yy2CMOxlE7eLlsTzFZ333/e656ff09a94ff0b63106de8d300903ac/CEH_Notes.pdf
2. https://resources.infosecinstitute.com/topic/process-scanning-and-enumeration/
3. https://owasp.org/Top10
4. https://medium.com/techloop/reconnaissance-the-key-to-ethical-hacking-3b853510d977
5. Don Matthews, Unintended Consequences, Ethical Hacking ...
6. www.coursera.org › lecture › industrial-iot-markets-security
7. https://www.coursera.org/lecture/cybersecurity-for-data-science/hacking-white-grey-and-black-hackers-DzVHT
8. https://www.coursera.org/lecture/cybersecurity-for-data-science/social-engineering-CD9QT
9. https://www.coursera.org/lecture/hacking-patching/penetration-testing-with-kali-linux-z06ZJ
10. https://medium.com/javarevisited/10-free-courses-to-learn-ethical-hacking-and-penetration-testing-for-beginners-84e40104aa6c.

Savitribai Phule Pune University, Pune
Final Year Information Technology (2019 Course)
414452: Elective-VI (Augmented and Virtual Reality)

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

Prerequisite Courses, if any:

Companion Course, if any:

Course Objectives:

1. To study modern overviews on virtual reality and list the applications of VR.
2. To know the representation of Virtual world in VR.
3. To Study the fundamentals of visual perception, motion and tracking in real and virtual world.
4. To study modern overviews and perspectives on Augmented reality and list the applications of AR
5. To study the working of various state of the art AR devices.
6. To study computer vision concepts for AR and describe AR techniques.

Course Outcomes:

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

CO1. Analyze how Virtual Reality systems work.
CO2. Understand the representation of Virtual world.
CO3. Describe the importance of motion and tracking in VR systems.
CO4. Analyze how AR systems work and list the applications of AR.
CO5. Identify the working of various AR components and AR devices.
CO6. Make use of computer vision concepts for AR.

COURSE CONTENTS

Unit I	Introduction to Virtual Reality	(6 hrs)

Defining Virtual Reality, History of VR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface to the Virtual World-Input & output- Visual, Aural & Haptic Displays, Applications of Virtual Reality.

Mapping of Course Outcomes for Unit I	CO1

Unit II	Representing the Virtual World in VR	(6 hrs)

Representation of the Virtual World, Visual Representation in VR, Aural Representation in VR and Haptic Representation in VR, Geometric Models, Changing Position and Orientation, Axis-Angle Representations of Rotation, Viewing Transformations

Mapping of Course Outcomes for Unit II	CO2

Unit III	Visual Perception, Motion and Tracking in VR	(6 hrs)

Visual Perception - Perception of Depth, Perception of Motion, Perception of Color, Combining Sources of Information Visual Rendering -Ray Tracing and Shading Models. Motion in Real and Virtual Worlds, Tracking- Tracking 2D & 3D Orientation.		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Introduction to Augmented Reality**	**(6 hrs)**
What Is Augmented Reality - Defining Augmented Reality, history of augmented reality, The Relationship Between Augmented Reality and Other Technologies-Media, Technologies, Other Ideas Related to the Spectrum Between Real and Virtual Worlds, Augmented Reality Concepts- How Does Augmented Reality Work? Concepts Related to Augmented Reality, Ingredients of an Augmented Reality Experience, Applications of Augmented Reality		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**Augmented Reality Components and Devices**	**(6 hrs)**
Augmented Reality Hardware – Displays – Audio Displays, Haptic Displays, Visual Displays, Other sensory displays, Visual Perception, Requirements and Characteristics, Spatial Display Model. Processors – Role of Processors, Processor System Architecture, Processor Specifications. Tracking &Sensors - Tracking, Calibration, and Registration, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors, Optical Tracking, Sensor Fusion. Types of AR devices.		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**Computer Vision for Augmented Reality & AR Software**	**(6hrs)**
Computer Vision for Augmented Reality - Marker Tracking, Multiple-Camera Infrared Tracking, Natural Feature Tracking by Detection, Simultaneous Localization and Mapping, Outdoor Tracking Augmented Reality Software - Introduction, Major Software Components for Augmented Reality Systems, Software used to Create Content for the Augmented Reality Application.		
Mapping of Course Outcomes for Unit VI	**CO6**	
Textbooks:		
1. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016 **2.** Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)”. Morgan Kaufmann Publishers, San Francisco, CA, 2002 **3.** Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India; First edition (12 October 2016), ISBN-10: 9332578494		

Reference Books:
1. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig, William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009. 2. Burdea, Grigore C and Philippe Coiffet, "Virtual Reality Technology", Wiley Interscience, India, 2003. 3. SanniSiltanen- Theory and applications of marker-based augmented reality. Julkaisija – Utgivare Publisher. 2012. ISBN 978-951-38-7449-0
E Books / E Learning References:
1. http://lavalle.pl/vr/book.html 2. https://www.vttresearch.com/sites/default/files/pdf/science/2012/S3.pdf 3. https://nptel.ac.in/courses/106/106/106106138/ 4. https://www.coursera.org/learn/ar

Savitribai Phule Pune University, Pune Final Year Information Technology (2019 Course) 414452: Elective VI (Business Analytics and Intelligence)		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory (TH): 03 hrs/week	**03 Credits**	**Mid_Semester: 30 Marks** **End_Semester: 70 Marks**

Prerequisite Courses: DBMS, ADBMS, DSBDA

Companion Course: -

Course Objectives:

1. Apply conceptual knowledge on how Business Intelligence is used within organizations.
2. Explore various systems and software for Business Intelligence
3. Understand several business scenarios where business analytics and intelligence can be useful
4. Understand the mathematical and analytical models behind Business Intelligence

Course Outcomes:

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

CO1. Apply conceptual knowledge on how Business Intelligence is used in decision making process

CO2. Use modelling concepts in Business Intelligence

CO3. Understand and apply the concepts of business reports and analytics with the help of visualization for business performance management

CO4. Comprehend the model-based decision making using prescriptive analytics

CO5. Analyze the role of analytics and intelligence in Business

CO6. Comprehend different Business Intelligence trends and its future impacts

COURSE CONTENTS

Unit I	**Introduction to Decision Making and Business Intelligence**	**(6hrs)**

Changing Business Environments, Decision Making & Simon's Decision-Making Process, Managerial roles in Decision Making, Information Systems Support for Decision Making, framework for Computerized Decision Support: The Gorry and Scott-Morton Classical Framework, Decision support systems (DSS). Capabilities of DSS, DSS Classification, DSS Components.

Business Intelligence (BI), Framework for BI, BI architecture, DSS - BI Connection, Goals of Business Intelligence, Business Intelligence: Tasks and Analysis Formats, BI use cases: Application in Patient Treatment, Application in Higher Education, Application in Logistics

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

Unit II	**Modeling in BI**	**(6hrs)**

Models and Modeling in BI, Model Presentation, Model Building, Model Assessment and Quality of Models, Modeling using Logical Structures: Ontologies &Frames, Modeling using Graph Structures: Business Process Model and Notation (BPMN) & Petri Nets, Modeling using Probabilistic Structures, Modeling Using Analytical Structures. Models and Data: Data Generation, The Role of Time, Data Quality

<table>
<tr><td>Mapping of Course Outcomes for Unit II</td><td colspan="2">CO2</td></tr>
<tr><td>Unit III</td><td>Business reporting, Visual analytics, and Performance management</td><td>(6 hrs)</td></tr>
<tr><td colspan="3">What Is a Business Report, Components of Business Reporting Systems, Data and Information Visualization, Types of Charts and Graphs, Visual Analytics, Performance Dashboards, Business Performance Management, Closed Loop BPM Cycle, Performance Measurement, Key Performance Indicators, Balanced Scorecards, The Four Perspectives of BSC?
BI Tools: Tableau, Qlik, power BI, Dundas BI, Sisense, Webfocus, Oracle BI</td></tr>
<tr><td>Mapping of Course Outcomes for Unit III</td><td colspan="2">CO3</td></tr>
<tr><td>Unit IV</td><td>Prescriptive Analytics & Model-Based Decision Making</td><td>(6hrs)</td></tr>
<tr><td colspan="3">What are Descriptive analytics, predictive analytics, and prescriptive analytics, Decision Support Systems Modeling, Structure of Mathematical Models for Decision Support, Certainty, Uncertainty, and Risk, Decision Modeling with Spreadsheets, Mathematical Programming Optimization, Multiple Goals, Sensitivity Analysis, What-If Analysis, and Goal Seeking, Decision Analysis with Decision Tables and Decision Trees, Multi-criteria Decision Making with Pairwise Comparisons</td></tr>
<tr><td>Mapping of Course Outcomes for Unit IV</td><td colspan="2">CO4</td></tr>
<tr><td>Unit V</td><td>Role of Analytics and Intelligence inBusiness</td><td>(6 hrs)</td></tr>
<tr><td colspan="3">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</td></tr>
<tr><td>Mapping of Course Outcomes for Unit V</td><td colspan="2">CO5</td></tr>
<tr><td>Unit VI</td><td>Business Analytics: Emerging Trends and Future Impacts</td><td>(6 hrs)</td></tr>
<tr><td colspan="3">Emerging Technologies, the critical success factors for implementing a BI strategy, Predicting the Future with the help of Data Analysis, BI Search & Text Analytics – Advanced Visualization – Rich Report, cloud computing and BI, Future beyond Technology. Impacts of Analytics in Organizations, Issues of Legality, Privacy, and Ethics, Location-Based Analytics for Organizations, Analytics Applications for Consumers.</td></tr>
<tr><td>Mapping of Course Outcomes for Unit VI</td><td colspan="2">CO6</td></tr>
<tr><td colspan="3">Textbooks:</td></tr>
<tr><td colspan="3">1. Wilfried Grossmann & Stefanie Rinderle-Ma “Fundamentals of Business Intelligence”, Springer, ISBN 978-3-662-46531-8 (eBook)
2. 2. Business Intelligence and Analytics: Systems for Decision Support, 10th edition, ISBN 978-0-133-05090-5, by Ramesh Sharda, DursunDelen, and Efraim Turban, published by Pearson Education © 2014.</td></tr>
</table>

Reference 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 Management: Improving Strategic and Operational Performance. 8th edn.Wiley.

E Books / E Learning References:

1. https://www2.deloitte.com/us/en/pages/deloitte-analytics/articles/business-analytics-case-studies.html
2. https://www.blastanalytics.com/analytics-case-studies
3. BI Foundations with SQL, ETL and Data Warehousing Specialization (Coursera)

Savitribai Phule Pune University, Pune Final Year Information Technology (2019 Course) 414452: Elective-VI (Blockchain Technology)		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory (TH): 3hrs/week	**03 Credits**	**Mid_Semester: 30 Marks** **End_Semester: 70 Marks**

Prerequisite Courses, if any:

Computer Network & security, distributed systems

Course Objectives:

1. To understand and explore cryptography in the blockchain.
2. To understand the working of blockchain technology.
3. To explore a blockchain platform: Ethereum and understand the concept of Tokenization
4. To understand the working of Hyper ledger.
5. To understand consensus mechanism.
6. To understand the applications & risks involved in blockchain.

Course Outcomes:

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

CO1. Understand the concept of cryptography and decentralization.

CO2. Acquire fundamental knowledge of blockchain with issues associated with it.

CO3. Acquire knowledge of Ethereum blockchain platform.

CO4. Understand hyper ledger fabric platform.

CO5. Acquire the knowledge regarding working of tokenization.

CO6. Describe the applications and risk involved

COURSE CONTENTS

Unit I	**Role of Cryptography in Blockchain**	**(6hrs)**

Introduction to cryptography, Use of Cryptography in Blockchain, Cryptographic algorithm, cryptographic elements, cryptocurrency and its Benefits, introduction to decentralized system Security, Integrity, and Privacy Issues of a Decentralized System.

Mapping of Course Outcomes for Unit I	**CO1**	
Unit II	**Introduction to Blockchain Technology**	**(6 hrs)**

What is bitcoin, Mechanics of Bitcoin, bitcoin transaction, Introduction of Block chain, History of Blockchain, Block chain Technology Definition, Types of Block Chain, Peer to Peer Network, platform for decentralization, Transactional blocks, why use blockchain technology.

Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**Blockchain Platforms: Ethereum**	**(6hrs)**

Blockchain Platform introduction, what is **Ethereum**, Ethereum feature,Components of Ethereum Ecosystem, Ethereum Programming Languages, Runtime Byte Code, Blocks and Blockchain, How Smart Contracts Work. **Introduction to Tokenization:** What is token, technology behind tokenization, how blockchain tokenization can help in enterprise systems, Tokenizing Shares and Fund Raising, challenges to tokenization		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Blockchain Platforms: Hyper ledger**	**(6 hrs)**
What is Hyper ledger, features of a Hyper ledger blockchain, How Does Hyper Ledger Fabric Work, The Architecture of Hyper ledger Fabric System, Benefits of Hyper ledger Fabric, Differences Between Ethereum And Hyper ledger		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**Introduction to Tokenization**	**(6hrs)**
Introduction to Tokenization: What is token, technology behind tokenization, how blockchain tokenization can help in enterprise systems, Tokenizing Shares and Fund Raising, challenges to tokenization, Consensus Mechanism.		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**Merits and Demerits of Blockchain and Applications**	**(6hrs)**
Selection Criteria for Blockchain platform for Applications, Blockchain and Enterprise – A Technology of Coordination, Risks and Limitations of Blockchain: Privacy, Security Risks of Blockchain, The "Evil Sides" of Blockchain and Legal Regulations for Blockchain: Ransomware, Money Laundering. Benefits of Blockchain in various scenarios. 1. Use Case: Blockchain for Supply Chain Financing 2. Use Case: Blockchain for Health Insurance.		
Mapping of Course Outcomes for Unit VI	**CO6**	

Textbooks:

1. Imran Bashir," Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks", Packt Publishing Limited, **ISBN-13:** 978-1787125445
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies", Princeton University Press, ISBN: hardcover9780691171692 ebook: 9781400884155

Reference Books:

1. Kumar Saurabh, Ashutosh Saxena, "Blockchain Technology: Concepts and Applications", Wiley publication, First Edition, ISBN: 978-8126557660.
2. Melanie Swan," Blockchain Blueprint for a New Economy", O'Reilly Media, Print ISBN: 9781491920497, 1491920491eText ISBN: 9781491920459, 1491920459

E Books / E Learning References:
1. BLOCKCHAIN, Cybrosys Limited Edition, E-book https://www.studocu.com/co/document/universidad-eia/calculo-integral/cybrosys-limited-edition-e-book-criptomonedas/14736261 2. Online Course by NPTEL https://nptel.ac.in/courses/106104220 https://drive.google.com/file/d/1PtYaDmWYaqPVGjKDnMYGWO5eoI5wMPtJ/view

Savitribai Phule Pune University, Pune Final Year Information Technology (2019 Course) 414453: Startup and Entrepreneurship		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Tutorial (TUT) : 03 hrs/week	**03 Credits**	**TW: 50 Marks**

Prerequisite Courses, if any:

Course Objectives:

1. To encourage students to build new technology, knowledge system based on innovations and can address local challenges.
2. Creating environment to innovate and build products towards sustainable development goals.
3. To provide platform for speedy communication and market reach of technology/ product developed by students.
4. To have start up ecosystem by bridging the gap between academia, industries and financial institutions, government support

Course Outcomes:

On Completion of Course students will be be able to:-

1. able to understand key concepts and framework of innovation and start-up ecosystem.
2. gain knowledge of how to develop start up ecosystem, its key components and how to influence and manage dynamics between them and increase the productivity of ecosystem.
3. understand the role of different stakeholders in ecosystem in building and supporting growth of start-ups.
4. have insight into global trend in start-up ecosystem and product development.
5. mapping different start-up ecosystems and developing performance indicators.

COURSE CONTENTS

Unit I	Start-up Opportunity	(3 hrs)
Identify business opportunity with problem identification, market size, existing pains for customers, existing alternatives, customer psychology, willingness to pay, customer segments.		
Mapping of Course Outcomes for Unit I	**CO1**	
Unit II	**Product/ Service Proposal**	**(3 hrs)**
Value Proposition Canvas, problem-solution fit, brainstorming, competition analysis, creating competitive advantage, sustainable differentiation.		
Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**Business model**	**(3 hrs)**
Types, Lean canvas, Risky assumptions related to product, market, business, and execution capabilities		
Mapping of Course Outcomes for Unit III	**CO3**	

Unit IV	Minimum Viable Product (MVP)	(3 hrs)
Create and iterate, testing of MVP, customer feedback, validate risky assumptions, solution-market fit		
Mapping of Course Outcomes for Unit IV	CO4	
Unit V	**Financial Plan**	**(3 hrs)**
Manpower, Sales, Expenses, profitability projections, reality check, Funding plan, Pitch deck		
Mapping of Course Outcomes for Unit V	CO5	
Unit VI	**Marketing strategy**	**(3 hrs)**
Importance of brand and branding strategy, positioning, market penetration strategy/ plan, digital marketing, use of social media, customer acquisition Use of technology: for business scalability, effective execution, growth plan		
Mapping of Course Outcomes for Unit VI	CO6	

E Books / E Learning References:

- https://www.forbes.com/sites/palomacanterogomez/2019/04/10/how-to-frame-a-problem-to-find-the-right-solution/?sh=13af54355993
- https://hbswk.hbs.edu/item/how-entrepreneurs-can-find-the-right-problem-to-solve
- https://www.youtube.com/watch?v=6y3WIrgp_NY
- https://hbr.org/2014/07/what-you-need-to-know-about-segmentation
- https://www.youtube.com/watch?v=ReM1uqmVfP0
- https://www.youtube.com/watch?v=w62zW30PKms
- https://www.youtube.com/watch?v=FULiFueLGzE
- https://www.youtube.com/watch?v=7o8uYdUaFR4
- https://steveblank.com/2021/04/20/the-secret-to-the-minimum-viable-product/
- https://www.youtube.com/watch?v=1hHMwLxN6EM
- https://www.youtube.com/watch?v=4uGx14UVWPc
- https://www.youtube.com/watch?v=OVnN4S52F3k
- https://www.entrepreneur.com/article/251687
- https://www.forbes.com/sites/forbesbusinessdevelopmentcouncil/2020/09/14/13-key-steps-to-developing-a-go-to-market-strategy/?sh=53023c476fc1
- https://www.garyfox.co/business-model/business-model-channels/
- https://www.forbes.com/sites/allbusiness/2019/05/25/small-business-website-tips/?sh=2c551a0421ad

- https://www.forbes.com/sites/forbesagencycouncil/2020/10/08/digital-marketing-best-practices-for-startups/?sh=2e55af9e3ded

Savitribai Phule Pune University, Pune
Final Year Information Technology (2019 Course)
414454: Lab Practice - V

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

Prerequisites:

1. Operating Systems
2. Computer Network Technology
3. Web Application Development

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 for Instructor's Manual

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

Guidelines for Student's Lab Journal

1. The laboratory assignments are to be submitted by students in the form of journals. The Journal consists of prologue, Certificate, table of contents, and handwritten/printed 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.

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/printed 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.

Guidelines for Laboratory Conduction

Staff in-charge will suitably frame the assignments and flexibility may be incorporated. All the assignments should be conducted on the latest version of Open-Source Operating Systems, tools and Multi-core CPU supporting Virtualization and Multi-Threading.

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

1. Implement multi-threaded client/server Process communication using RMI.
2. Develop any distributed application using CORBA to demonstrate object brokering. (Calculator or String operations).
3. Develop a distributed system, to find sum of N elements in an array by distributing N/n elements to n number of processors MPI or OpenMP. Demonstrate by displaying the intermediate sums calculated at different processors.
4. Implement Berkeley algorithm for clock synchronization.
5. Implement token ring based mutual exclusion algorithm.
6. Implement Bully and Ring algorithm for leader election.
7. Create a simple web service and write any distributed application to consume the web service.
8. **Mini Project (In group):** A Distributed Application for Interactive Multiplayer Games

Reference Books:

1. Distributed Systems –Concept and Design, George Coulouris, Jean Dollimore, Tim Kindberg& Gordon Blair,Pearson,5th Edition,ISBN:978-13-214301-1.
2. Distributed Algorithms,Nancy Ann Lynch, Morgan Kaufmann Publishers, illustrated, reprint, ISBN: 9781558603486.
3. Java Network Programming & Distributed Computing by David Reilly, Michael Reilly
4. Distributed Systems - An Algorithmic approach by Sukumar Ghosh (good book for distributed algorithms)
5. Distributed Algorithms: Principles, Algorithms, and Systems by A. D. Kshemkalyani and M. Singhal (Good for algorithms, but very detailed, has lots of algorithms; good reference)
6. Design and Analysis of Distributed Algorithms by Nicola Santoro (good, distributed algorithms book)

Savitribai Phule Pune University, Pune
Final Year Information Technology (2019 Course)
414455: Lab Practice VI (Ethical Hacking and Security)

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR): 02hrs/week	01 Credits	OR: 50 Marks TW: 25 Marks

Prerequisites: Computer Network, Cyber Security,Kali Linux

Course Objectives:

1. To obtain practical knowledge of finding vulnerabilities in network and web applications.
2. To understand legal usage of industry standard security tools in an isolated environment.
3. To gain hands-on practical on current security threats and its approach.
4. To grasp the understanding of breaching different operating systems.

Course Outcomes:

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

CO1. Perform internal and external vulnerability analysis on web application and network.
CO2. Comprehend the hacker's mindset while conducting reconnaissance and system hacking.
CO3. Implement industry standard security protocols to prevent cyber-attacks.
CO4. Carry-out the same tactics, techniques, and procedures as actual hackers.

Guidelines for Instructor's Manual

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

Guidelines for Student's Lab Journal

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

1. There must be hand-written write-ups for every assignment in the journal. Student should work on real time ethical hacking tools and find vulnerabilities, Kali linux software must be installed on system with different commands.

Guidelines for Practical Examination
Practical should be conducted on Kali Linux. Google dorking should be experienced with real time website finding vulnerabilities.
List of Laboratory Assignments
1. **Assignment No 1: Reconnaissance (2 Hrs)** To perform reconnaissance on a website using google dorking technique on a tryhackme room. Perform Google Dorking: https://tryhackme.com/room/googledorking 2. **Assignment No.2(2 Hrs)** To perform reconnaissance on a website using web OSINT technique on a tryhackme room. Perform Web OSINT: https://tryhackme.com/room/webosint 3. **Assignment No 3: Scanning, enumeration, and analysis (2 Hrs)** To perform scanning using nmap(a powerful network scanning tool) in a tryhackme room. Perform scanning using Nmap tools: https://tryhackme.com/room/furthernmap Perform vulnerability analysis using Nessus tool: https://tryhackme.com/room/rpnessusredux 4. **Assignment 4 - POST-EXPLOITATION (2Hrs)** Perform Windows Privilege Escalation: https://tryhackme.com/room/windowsprivescarena Perform Post-Exploitation: https://tryhackme.com/room/postexploit Perform Linux Privilege Escalation: https://tryhackme.com/room/linuxprivesc
Reference Books:
1. Hacking: The Art of Exploitation, 2nd Edition 2nd Edition, Kindle Editionby Jon Erickson 2. javascript:void(0)The Basics of Hacking and Penetration Testing, Patrick Engebretson, 2nd edition 3. he Hacker Playbook 2, Peter Kim, 1st edition 4. Penetration Testing, Georgia Weidman, 1st edition
Virtual Laboratory
Penetration Testing Lab | Virtual Hacking Labs Kali Linux | Penetration Testing and Ethical Hacking Linux ... https://www.kali.org

<table>
<tr><td colspan="3">Savitribai Phule Pune University, Pune
Final Year Information Technology (2019 Course)
414455: Lab Practice VI (Augmented and Virtual Reality)</td></tr>
<tr><td>Teaching Scheme:</td><td>Credit Scheme:</td><td>Examination Scheme:</td></tr>
<tr><td>Practical (PR):2 hrs/week</td><td>01 Credit</td><td>OR: 50 Marks
TW: 25 Marks</td></tr>
<tr><td colspan="3">Prerequisites:</td></tr>
<tr><td colspan="3">Course Objectives:</td></tr>
<tr><td colspan="3">Course Outcomes:</td></tr>
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Guidelines for Instructor's Manual

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

Guidelines for Student's Lab Journal

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

1. There must be hand-written write-ups for every assignment in the journal.
2. Appropriate tools must be made available to students to perform assignments. Prefer open source if available.

Guidelines for Practical Examination

The exam will be based on all assignments .

List of Laboratory Assignments

1. **Assignment No.1**
   Study of various AR VR Development tools.
2. **Assignment No.2**
   Case study of an any single application using both VR and AR technologies.
3. **Assignment No.3**
   Installation and understanding of UNITY 3D IDE.
4. **Assignment No.4**

Create a C# script which plays a video when an image is scanned using AR App (use ARCore& Unity).
Text Books
1. Steve Aukstakalnis- Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR, Addison-Wesley Professional, September 2016, ISBN: 9780134094328 2. Allan Fowler- Beginning iOS AR Game Development Developing Augmented Reality Apps with Unity and C#, 1st Edition, Apress Publications, 2018, ISBN 978-1484236178
Reference Books
1. Learning C# by Developing Games with Unity 3D Beginner's Guide Terry Norton Pack Publication Packt publishing, 9th October 2017. ISBN-13: 978-1787286436 2. Jonathan Linowes, KrystianBabilinski – Augmented Reality for Developers: Build practical augmented reality applications with Unity, ARCore, ARKit, and Vuforia.
Online links
Manual:https://docs.unity3d.com/Packages/com.unity.xr.arfoundation@4.1/manual/index.html

Savitribai Phule Pune University, Pune
Final Year Information Technology (2019 Course)
414455: Lab Practice VI (Business Analytics and Intelligence)

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR): 02hrs/week	01 Credits	OR: 50 Marks TW: 25 Marks

Prerequisites: DSBDA Lab

Course Objectives:

1. To apply conceptual knowledge on various Business Analytics aspects.
2. To explore various tools for Data Analysis and visualization
3. To understand different practical techniques used by businesses for analytics
4. To understand the mathematical and analytical models behind Business Intelligence

Course Outcomes:

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

CO1. Compare and analyze different analytical tools used by businesses

CO2. Understand the application of critical notion of KPI using real time case studies

CO3. Design and implement the analytical models using suitable tools

CO4. Create visualizations using suitable tools

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. For each laboratory assignment, it is essential for students to draw/write/generate visualizations, mathematical model, Test data set and comparative/complexity analysis (as applicable).

Guidelines for Student's Lab Journal

Program codes / analysis with sample output of all performed assignments are to be submitted as softcopy. Use of Google Classroom / Drive /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 visualizations, 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. Comparative Study of Open-Source Data Analysis tools
2. Identify Key Performance Indicators (KPI) for any real time case study and present analysis for the same

Group B

1. Create, model, and analyze Petri nets with a standards-compliant Petri net tool for Producer / Consumer OR Dining Philosophers problem
2. Perform a what-if-analysis on Book Store Scenario using Excel
3. Create a decision tree for predicting the loan eligibility process using Python

Group C

1. Create following visualizations using Excel
   a. Combo charts
   b. Band Chart
   c. Thermometer Chart
   d. Gantt Chart
   e. Waterfall Chart
   f. Sparklines
   g. PivotCharts
2. Create interactive visualizations using any open-source tool. (Eg. KNIME, D3.js, Grafana, etc.)
3. Create a dashboard / report using Google Data Studio on YouTube Channel Data / Google Ads Data / Search Console Data

Reference Books:

1. Wilfried Grossmann & Stefanie Rinderle-Ma "Fundamentals of Business Intelligence", Springer, ISBN 978-3-662-46531-8 (eBook)
2. https://datastudio.google.com/
3. http://pipe2.sourceforge.net/
4. https://www.knime.com/

Savitribai Phule Pune University, Pune
Final Year Information Technology (2019 Course)
414455: Lab Practice VI (Blockchain Technology)

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR): 02 hrs/week	01 credit	OR: 50 Marks TW: 25 Marks

Prerequisites: Programming skills: javascript, react.js

Course Objectives:

1. To acquaint students with the basic skills required for adopting to crypto currency & block chain
2. To acquire knowledge about consensus algorithms and its working.

Course Outcomes:

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

1.To implement small blockchain experimentations.

2. Identify Consensus mechanism for Blockchain Application.

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's Lab 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.

Guidelines for Lab /TW Assessment

Faculty member should frame Practical Assignments based on 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 examination

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. Use of open-source software is to be encouraged. All the assignments should be conducted on Latest version of open-Source Operating Systems, tools and Multi-core CPU supporting Virtualization and Multi-Threading.

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.

List of Laboratory Assignments

1. **Assignment No.1**

   To setup a crypto wallet

   a) i) hosted wallets ii) self-custody wallet iii) hardware wallets (optional) and evaluate each of these.

b) Understand the basic operations in the wallet on bitcoin such as 1) buy 2) sell 3) send 4) receive 5) exchange 6) mining.

2. **Assignment No.2**
   1) Create a local Ethereum network using Hardhat or any other tool, build a smart contract that lets you send a 👋 (wave) to your contract and keep track of the total # of waves. Compile it to run locally.
   2) Connect to any Ethereum walleteg.Metamask. Deploy the contract with testnet. Connect wallet with your webapp. Call the deployed contract through your web app. Then store the wave messages from users in arrays using structs
3. **Assignment no.3**

   Prepare your build system and Building Bitcoin Core.
   a. Write Hello World smart contract in a higher programming language (Solidity).
   b. Solidity example using arrays and functions
4. **Assignment no.4**

   Deploy a simple contract to the Ethereum blockchain.
5. **Assignment no.5**

   Polling / voting system using Solidity, Ethereum and a data structure hashmap(optional)

Online References

- https://buildspace.so/p/build-solidity-web3-app/lessons/welcome
- https://www.theinsaneapp.com/2022/05/best-web3-projects.html
- https://www.coinbase.com/learn/tips-and-tutorials/how-to-set-up-a-crypto-wallet

Savitribai Phule Pune University, Pune
Final Year Information Technology (2019 Course)
414456 : Project-II

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical: 10 hrs/week	05 Credits	Term Work : 100 Marks Oral : 50 Marks

Prerequisite Courses, if any: Project Phase-I (B.E. (IT) Final Year Semester-I)

Companion Course, if any: NA

Course Objectives:

1. To enable the student to extend further the investigative study taken up under Project stage-I, 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 build up exposure of implementation and hence develops analysis of results by considering performance measures.
3. To expose students to product development environment using industrial experience, use of state of art technologies.
4. To encourage and expose students with funding agency for sponsored projects.
5. To generate the opportunities to experience practically the facts learned in various fields together.
6. To improve overall communication skill, Teamwork and Leadership Qualities, professionalism.
7. Evaluate the various validation and verification methods.
8. Analyzing professional issues, including ethical, legal and security issues, related to computing projects.
9. To evaluate alternative approaches, and justify the results obtained.

Course Outcomes:

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

1. To apply engineering and mathematical knowledge to investigate / select proper technology / Algorithm suitable to solve the problem in hand.
2. To apply knowledge of statistics for analysis of results and express conclusion and justification for the same.
3. To design and conduct experiments, as well as to analyze and interpret data or develop prototype model of the application.
4. To communicate effectively.
5. Get broad education which is necessary to understand the impact of engineering solutions in a global, economic, environmental, ethically and societal context.
6. Recognition of the need for, and an ability to engage in life-long learning.

Introductory Information:

BE Project Phase-II is the continuation of Project Phase-I for implementation, and analysis of results to arrive a valid conclusion with justification.

Guidelines to Faculty and Students:

1. Preferably same review committee needs to continue for Project Phase-II.
2. There shall be **TWO** reviews in Project phase –II (in semester-II) by the review committee.
3. The Project Review committee will be responsible for evaluating the timely progress of the projects. It is suggested to evaluate the skills learned by the students in their PBL (in their previous years).
4. Student needs to justify the Algorithm / Model used for implementation.
5. Every student of the project group shall make presentation on the progress made by them before the committee during each reviews. Each student/group is required to give presentation as part of review for 10 to 15 minutes followed by a detailed discussion and query session.
6. Students need to note down the queries raised during review(s) and comply the same in the next review session.
7. The record of the remarks/suggestions of the review committee (project dairy) should be properly maintained in continuation of Project Phase-II and should be made available at the time of university examination.
8. Project group needs to present / publish **TWO** papers (One in each semester, at least one paper should be in **UGC – Care journal**).
    a. Paper must be checked for Plagiarism by any open software.
    b. One paper during second semester which includes Methodologies / Algorithms implemented, Results obtained, Analysis of results and conclusion.
9. Project report must also be checked for Plagiarism.
10. The examinee will be assessed by a panel of examiners of which one is necessarily an external examiner. The assessment will be broadly based on work undergone, content delivery, presentation skills, documentation, question-answers and report.

Review 3: Implementation –

Points to be covered:

1. Detailed study of Algorithm(s) / Model / Hardware specification (As applicable).
2. Confirmation of Data set used (As applicable)
3. Detailed ER Diagram / DFD diagrams.
4. Detailed UML Diagrams.
5. Sample results (module based).

Review 4: Testing and Result Analysis.

Points to be covered:

1. Appropriate test cases and results of test cases.
2. Representation of results with analysis.
3. Conclusion over performance parameters (as applicable)
4. Conclusion and future work suggested.
5. Knowledge of references utilized.

Evaluation Criteria:

Following criteria and weightage is suggested for evaluation of Project-Phase II Term Work.

1. Availability of standard Data set / Input parameters: 10%
2. Depth of Understanding of implemented Technology / Algorithm / Domain / Model: 40%
3. Test cases / Validation and Verification process: 10%
4. Justification of Algorithm / Model / Architecture / System: 10%
5. Analysis of results and conclusion: 10%
6. Presentation Skill: 10%
7. Report preparation and Paper publication: 10%

Project report contains the details as Follows:

It is suggested to have only one Project report which includes work carried at Project Phase-I as well. Project report must have:

- **i.** Certificate from the institute.
- **ii.** Certificate sponsoring organization (If any).
- **iii.** Acknowledgement.
- **iv.** Abstract.
- **v.** Contents.
- **vi.** List of Abbreviations (As applicable).
- **vii.** List of Figures (As applicable).
- **viii.** List of Graphs (As applicable).
- **ix.** List of Tables (As applicable).
  - **1)** Introduction and aims/motivation and objectives.
  - **2)** Literature Survey (with proper citation).
  - **3)** Problem Statement/definition.
  - **4)** Software Requirement Specification (In SRS Documentation only).
  - **5)** Flowchart
  - **6)** Project Requirement specification.
  - **7)** Proposed system Architecture.
  - **8)** High level design of the project (DFD , UML , ER Diagrams).
  - **9)** System implementation-code documentation: Algorithm style, Description of detailed methodologies, protocols used etc..as applicable.
  - **10)** Test cases.
  - **11)** GUI/Working modules and Experimental Results in suitable format.
  - **12)** Project Plan.
  - **13)** Analysis and Conclusions with future work.
  - **14)** Bibliography in IEEE format.

Appendices

- **a)** Plagiarism Report of Paper and Project report from any open source tool.
- **b)** Base Paper(s) [If any].
- **c)** Tools used / Hardware Components specifications [If any].
- **d)** Published Papers and Certificates (Both Papers).

Use appropriate plagiarism tools, reference managers, Latex for efficient and effective project writing.

Savitribai Phule Pune University, Pune
B.E Information Technology (2019 Course)
414457A: Audit Course8
Functional Programming in Haskell

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory (TH): 01 hrs/week	Non-Credit	Audit Course

Prerequisite Courses: Programming using any high-level language.

Course Objectives:

1. To understand the paradigm of programming.
2. To develop insight about 'lazy' execution.
3. To learn the syntax and semantics of the Haskell programming language.
4. To learn 'idioms' of Haskell programming

Course Outcomes:

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

CO1. Understand the correctness of programs.

CO2. Make use of higher-order functions.

CO3. Make use of the data encapsulation and parametric polymorphism for functional programming.

CO4. Understand the importance of the 'type checking' of values/functions to develop programs relatively faster.

COURSE CONTENTS

Unit I	Introduction	(3 hrs)
Types and Values, Running Haskell Programs, Lists, Strings, Tuples. Introduction to ghci interpreter		
Mapping of Course Outcomes for Unit I	CO1	
Unit II	**Functions**	**(3 hrs)**
Functions, Type Inference, Recursion, Higher-order Functions, Polymorphic Types, Lambda Functions. Computation as rewriting, lazy evaluation and infinite data structures		
Mapping of Course Outcomes for Unit II	CO2, CO3	
Unit III	**Data Types**	**(3 hrs)**
User defined Data Types, Abstract data types, Recursive Data Types-Binary search trees		
Mapping of Course Outcomes for Unit III	CO4	
Unit IV	**Arrays and IO**	**(3hrs)**
Arrays, Input / Output		
Mapping of Course Outcomes for Unit IV	CO4	

Textbooks:
1. Brian O'Sullivan, John Goerzen and Don Stewart, 'Real World Haskell', O'reilly. **2.** MiranLipovača, 'Learn You a Haskell for Great Good!', No Starch Press. **3.** Graham Hutton, "Programming in Haskell", Cambridge University Press. **4.** https://nptel.ac.in/courses/106106137
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.

Savitribai Phule Pune University, Pune

B.E Information Technology (2019 Course)

414457B: Audit Course 8

Cyber Laws And Use Of Social Media

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory (TH): 01 hrs/week	Non-Credit	Audit Course

Prerequisite Courses: Programming using any high-level language.

Course Objectives:

To understand and aware Cyber laws which are focusing on protecting the privacy of users from organizations and other users.
To know the cyber threats happening around them and to help them stay secure in the daily use of Cyberspace.

Course Outcomes:

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

CO1. Understand the importance of IT Act.

CO2. Understand the significance of cyber laws and its practices.

CO3. Identify and Analyze software vulnerabilities and security solutions to reduce the risk of exploitation.

CO4. To study various privacy and security concerns of Online social media.

COURSE CONTENTS

Unit I	Introduction to IT Act	(03 hrs)

Evolution of the IT Act, Genesis and Necessity Various authorities under IT Act and their powers: Penalties & Offences, amendments. Traditional Principals of Jurisdiction, Extra-terrestrial Jurisdiction, Case Laws on Cyber Space Jurisdiction

Mapping of Course Outcomes for Unit I	CO1

Unit II	Cyber Law: International Perspective	(03 hrs)

EDI: Concept and legal Issues, UNCITRAL Model Law, Electronic Signature Laws of Major Countries, Cryptography Laws, Cyber Laws of Major Countries, EU Convention on Cyber Crime

Mapping of Course Outcomes for Unit II	CO2

Unit III	Cyber Forensic and Computer Crimes	(03 hrs)

Types, Crimes targeting Computers: Definition of Cyber Crime & Computer related crimes.
Classification & Differentiation between traditional crime and cyber-crimes.
Cyber-crimes and cyber terrorism: -
a) Cyber-crimes and the categories of crime i) Cyber frauds ii) Cyber thefts iii) Cyber stacking
b) Cyber Terrorism. c) Hacking, Virus, Trojan, worms etc.

Mapping of Course Outcomes for Unit III	CO3

Unit IV	Use of Social Media	(03 hrs)

Elements of Social Networks, Social Media Outlets. (Facebook, Twitter, etc.): How the differences impact, how to use them. Videos: Broadcasting to peers, many to many, friends and followers, apps, pages, pseudonyms of good and evil Focused Networks (Flickr, Linked In, YouTube, etc.) networks that focus on specific topics or activities	
Mapping of Course Outcomes for Unit IV	**CO4**

Textbooks:

1. The Information Technology act, 2000, Bare Act-Professional Book Publishers, New Delhi.
2. Aparna Viswanathan, "Cyber Law- Indian and International Perspectives On Key Topics Including Data Security, E-Commerce, Cloud Computing and Cyber Crimes".
3. First Responder's Guide to Computer Forensics by Richard Nolan etal; Carnegi Mellon, 2005.
4. https://nptel.ac.in/courses/106106146

Evaluation

Students should select any one of the topics 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.

<table>
<tr><td colspan="3" align="center">Savitribai Phule Pune University, Pune
B.E Information Technology (2019 Course)
414457C: Audit Course 8
Constitution Of India</td></tr>
<tr><td>Teaching Scheme:</td><td>Credit Scheme:</td><td>Examination Scheme:</td></tr>
<tr><td>Theory(TH): 01 hrs/week</td><td>Non-Credit</td><td>Audit Course</td></tr>
<tr><td colspan="3">Prerequisite Courses, if any:</td></tr>
<tr><td colspan="3">Course Objectives:
1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals’ constitutional role and entitlement to civil and economic rights.
3. To address the role and functions of local administration.</td></tr>
<tr><td colspan="3">Course Outcomes:
On completion of the course, students will be able to–
CO1. Understand the Principles of the Indian Constitution.
CO2. Understand and identify the growth of the demand for civil rights in India.
CO3. Understand the organizations of governance.
CO4. Understand the role and functions of local administration.</td></tr>
<tr><td colspan="3" align="center">COURSE CONTENTS</td></tr>
<tr><td>Unit I</td><td>History of Making of the Indian Constitution</td><td>(03 hrs)</td></tr>
<tr><td colspan="3">History Drafting Committee, (Composition & Working), Philosophy of the Indian Constitution: Preamble, Salient Features</td></tr>
<tr><td>Mapping of Course Outcomes for Unit I</td><td colspan="2">CO1</td></tr>
<tr><td>Unit II</td><td>Contours of Constitutional Rights & Duties</td><td>(03 hrs)</td></tr>
<tr><td colspan="3">Fundamental Rights, Right to Equality, Right to Freedom, right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.</td></tr>
<tr><td>Mapping of Course Outcomes for Unit II</td><td colspan="2">CO2</td></tr>
<tr><td>Unit III</td><td>Organs of Governance:</td><td>(03 hrs)</td></tr>
<tr><td colspan="3">Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary</td></tr>
<tr><td>Mapping of Course Outcomes for Unit III</td><td colspan="2">CO3</td></tr>
<tr><td>Unit IV</td><td>Local Administration and Election Commission</td><td>(03 hrs)</td></tr>
</table>

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected representative, CEO of Municipal Corporation.
Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role.
Block level: Organizational Hierarchy (Different departments),
Village level: Role of Elected and Appointed officials, Importance of grass root democracy.
Election Commission: Role and Functioning

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

Textbooks:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.
5. https://nptel.ac.in/courses/129106003

Evaluation:

Students should select any one of the topics in a group of 3 to 5. Students should submit a written Report. Make a presentation on the topic. Report will be evaluated by the faculty as per rubrics defined by them at start of course.