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

http://unipune.ac.in

Curriculum
for
Second Year of
Computer Science And Design
(2021 Course)
(with effect from A.Y. 2022-23)

Preamble

The field of computing is rapidly changing, especially, since the last decade with continuous emergence of new disruptive technologies such as animation, gaming, virtual reality, augmented reality in addition to artificial intelligence, data science, cyber security, Internet of things, robotics and so on.

21st Century has witnessed rapid technological developments in every sector including the field of Computing. Moreover, it has created new job roles and massive job opportunities for budding engineers.

Premium Institutes such as IITs, NITs, IIITs, public and private Universities, autonomous and affiliated colleges in India have always played a crucial role in producing human resources with required skill sets by capturing and monitoring these developments and by designing and offering various Bachelors degree programmes in engineering.

Savitribai Phule Pune University, Pune has made its significant contribution by offering degree programmes as per the trends from time to time. In the year 1983, it started offering a degree programme in Computer Engineering and the Bachelor of Computer Science (BCS) course, now called B. Sc. (Computer Science) was introduced in the year 1989-90 and was its unique offering in the state of Maharashtra.

The degree programs offered by various Universities in the computing domain have undergone fusion and fission. Thus starting from Electrical Engineering, we have witnessed emergence of degree programs such as Electronics Engineering, Computer Engineering and Information Technology. Universities across nation today are not only offering basic degrees in Computing such as Computer Engineering/Computer Science & Engineering/Computer Technology, Information technology etc but have also recently started offering engineering degree programs in specialized emerging areas such as Artificial intelligence, Data Science, Machine Learning, IoT, Cyber security etc. to provide specialized skills in these emerging areas to cater the tremendous demands by the IT industries in India and abroad. In the years to follow, additional degree programs will be offered in the areas of Cyber Physical systems, Quantum Computing etc.

Computer gaming, graphics and animation, 3D modeling, augmented reality, virtual reality are some of the disruptive technologies that are currently in high demand, but need specialized skill sets. Moreover, industry not only expects the engineering graduates from computing domain to possess traditional skills such as programming and software designs but also the specialized skills from the domains mentioned above. Along with traditional job roles such as programmer, Software Engineer, System Analyst, Software tester etc, new job roles are now been created in these specialized areas such as AR-VR content writer/developer, AR-VR user experience designer, Animator, Audio Engineer, UI and UX designers, 3D Modeler, Graphics designer, Game designer, Professional Gamer, community manager, product manager to name a few. The All India Council for Technical Education (AICTE), New

Delhi in its process handbook for the AY 2021-22 has included the course on Computer Science and Design.

The Board of Studies in Computer Engineering discussed at length such emerging trends and skill set requirements of the domains mentioned above and thereby recommends the University authorities to instantiate a new four years Bachelors Degree in Computer Science and design under the faculty of Science and Technology as a response to cater the needs of industries that are looking for computer professionals with basic computing skills as well as skills from the specialized domains mentioned above.

The Board of Studies in Computer Engineering has prepared a structure for this programme with following features

- The structure is in line with the existing structure for all bachelors programmes offered under the faculty of Science and Technology with respect to teaching scheme, examination scheme, credits and types of courses (Credit, audit, seminars, projects, Internships, Project Based Learning etc)
- The structure and various courses offered for the two semesters of the First year will be the same as offered for all other bachelor programmes.
- Core courses in Computing (Data Structures, Discrete Structures, Logic Design, Databases, Operating Systems, Networks, Theory of Computation, Software Engineering) shall be offered in second, third and final year of the programme. These courses shall inculcate basic computing skills. Core courses on Artificial Intelligence and data science provides adequate base for the learner in these disruptive technologies and their application in AR- VR, Animation and Gaming etc.
- Specialized core courses such as Design Thinking, Human Computer Interface, Digital and media marketing, Web Application development etc shall be offered in second, third and final year of the programme.
- Specialized elective courses such as Animation Design and Principles, Multi- media, Computer Game design, Computer Vision, Graphics Design, Usability Engineering, Augmented reality, virtual reality, 3D interaction design etc shall be offered in two separate tracks with six courses in each of the tracks.

The specialized core and elective courses would be useful to inculcate skill sets in emerging areas of AR-VR, Gaming, Animation, Multimedia, Graphics etc

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Savitribai Phule Pune University Bachelor of Computer Science and Design		
Program Outcomes (POs)		
Learners are expected to know and be able to–		
PO1	**Engineering knowledge**	Apply the knowledge of mathematics, science, Engineering fundamentals, and an Engineering specialization to the solution of complex Engineering problems.
PO2	**Problem analysis**	Identify, formulate, review research literature and analyze complex Engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and Engineering sciences.
PO3	**Design / Development of Solutions**	Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations.
PO4	**Conduct Investigations of Complex Problems**	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern Tool Usage**	Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modeling to complex Engineering activities with an understanding of the limitations.
PO6	**The Engineer and Society**	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practices.
PO7	**Environment and Sustainability**	Understand the impact of the professional Engineering solutions in societal and Environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**	Apply ethical principles and commit to professional ethics and responsibilities and norms of Engineering practice.
PO9	**Individual and Team Work**	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication Skills**	Communicate effectively on complex Engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project Management and Finance**	Demonstrate knowledge and understanding of Engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary Environments.
PO12	**Life-long Learning**	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSO)	
A graduate of the Computer Science and Design Engineering Program will demonstrate-	
PSO1	**Professional Skills**-The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexities.
PSO2	**Problem-Solving Skills**- The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.
PSO3	**Successful Career and Entrepreneurship**- The ability to employ modern computer languages, environments and platforms in creating innovative career paths to be an entrepreneur and to have a zest for higher studies.

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Semester-III

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credit Scheme			
		Lecture	Practical	Tutorial	Mid-Sem	End-Sem	Term work	Practical	Oral	Total	Lecture	Practical	Tutorial	Total
210241	Discrete Mathematics	03	-	-	30	70	-	-	-	100	03	--	-	03
218242	Data Structure and Algorithms	03	-	-	30	70	-	-	-	100	03	-	-	03
210243	Object Oriented Programming (OOP)	03	-	-	30	70	-	-	-	100	03	-	-	03
210244	Computer Graphics	03	-	-	30	70	-	-	-	100	03	-	-	03
218245	Logic Design and Computer Architecture	03	-	-	30	70	-	-	-	100	03	-	-	03
210246	Data Structures Laboratory	-	04	-	-	-	25	25	-	50	-	02	-	02
210247	OOP and Computer Graphics Laboratory	-	04	-	-	-	25	25	-	50	-	02	-	02
218248	Logic Design and Computer Architecture Laboratory	-	02	-	-	-	25	25	-	50	-	01	-	01
210249	Soft Skills	-	02	-	-	-	25	-	-	25	-	01	-	01
210250	Humanities and Social Science	-	-	01	-	-	25	-	-	25	-	-	01	01
210251	Audit Course 3													
Total Credit											**15**	**06**	**01**	**22**
Total		**15**	**12**	**01**	**150**	**350**	**125**	**75**	**-**	**700**	**-**	**-**	**-**	**-**

Semester-IV

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credit Scheme			
		Lecture	Practical	Tutorial	Mid-Sem	End-Sem	Term work	Practical	Oral	Total	Lecture	Practical	Tutorial	Total
207003	Engineering Mathematics-III	03	-	01	30	70	25	-	-	125	03	-	01	04
218253	Data Structures and Files	03	-	-	30	70	-	-	-	100	03	-	-	03
218254	Operating Systems	03	-	-	30	70	-	-	-	100	03	-	-	03
218255	Computer Networks	03	-	-	30	70	-	-	-	100	03	-	-	03
218256	Design Thinking	03	-	-	30	70	-	-	-	100	03	-	-	03
218257	Data Structures and Files Laboratory	-	04	-	-	-	25	25	-	50	-	02	-	02
218258	Software Laboratory	-	04	-	-	-	25	-	25	50	-	02	-	02
210258	Project Based Learning II	-	02	-	-	-	50	-	-	50	-	01	-	01
210259	Code of Conduct	-	-	01	-	-	25	-	-	25	-	-	01	01
210260	Audit Course 4													
Total Credit											**15**	**05**	**02**	**22**
Total		**15**	**10**	**02**	**150**	**350**	**125**	**25**	**25**	**700**	**-**	**-**	**-**	**-**

General Guidelines

1. Every undergraduate program has its own objectives and educational outcomes. These objectives and outcomes are furnished by considering various aspects and impacts of the curriculum. These **Program Outcomes (POs)** are categorically mentioned at the beginning of the curriculum (ref: NBA Manual). There should always be a rationale and a goal behind the inclusion of a course in the curriculum. Course Outcomes though highly rely on the contents of the course; many-a-times are generic and bundled. The **Course Objectives**, **Course Outcomes** and **CO-PO mappings matrix** justifies the motives, accomplishment and prospect behind learning the course. The Course Objectives, Course Outcomes and CO-PO Mapping Matrix are provided for reference and these are indicative only. The course instructor may modify them as per his or her perspective.

2. @:**CO and PO Mapping Matrix** (Course Outcomes and Program Outcomes)- The **expected** attainment mapping matrix at end of course contents, indicates the correlation levels of 3, 2, 1 and '-'. The notation of 3, 2 and 1 denotes substantially (high), moderately (medium) and slightly (low). The mark '-' indicates that there is no correlation between the respective CO and PO.

3. **#:Elaborated examples/Case Studies-** For each course, contents are divided into six units-I, II, III, IV, V and VI. Elaborated examples/Case Studies are included at the end of each unit to explore how the learned topics apply to real world situations and need to be explored so as to assist students to increase their competencies, inculcating the specific skills, building the knowledge to be applicable in any given situation along with an articulation. One or two sample exemplars or case studies are included for each unit; instructor may extend the same with more. **Exemplar/Case Studies** may be assigned as self-study by students and to be excluded from theory examinations.

4. *****:For each unit contents, the desired content attainment mapping is indicated with Course Outcome(s). Instructor may revise the same as per their viewpoint.

5. For laboratory courses, set of suggested assignments is provided for reference. Laboratory Instructors may design suitable set of assignments for respective course at their level. Beyond curriculum assignments and mini-project may be 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.

6. 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 tutorial may be as per guidelines of authority.

7. For each course, irrespective of the examination head, the instructor should motivate students to read and publish articles, research papers related to recent development and invention in the field.

8. For laboratory, instructions have been included about the conduction and assessment of laboratory work. These guidelines are to be strictly followed. Use of open source software is appreciated.

9. **Term Work**[1]**–**Term work is continuous assessment that evaluates a student's progress throughout the semester[1]. 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 internal monthly practical examination aspart of continuous assessment.

   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.

10. **Laboratory 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 journal may be avoided. Submission of journal/ term work in the form of softcopy is desirable and appreciated.

11. **Tutorial**[1] **-** Tutorials can never be an individual course but an additional aid to the learners. Tutorials help the learners to inculcate the contents of the course with focused efforts on small group of the learners. Tutorial conduction should concentrate more on simplifying the intricacies converging to clear understanding and application. **Assessment of tutorial work is to be done in a manner similar to assessment of term-work; do follow same guidelines.**

12. **Audit Course**[1]- The student registered for audit course shall be awarded the grade AP/PP (Audit Course Pass) and the grade 'AP'/'PP' shall be included in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory performance and secured a passing grade in that audit course. No grade points are associated with this 'AP'/'PP'' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA. Evaluation of audit course will be done at institute level itself.

13. **$**:For courses 210249: Business Communication Skills, 210250: Humanity and Social Science and 210260: Code of Conduct, one credit can be earned by student if student successfully completes the Swayam course as listed in curriculum of respective course in this document.

    UGC has issued the UGC (Credit Framework for online learning courses through SWAYAM) Regulation 2016 advising the Universities to identify courses where credits can be transferred on to the academic record of the students for courses done on SWAYAM. AICTE has also put out gazette notification in 2016 and subsequently for adoption of these courses for credit transfer [2].

    SWAYAM is a programme initiated by Government of India and designed to achieve the three cardinal principles of Education Policy viz., access, equity and quality. This is done through a platform that facilitates hosting of the courses to be accessed by anyone, anywhere at any time. Courses delivered through SWAYAM are interactive, prepared by the best teachers in the country and are available, free of cost to any learner. However, learners wanting a SWAYAM certificate should register for the final proctored exams that come at a fee and attend in-person at designated center on specified dates. Eligibility for the certificate is generally announced on the course page. Universities/colleges approving credit transfer for these courses can use the marks/certificate obtained in these courses for the same.[2]

Note: For Examination rules, pattern and assessment please refer [1]

[1] http://collegecirculars.unipune.ac.in/sites/documents/Syllabus%202019/Rules%20and%20Regulati ons%20F.E.%202019%20Patt_10.012020.pdf

[2] https://swayam.gov.in/about

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

Semester III

Savitribai Phule Pune University Second Year of Computer Science and Design (2021 Course) 210241: Discrete Mathematics		
Teaching Scheme	**Credit Scheme**	**Examination Scheme and Marks**
Lecture: 03 Hours/Week	**03**	**Mid_Semestr(TH): 30 Mark** **End_Semester(TH): 70 Marks**

Prerequisite Courses : Basic Mathematics

Companion Course : ---

Course Objectives:

To introduce several Discrete Mathematical Structures found to be serving as tools even today in the development of theoretical computer science.

- To introduce students to understand, explain, and apply the foundational mathematical concepts at the core of computer science.
- To understand use of set, function and relation models to understand practical examples, and interpret the associated operations and terminologies in context.
- To acquire knowledge of logic and proof techniques to expand mathematical maturity.
- To learn the fundamental counting principle, permutations, and combinations.
- To study how to model problem using graph and tree.
- To learn how abstract algebra is used in coding theory.

Course Outcomes:

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

CO1: Formulate problems precisely, solve the problems, apply formal proof techniques, and explain the reasoning clearly.

CO2: Apply appropriate mathematical concepts and skills to solve problems in both familiar and unfamiliar situations including those in real-life contexts.

CO3: Design and analyze real world engineering problems by applying set theory, propositional logic and to construct proofs using mathematical induction.

CO4: Specify, manipulate and apply equivalence relations; construct and use functions and apply these concepts to solve new problems.

CO5: Calculate numbers of possible outcomes using permutations and combinations; to model and analyze computational processes using combinatorics.

CO6: Model and solve computing problem using tree and graph and solve problems using appropriate algorithms.

CO7: Analyze the properties of binary operations, apply abstract algebra in coding theory and evaluate the algebraic structures**.**

Course Contents

Unit I	**Set Theory and Logic**	**(07 Hours)**

Introduction and significance of Discrete Mathematics, **Sets–** Naïve Set Theory (Cantorian Set Theory), Axiomatic Set Theory, Set Operations, Cardinality of set, Principle of inclusion and exclusion.

Types of Sets – Bounded and Unbounded Sets, Diagonalization Argument, Countable and Uncountable Sets, Finite and Infinite Sets, Countably Infinite and Uncountably Infinite Sets, Power set,

Propositional Logic- logic**,** Propositional Equivalences, Application of Propositional Logic- Translating English Sentences, Proof by Mathematical Induction and Strong Mathematical Induction.

#Exemplar/Case Studies	Know about the great philosophers- Georg Cantor, Richard Dedekind and Aristotle
***Mapping of Course**	CO1,CO2,CO3

Outcomes for Unit 1		
Unit II	**Relations and Functions**	**(07 Hours)**
Relations and their Properties, n-ary relations and their applications, Representing relations, Closures of relations, Equivalence relations, Partial orderings, Partitions, Hasse diagram, Lattices, Chains and Anti-Chains, Transitive closure and Warshall's algorithm. **Functions-** Surjective, Injective and Bijective functions, Identity function, Partial function, Invertible function, Constant function, Inverse functions and Compositions of functions, The Pigeonhole Principle.		
#Exemplar/Case Studies	Know about the great philosophers-Dirichlet	
*Mapping of Course Outcomes for Unit II	CO2,CO4	
Unit III	**Counting Principles**	**(07Hours)**
The Basics of Counting, rule of Sum and Product, Permutations and Combinations, Binomial Coefficients and Identities, Generalized Permutations and Combinations, Algorithms for generating Permutations and Combinations.		
#Exemplar/Case Studies	Study Sudoku solving algorithms and algorithm for generation of new SUDOKU. Study Hank-shake Puzzle and algorithm to solve it.	
*Mapping of Course Outcomes for Unit III	CO2,CO5	
Unit IV	**Graph Theory**	**(07Hours)**
Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, the handshaking lemma, Single source shortest path- Dijkstra's Algorithm, Planar Graphs, Graph Colouring.		
#Exemplar/Case Studies	Three utility problem, Web Graph, Google map	
*Mapping of Course Outcomes for Unit IV	CO1,CO2,CO6	
Unit V	**Trees**	**(07Hours)**
Introduction, properties of trees, Binary search tree, tree traversal, decision tree, prefix codes and Huffman coding, cut sets, Spanning Trees and Minimum Spanning Tree, Kruskal's and Prim's algorithms, The Max flow- Min Cut Theorem (Transport network).		
#Exemplar/Case Studies	Algebraic Expression Tree, Tic-Tac-Toe Game Tree	
*Mapping of Course Outcomes for Unit V	CO1,CO2,CO6	
Unit VI	**Algebraic Structures and Coding Theory**	**(07Hours)**
The structure of algebra, Algebraic Systems, Semi Groups, Monoids, Groups, Homomorphism and Normal Subgroups, and Congruence relations, Rings, Integral Domains and Fields, Coding theory, Polynomial Rings and polynomial Codes, Galois Theory –Field Theory and Group Theory.		
#Exemplar/Case Studies	Cryptography used in world war II	
*Mapping of Course Outcomes for Unit VI	CO1, CO2, CO7	

Learning Resources

Text Books:

1. C. L. Liu, "Elements of Discrete Mathematics"‖, TMH, ISBN 10:0-07-066913-9.
2. N. Biggs, "Discrete Mathematics", 3rd Ed, Oxford University Press, ISBN 0 –19-850717–8.

Savitribai Phule Pune University Second Year of Computer Science and Design (2021 Course) 218242: Data Structures and Algorithms		
Teaching Scheme	**Credit Scheme**	**Examination Scheme and Marks**
Lecture: 03 Hours/Week	**03**	**Mid_Semestr(TH): 30 Mark** **End_Semester(TH): 70 Marks**

Prerequisite Courses : 110005: Programming and Problem Solving

Companion Course : 210246: Data Structures Laboratory

Course Objectives:

The course is intended to provide the foundations of the practical implementation and usage of Data Structures and Algorithms to ensure that the learner evolves into a competent programmer capable of designing and analyzing implementations of data structures and algorithms for different kinds of problems.

- To understand the standard and abstract data representation methods.
- To acquaint with the structural constraints and advantages in usage of the data.
- To understand various data structures, operations on it and the memory requirements
- To understand various data searching and sorting methods.
- To understand various algorithmic strategies to approach the problem solution.

Course Outcomes:

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

CO1: Design the algorithms to solve the programming problems, **identify** appropriate algorithmic strategy for specific application, and **analyze** the time and space complexity.

CO2: Discriminate the usage of various structures, **Design/Program/Implement** the appropriate data structures; use them in implementations of abstract data types and Identity the appropriate data structure in approaching the problem solution.

CO3: Demonstrate use of sequential data structures- Array and Linked lists to store and process data.

CO4: Understand the computational efficiency of the principal algorithms for searching and sorting and choose the most efficient one for the application.

CO5: Compare and **contrast** different implementations of data structures (dynamic and static).

CO6: Understand, Implement and apply principles of data structures-stack and queue to solve computational problems.

Course Contents

Unit I	Introduction to Algorithm and Data Structures	(07 Hours)

Introduction: From Problem to Program (Problem, Solution, Algorithm, Data Structure and Program). Data Structures: Data, Information, Knowledge, and Data structure, Abstract Data Types (ADT), Data Structure Classification (Linear and Non-linear, Static and Dynamic, Persistent and Ephemeral data structures).

Algorithms: Problem Solving, Introduction to algorithm, Characteristics of algorithm, Algorithm design tools: Pseudo-code and flowchart. **Complexity of algorithm:** Space complexity, Time complexity, Asymptotic notation- Big-O, Theta and Omega, finding complexity using step count method, Analysis of programming constructs-Linear, Quadratic, Cubic, Logarithmic. **Algorithmic Strategies:** Introduction to algorithm design strategies- Divide and Conquer, and Greedy strategy.

#Exemplar/Case Studies	Multiplication technique by the mathematician Carl Friedrich Gauss and Karatsuba algorithm for fast multiplication
*Mapping of Course Outcomes for Unit 1	CO1,CO2

Unit II	**Linear Data Structure Using Sequential Organization**	**(07 Hours)**
Concept of Sequential Organization, Overview of Array, Array as an Abstract Data Type, Operations on Array, Merging of two arrays, Storage Representation and their Address Calculation: Row major and Column Major, Multidimensional Arrays: Two-dimensional arrays, n-dimensional arrays. Concept of Ordered List, **Single Variable Polynomial**: Representation using arrays, Polynomial as array of structure, Polynomial addition, Polynomial multiplication. **Sparse Matrix:** Sparse matrix representation using array, Sparse matrix addition, Transpose of sparse matrix- Simple and Fast Transpose, Time and Space tradeoff.		
#Exemplar/Case Studies	Study use of sparse matrix in Social Networks and Maps. Study how Economists use polynomials to model economic growth patterns, how medical researchers use them to describe the behaviour of Covid-19 virus.	
***Mapping of Course Outcomes for Unit II**	CO1, CO2, CO3	
Unit III	**Searching and Sorting**	**(07Hours)**
Searching: Search Techniques-Sequential Search/Linear Search, Variant of Sequential Search- Sentinel Search, Binary Search, Fibonacci Search, and Indexed Sequential Search. **Sorting:** Types of Sorting-Internal and External Sorting, General Sort Concepts-Sort Order, Stability, Efficiency, and Number of Passes, Comparison Based Sorting Methods-Bubble Sort, Insertion Sort, Selection Sort, Quick Sort, Shell Sort, **Non-comparison Based Sorting Methods**-Radix Sort, Counting Sort, and Bucket Sort, Comparison of All Sorting Methods and their complexities.		
#Exemplar/Case Studies	Use of Fibonacci search in non-uniform access memory storage and in Optimization of Unimodal Functions. Timsort as a hybrid stable sorting Algorithm	
***Mapping of Course Outcomes for Unit III**	CO1, CO2, CO4	
Unit IV	**Linked List**	**(07Hours)**
Introduction to Static and Dynamic Memory Allocation, **Linked List:** Introduction, of Linked Lists, Realization of linked list using dynamic memory management, operations, Linked List as ADT, **Types of Linked List:** singly linked, linear and Circular Linked Lists, Doubly Linked List, Doubly Circular Linked List, Primitive Operations on Linked List- Create, Traverse, Search, Insert, Delete, Sort, Concatenate. Polynomial Manipulations-Polynomial addition. Generalized Linked List (GLL) concept, Representation of Polynomial using GLL.		
#Exemplar/Case Studies	Garbage Collection	
***Mapping of Course Outcomes for Unit IV**	CO1, CO2, CO3, CO5	
Unit V	**Stack**	**(07Hours)**
Basic concept, stack Abstract Data Type, Representation of Stacks Using Sequential Organization, stack operations, Multiple Stacks, **Applications of Stack**- Expression Evaluation and Conversion, Polish notation and expression conversion, Need for prefix and postfix expressions, Postfix expression evaluation, Linked Stack and Operations. **Recursion-** concept, variants of recursion- direct, indirect, tail and tree, backtracking algorithmic strategy, use of stack in backtracking.		
#Exemplar/Case Studies	Android- multiple tasks/multiple activities and back-stack, Tower of Hanoi, 4 Queens problem.	
***Mapping of Course Outcomes for Unit V**	CO1, CO2, CO3, CO5, CO6	

Unit VI	Queue	(07Hours)
Basic concept, Queue as Abstract Data Type, Representation of Queue using Sequential organization, Queue Operations, Circular Queue and its advantages, Multi-queues, Linked Queue and Operations**.** **Deque**-Basic concept, types (Input restricted and Output restricted), Priority Queue-Basic concept, types (Ascending and Descending).		
#Exemplar/Case Studies	Priority queue in bandwidth management	
***Mapping of Course Outcomes for Unit VI**	CO1, CO2, CO3, CO5, CO6	

Learning Resources

Text Books:

1. Horowitz and Sahani, "Fundamentals of Data Structures in C++", University Press, ISBN 10: 0716782928 ISBN 13: 9780716782926.
2. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures andAlgorithmsin Python", Wiley Publication, ISBN: 978-1-118-29027-9

Reference Books:

1. Steven S S. Skiena, "The Algorithm Design Manual", Springer, 2nd ed. 2008 Edition, ISBN-13: 978-1849967204, ISBN-10: 1849967202.
2. Allen Downey, Jeffery Elkner, Chris Meyers, "How to think like a Computer Scientist: Learning with Python", Dreamtech Press, ISBN: 9789351198147.
3. M. Weiss, "Data Structures and Algorithm Analysis in C++", 2nd edition, Pearson Education, 2002, ISBN-81-7808-670-0.
4. Brassard and Bratley, "Fundamentals of Algorithmic", Prentice Hall India/Pearson Education, ISBN 13-9788120311312.
5. Yashwant Kanetkar & A. Kanetkar, "Let us Python", BPB Publisher, ISBN: 9789389845006

e-Books:

- https://www.ebooks.com/en-us/book/95777110/Python-data-structures-and-algorithms/benjamin-baka/
- https://www.ebookphp.com/advanced-data-structures-epub-pdf/
- https://www.ebookphp.com/data-structures-and-algorithms-professional-edition-beginners-guide-epub- pdf/

MOOC Links/Video Lectures available at:

- https://nptel.ac.in/courses/106/102/106102064/
- https://nptel.ac.in/courses/106/105/106105085
- https:// nptel.ac.in/courses/106/106/106106127

Other:

(https://www.bigocheatsheet.com/)
(https://github.com/RehanSaeed/.NET-Big-O-Algorithm-Complexity-Cheat-Sheet

Savitribai Phule Pune University

Second Year of Computer Science and Design (2021 Course)

210243: Object Oriented Programming(OOP)

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	03	Mid_Semestr(TH): 30 Mark End_Semester(TH): 70 Marks

Prerequisite Courses : 110005: Programming and Problem Solving

Companion Course : 210247: OOP and Computer Graphics Laboratory

Course Objectives:

The course is intended to provide the foundations and in-depth understanding of a modern object-oriented language and develop skills in software development, through an algorithmic approach andthe application of principles of objected oriented programming.

- To learn the object-oriented programming paradigm, focusing on the definition and use of classes along with the fundamentals of object-oriented design.
- To learn the syntax and semantics of the C++ programming language.
- To understand the concept of data abstraction and encapsulation, how to design C++ classes for code reuse, how to implement copy constructors and class member functions, to overload functions and operators in C++.
- To learn how inheritance and virtual functions implement dynamic binding with polymorphism.
- To learn how to design and implement generic classes with C++ templates and how to use exception handling in C++ programs.

Course Outcomes:

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

CO1: Apply constructs- sequence, selection and iteration; classes and objects, inheritance, use of predefined classes from libraries while developing software.

CO2: Design object-oriented solutions for small systems involving multiple objects.

CO3: Use virtual and pure virtual function and complex programming situations.

CO4: Apply object-oriented software principles in problem solving.

CO5: Analyze the strengths of object-oriented programming.

CO6: Develop the application using object oriented programming language(C++).

Course Contents

Unit I	Fundamentals of Object Oriented Programming	(07 Hours)

Introduction to object-oriented programming, Need of object-oriented programming, Fundamentals of object-oriented programming: Namespaces, objects, classes, data members, methods, messages, data encapsulation, data abstraction and information hiding, inheritance, polymorphism. Benefits of OOP, C++ as object oriented programming language.

C++ Programming- C++ programming Basics, Data Types, Structures, Enumerations, control structures, Arrays and Strings, Class, Object, class and data abstraction, Access specifiers, separating interface from implementation.

Functions- Function, function prototype, accessing function and utility function, Constructors and destructor, Types of constructor, Objects and Memory requirements, Static members: variable and functions, inline function, friend function.

#Exemplar/Case Studies	Story of C++ invention by Bjarne Stroustrup

*Mapping of Course Outcomes for Unit	CO1, CO5	
Unit II	**Inheritance and Pointers**	**(07 Hours)**
Inheritance- Base Class and derived Class, protected members, relationship between base Class and derived Class, Constructor and destructor in Derived Class, Overriding Member Functions, Class Hierarchies, Public and Private Inheritance, Types of Inheritance, Ambiguity in Multiple Inheritance, Virtual Base Class, Abstract class, Friend Class, Nested Class. **Pointers:** declaring and initializing pointers, indirection Operators, Memory Management: new and delete, Pointers to Objects, this pointer, Pointers Vs Arrays, accessing Arrays using pointers, Arrays of Pointers, Function pointers, Pointers to Pointers, Pointers to Derived classes, Passing pointers to functions, Return pointers from functions, Null pointer, void pointer.		
#Exemplar/Case Studies	Know about Firefox and Thunderbird as one of the popular softwares developed using C++	
*Mapping of Course Outcomes for Unit II	CO2, CO4	
Unit III	**Polymorphism**	**(07Hours)**
Polymorphism- Introduction to Polymorphism, Types of Polymorphism, Operator Overloading- concept of overloading, operator overloading, Overloading Unary Operators, Overloading Binary Operators, Data Conversion, Type casting (implicit and explicit), Pitfalls of Operator Overloading and Conversion, Keywords explicit and mutable. Function overloading, **Run Time Polymorphism**- Pointers to Base class, virtual function and its significance in C++, pure virtual function and virtual table, virtual destructor, abstract base class.		
#Exemplar/Case Studies	Study about use of C++ SDKs wrappers for Java and .Net.	
*Mapping of Course Outcomes for Unit III	CO2, CO3, CO4	
Unit IV	**Files and Streams**	**(07 Hours)**
Data hierarchy, Stream and files, Stream Classes, Stream Errors, Disk File I/O with Streams, File Pointers, and Error Handling in File I/O, File I/O with Member Functions, Overloading the Extraction and Insertion Operators, memory as a Stream Object, Command-Line Arguments, Printer output.		
#Exemplar/Case Studies	Study features used for Microsoft Office, Internet Explorer and Visual Studio that are written in Visual C++	
*Mapping of Course Outcomes for Unit IV	CO2, CO4	
Unit V	**Exception Handling and Templates**	**(07 Hours)**
Exception Handling- Fundamentals, other error handling techniques, simple exception handling- Divide by Zero, Multiple catching, re-throwing an exception, exception specifications, user defined exceptions, processing unexpected exceptions, constructor, destructor and exception handling, exception and inheritance. **Templates**- The Power of Templates, Function template, overloading Function templates, and class template, class template and Nontype parameters, template and friends Generic Functions, The type name and export keywords.		
#Exemplar/Case Studies	Study about use of exception handling in Symbian Operating System (discontinued mobile operating system) that was developed using C++.	
*Mapping of Course Outcomes for Unit V	CO2, CO4, CO6	
Unit VI	**Standard Template Library (STL)**	**(07 Hours)**
Introduction to STL, STL Components, Containers- Sequence container and associative containers, container adapters, Application of Container classes: vector, list, **Algorithms**- basic searching and sorting algorithms, min-max algorithm, set operations, heap sort, **Iterators**- input, output, forward, bidirectional and random access. Object Oriented Programming – a		

road map to future	
#Exemplar/Case Studies	Study MySQL open source C++ code available at GitHub.
***Mapping of Course Outcomes for Unit VI**	CO2, CO4, CO6

Learning Resources

Text Books:

1. Deitel,"C++ How to Program", 4th Edition, Pearson Education, ISBN:81-297-0276-2
2. Robert Lafore, "Object-Oriented Programming in C++", fourth edition, Sams Publishing, ISBN:0672323087 (ISBN 13: 9780672323089)

Reference Books:

1. Herbert Schildt, "C++-The complete reference", Eighth Edition, McGraw- Hill Professional, 2011, ISBN:978-00-72226805
2. Matt Weisfeld, "The Object-Oriented Thought Process", Third Edition Pearson ISBN-13:075-2063330166
3. E.Balagurusamy,"Object-Oriented Programming with C++",7th edition, MCGraw-Hill Publication, ISBN 10: 9352607996 ISBN 13: 9789352607990
4. Cox Brad, Andrew J. Novobilski, "Object –Oriented Programming: An Evolutionary Approach", Second Edition, Addison–Wesley, ISBN:13:978-020-1548341

e-B ooks:

- https://www.springer.com/gp/book/9781852334505
- https://www.ebookphp.com/object-oriented-programming-in-c-epub-pdf/
- https://www.springer.com/gp/book/9781447133780

MOOC/ Video Lectures available at:

- https://nptel.ac.in/courses/106/105/106105151/
- https://swayam.gov.in/nd1_noc20_cs07/preview
- https://www.classcentral.com/course/swayam-programming-in-c-6704

@The CO-PO Mapping Matrix

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

Savitribai Phule Pune University Second Year of Computer Science and Design (2021 Course) 210244: Computer Graphics		
Teaching Scheme	**Credit Scheme**	**Examination Scheme and Marks**
Lecture: 03 Hours/Week	**03**	**Mid_Semestr(TH): 30 Mark** **End_Semester(TH): 70 Marks**
Prerequisite Courses : Basic Mathematics		
Companion Course : 210247: OOP and Computer Graphics Laboratory		

Course Objectives:

The Computer Graphics course prepares students for activities involving the design, development, and testing of modeling, rendering, and animation solutions to a broad variety of problems found in entertainment, sciences, and engineering.

- **Remembering:** To acquaint the learner with the basic concepts of Computer Graphics.
- **Understanding:** To learn the various algorithms for generating and rendering graphical figures.
- **Applying:** To get familiar with mathematics behind the graphical transformations.
- **Understanding:** To understand and apply various methods and techniques regarding projections, animation, shading, illumination and lighting.
- **Creating:** To generate Interactive graphics using OpenGL.

Course Outcomes:

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

CO1: Identify the basic terminologies of Computer Graphics and interpret the mathematical foundation of the concepts of computer graphics.

CO2: Apply mathematics to develop Computer programs for elementary graphic operations.

CO3: Illustrate the concepts of windowing and clipping and **apply** various algorithms to fill and clip polygons.

CO4: Understand and **apply** the core concepts of computer graphics, including transformation in two and three dimensions, viewing and projection.

CO5: Understand the concepts of color models, lighting, shading models and hidden surface elimination.

CO6: Create effective programs using concepts of curves, fractals, animation and gaming.

Course Contents

Unit I	**Graphics Primitives and Scan Conversion Algorithms**	**(07 Hours)**

Introduction, graphics primitives - pixel, resolution, aspect ratio, frame buffer. Display devices, applications of computer graphics.

Introduction to OpenGL - OpenGL architecture, primitives and attributes, simple modelling and rendering of two- and three-dimensional geometric objects, GLUT, interaction, events and call-backs picking. (**Simple Interaction with the Mouse and Keyboard)**

Scan conversion: Line drawing algorithms: Digital Differential Analyzer (DDA), Bresenham. Circle drawing algorithms: DDA, Bresenham, and Midpoint.

#Exemplar/Case Studies	Study about OpenGL Architecture Review Board (ARB)
***Mapping of Course Outcomes for Unit**	CO1, CO2

Unit II	**Polygon, Windowing and Clipping**	**(07 Hours)**

Polygons: Introduction to polygon, types: convex, concave and complex. Inside test. **Polygon Filling:** flood fill, seed fill, scan line fill. **Windowing and clipping:** viewing transformations, 2-D clipping: Cohen – Sutherland algorithm line Clipping algorithm, Sutherland Hodgeman Polygon clipping algorithm, Weiler Atherton Polygon Clipping algorithm.		
#Exemplar/Case Studies	Study Guard-band clipping Technique and its use in various rendering softwares, Use of 3D pipeline/ polygonal modelling and applications.	
***Mapping of Course Outcomes for Unit II**	CO2, CO3	
Unit III	**2D, 3D Transformations and Projections**	**(07Hours)**
2-D transformations: introduction, homogeneous coordinates, 2-D transformations - Translation, scaling, rotation and shear, rotation about an arbitrary point. **3-D transformations:** introduction, 3-D transformations - Translation, scaling, rotation and shear, rotation about an arbitrary axis. **Projections :** Parallel (Oblique: Cavalier, Cabinet and orthographic: isometric, diametric, trimetric) and Perspective (Vanishing Points – 1 point, 2 point and 3 point)		
#Exemplar/Case Studies	Study use of transformations and projections in education and training software.	
***Mapping of Course Outcomes for Unit III**	CO2, CO4	
Unit IV	**Light, Colour, Shading and Hidden Surfaces**	**(07 Hours)**
Colour models: Properties of Light, CIE chromaticity Diagram, RGB, HSV, CMY. **Illumination Models**: Ambient Light, Diffuse reflection, Specular Reflection, and the Phong model, Combined diffuse and Specular reflections with multiple light sources, warn model, **Shading Algorithms**: Halftone, Gauraud and Phong Shading. **Hidden Surfaces** Introduction, Back face detection and removal, Algorithms: Depth buffer (z), Depth sorts (Painter), Area subdivision (Warnock)		
#Exemplar/Case Studies	Study any popular graphics designing software	
***Mapping of Course Outcomes for Unit IV**	CO5	
Unit V	**Curves and Fractals**	**(07 Hours)**
Curves: Introduction, Interpolation and Approximation, Blending function, B-Spline curve, Bezier curve, **Fractals**: Introduction, Classification, Fractal generation: snowflake, Triadic curve, Hilbert curve, Applications.		
#Exemplar/Case Studies	Case study on measuring the length of coastline using fractals	
***Mapping of Course Outcomes for Unit V**	CO2, CO6	
Unit VI	**Introduction to Animation and Gaming**	**(07 Hours)**
Segment: Introduction, Segment table, Segment creation, closing, deleting and renaming, Visibility. **Animation:** Introduction, Conventional and computer based animation, Design of animation sequences, Animation languages, Key- frame, Morphing, Motion specification. **Gaming:** Introduction, Gaming platform (NVIDIA, i8060), Advances in Gaming.		
#Exemplar/Case Studies	Study of any open source tools- Unity/Maya/Blender .	
***Mapping of Course Outcomes for Unit VI**	CO6	

Learning Resources

Text Books:

1. S. Harrington, "Computer Graphics", 2nd Edition, McGraw-Hill Publications, 1987, ISBN 0 –07– 100472 – 6.
2. Donald D. Hearn and Baker, "Computer Graphics with OpenGL", 4th Edition, ISBN-13: 9780136053583.
3. D. Rogers, "Procedural Elements for Computer Graphics", 2nd Edition, Tata McGraw-Hill Publication, 2001, ISBN 0 – 07 – 047371 – 4.

Reference Books:

1. J. Foley, V. Dam, S. Feiner, J. Hughes, "Computer Graphics Principles and Practice", 2nd Edition, Pearson Education, 2003, ISBN 81 – 7808 – 038 – 9.
2. D. Rogers, J. Adams, "Mathematical Elements for Computer Graphics", 2nd Edition, Tata McGraw Hill Publication, 2002, ISBN 0 – 07 – 048677 – 8.

e-Books:

- https://open.umn.edu/opentextbooks/textbooks/introduction-to-computer-graphics
- http://www2.cs.uidaho.edu/~jeffery/courses/324/lecture.html

MOOC/ Video Lectures available at:

- https://nptel.ac.in/courses/106/106/106106090/
- https://nptel.ac.in/courses/106/102/106102065/

@The CO-PO Mapping Matrix

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

Savitribai Phule Pune University
Second Year of Computer Science and Design (2021 Course)
218245: Logic Design and Computer Architecture

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	03	Mid_Semestr(TH): 30 Mark End_Semester(TH): 70 Marks

Prerequisite Courses :104010: Basic Electronics Engineering

Companion Course : Logic Design and Computer Architecture Lab

Course Objectives:

The goal of this course is to impart the fundamentals of digital logic design; starting from learning the basic concepts of the different base number systems, to basic logic elements and deriving logical expressions to further optimize a circuit diagram. Objective is to see that learners are not only able to evaluate different combinational logic designs, but also design their own digital circuits given different parameters.

- To study number systems and develop skills for design and implementation of combinational logic circuits and sequential circuit
- To understand the functionalities, properties and applicability of Logic Families.
- To make undergraduates, understand the functions, characteristics of various components of Computer & in particular processor & memory.
- To introduce students to basics of microprocessor.

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 I	Introduction To Logic Design	(07 Hours)

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.

Logic Design Minimization Technique: Minimization of Boolean function using K-map(up to 4 variables), Representation of signed number- sign magnitude representation, 1's complement and 2's complement form (red marked can be removed), Sum of product and Product of sum form, Floating Point Number Representation ,Minimization of SOP and POS using K-map.

#Exemplar/Case Studies	To study the various basic gate design using TTL/CMOS logic family
*Mapping of Course Outcomes for Unit 1	CO1

Unit II	Combinational Logic Design	(07 Hours)

Code converter -: BCD, Excess-3, Gray code, Binary Code. Half- Adder, Full Adder, Half Subtractor, Full Subtractor, Binary Adder (IC 7483), BCD adder, Look ahead carry generator, Multiplexers (MUX): MUX (IC 74153, 74151), Cascading multiplexers, Demultiplexers (DEMUX)- Decoder (IC 74138, IC 74154), Implementation of SOP and POS

using MUX, DMUX, Comparators (2 bit), Parity generators and Checker.		
#Exemplar/Case Studies	Combinational Logic Design of BCD to 7-segment display Controller	
*Mapping of Course Outcomes for Unit II	CO2	
Unit III	**Sequential Logic Design**	**(07Hours)**
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.		
#Exemplar/Case Studies	Use of sequential logic design in a simple traffic light controller	
*Mapping of Course Outcomes for Unit III	CO3	
Unit IV	**Computer Organization & Architecture**	**(07 Hours)**
Computer organization & computer architecture, organization, functions & types of computer units- CPU(typical organization ,Functions , Types), Memory (Types & their uses in computer), IO(types & functions) & system bus(Address, data & control , Multiple-Bus Hierarchies); Von Neumann & Harvard architecture; Instruction cycle. **Processor:** Single bus organization of CPU; ALU (ALU signals, functions & types); Register (types & functions of user visible, control & status registers such as general purpose, address registers, data registers, flags, PC, MAR, MBR, IR) & control unit (control signals & typical organization of hard wired & micro programmed CU). **Micro Operations** (fetch, indirect, execute, interrupt) and control signals for these micro operations.		
#Exemplar/Case Studies	80386 Processor Block Diagram	
*Mapping of Course Outcomes for Unit IV	CO4	
Unit V	**Processor Instructions & Processor Enhancements**	**(07 Hours)**
Instruction : elements of machine instruction ; instruction representation (Opcode & mnemonics, Assembly language elements); Instruction Format & 0-1-2-3 address formats, Types of operands Addressing modes; Instruction types based on operations (functions & examples of each); key characteristics of RISC & CISC; Interrupt: its purpose, types , classes & interrupt handling (ISR , multiple interrupts), exceptions; instruction pipelining (operation & speed up) Multiprocessor systems: Taxonomy of Parallel Processor Architectures, two types of MIMD clusters & SMP (organization & benefits) & multicore processor (various Alternatives & advantages 0f multicores), typical features of multicore Intel core i7.		
#Exemplar/Case Studies	80386 Assembly language programming	
*Mapping of Course Outcomes for Unit V	CO5	
Unit VI	**Memory & Input / Output Systems**	**(07 Hours)**
Memory Systems: Characteristics of Memory Systems, Memory Hierarchy, signals to connect memory to processor, memory read & write cycle, characteristics of semiconductor memory: SRAM, DRAM &ROM, **Cache Memory –** Principle of Locality, Organization, Mapping functions, write policies, Replacement policies, Multilevel Caches, Cache Coherence.		

Input / Output Systems: I/O Module Programmed I/O, Interrupt Driven I/O, Direct Memory Access (DMA).	
#Exemplar/Case Studies	USB flash drive
***Mapping of Course Outcomes for Unit VI**	CO6

Learning Resources

Text Books:

1. R.P.Jain, " Modern Digital Electronics", Tata McGraw Hill 4th Edition, ISBN 978-0-07-06691-16
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

e-Books:

- https://www.springer.com/gp/book/9783030361952
- https://www.mheducation.co.uk/ebook-fundamentals-of-digital-logic-9780077144227-emea

@The CO-PO Mapping Matrix

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

Savitribai Phule Pune University

Second Year of Computer Science and Design (2021 Course)

210246: Data Structures Laboratory

Teaching Scheme Practical:	Credit Scheme : 02	Examination Scheme and Marks
04 Hours/Week		Term Work:25 Marks Practical:25 Marks

Companion Course : 218242: Data Structures and Algorithms

Course Objectives:

- To understand basic techniques and strategies of algorithm analysis, the memory requirement for various data structures like array, linked list, stack, queue etc using concepts of python and C++ programming language.

Course Outcomes:

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

CO1: Use algorithms on various linear data structure using sequential organization to solve real life problems.

CO2: Analyze problems to **apply** suitable searching and sorting algorithm to various applications.

CO3: Analyze problems to **use variants of** linked list and solve various real life problems.

CO4: Designing and implement data structures and algorithms for solving different kinds of problems.

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), University syllabus, conduction and Assessment guidelines, topics under consideration- Concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references.

Guidelines for Student's Laboratory Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of prologue, Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Objectives, Problem Statement, Outcomes, software and Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept in brief, algorithm, flowchart, test cases, Test Data Set(if applicable), mathematical model (if applicable), conclusion/analysis. **Program codes with sample output of all performed assignments are to be submitted as softcopy.**

As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Use of DVD containing students programs maintained by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

Guidelines for Laboratory /Term Work Assessment

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

Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications. Encourage students for appropriate use of Hungarian notation,

proper indentation and comments. Use of open source software is to be encouraged. In addition to these, instructor may assign one real life application in the form of a mini-project based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch **beyond the scope of syllabus.**

Set of suggested assignment list is provided in groups- A, B, C, D, and E. Each student must perform at least 13 assignments (at least 3 from group A, 3 from group B, 2 from group C, 2 from group D and 3 from group E)

Group A and B assignments should be implemented in Python without using built-in methods for major functionality of assignment. Use List data structure of Python as array. Group C, D and E assignments should be implemented in C++ language.

Operating System recommended:- 64-bit Open source Linux or its derivative

Programming tools recommended: - Open Source Python, Programming tool like Jupyter Notebook, Pycharm, Spyder, G++/GCC.

Guidelines for Practical Examination

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

Virtual Laboratory:

http://cse01-iiith.vlabs.ac.in/Courses%20Aligned.html?domain=Computer%20Science

Suggested List of Laboratory Experiments/Assignments

Sr. No.	Group A
1	In second year computer engineering class, group A student's play cricket, group B students play badminton and group C students play football. Write a Python program using functions to compute following: - a) List of students who play both cricket and badminton b) List of students who play either cricket or badminton but not both c) Number of students who play neither cricket nor badminton d) Number of students who play cricket and football but not badminton. (Note- While realizing the group, duplicate entries should be avoided, Do not use SET built-in functions)
2	Write a Python program to store marks scored in subject "Fundamental of Data Structure" by N students in the class. Write functions to compute following: a) The average score of class b) Highest score and lowest score of class c) Count of students who were absent for the test d) Display mark with highest frequency
3	Write a **Python** program for department library which has N books, write functions for following: a) Delete the duplicate entries b) Display books in ascending order based on cost of books c) Count number of books with cost more than 500. d) Copy books in a new list which has cost less than 500.

<table>
<tr><td>4</td><td>Write a Python program that computes the net amount of a bank account based a transaction log from console input. The transaction log format is shown as following: D 100 W 200 (Withdrawal is not allowed if balance is going negative. Write functions for withdraw and deposit) D means deposit while W means withdrawal.
Suppose the following input is supplied to the program:
D 300, D 300 , W 200, D 100 Then, the output should be: 500</td></tr>
<tr><td>5</td><td>Write a Python program to compute following operations on String:
a) To display word with the longest length
b) To determines the frequency of occurrence of particular character in the string
c) To check whether given string is palindrome or not
d) To display index of first appearance of the substring
e) To count the occurrences of each word in a given string</td></tr>
<tr><td>6</td><td>It is decided that weekly greetings are to be furnished to wish the students having their birthdays in that week. The consolidated sorted list with desired categorical information is to be provided to the authority. Write a Python program to store students PRNs with date and month of birth. Let List_A and List_B be the two list for two SE Computer divisions. Lists are sorted on date and month. Merge these two lists into third list “List_SE_Comp_DOB” resulting in sorted information about Date of Birth of SE Computer students</td></tr>
<tr><td>7</td><td>Write a Python Program for magic square. A magic square is an n * n matrix of the integers 1 to n2 such that the sum of each row, column, and diagonal is the same. The figure given below is an example of magic square for case n=5. In this example, the common sum is 65.
<table>
<tr><td>15</td><td>8</td><td>1</td><td>24</td><td>17</td></tr>
<tr><td>16</td><td>14</td><td>7</td><td>5</td><td>23</td></tr>
<tr><td>22</td><td>20</td><td>13</td><td>6</td><td>4</td></tr>
<tr><td>3</td><td>21</td><td>19</td><td>12</td><td>10</td></tr>
<tr><td>9</td><td>2</td><td>25</td><td>18</td><td>11</td></tr>
</table></td></tr>
<tr><td>8</td><td>Write a Python program that determines the location of a saddle point of matrix if one exists. An m x n matrix is said to have a saddle point if some entry a[i][j] is the smallest value in row i and the largest value in j.</td></tr>
<tr><td>9</td><td>Write a Python program to compute following computation on matrix:
a) Addition of two matrices b) Subtraction of two matrices
c) Multiplication of two matrices d) Transpose of a matrix</td></tr>
<tr><td>10</td><td>Write a Python program for sparse matrix realization and operations on it- Transpose, Fast Transpose and addition of two matrices</td></tr>
<tr><td></td><td>Group B</td></tr>
<tr><td>11</td><td>a) Write a Python program to store roll numbers of student in array who attended training program in random order. Write function for searching whether particular student attended training program or not, using Linear search and Sentinel search.
b) Write a Python program to store roll numbers of student array who attended training program in sorted order. Write function for searching whether particular student attended training program or not, using Binary search and Fibonacci search</td></tr>
<tr><td>12</td><td>a) Write a Python program to store names and mobile numbers of your friends in sorted order on names. Search your friend from list using binary search (recursive and non- recursive). Insert friend if not present in phonebook
b) Write a Python program to store names and mobile numbers of your friends in sorted order on names. Search your friend from list using Fibonacci search. Insert friend if not present in phonebook.</td></tr>
</table>

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13	Write a **Python** program to maintain club members, sort on roll numbers in ascending order. Write function "Ternary_Search" to search whether particular student is member of club or not. Ternary search is modified binary search that divides array into 3 halves instead of two.
14	Write a **Python** program to store first year percentage of students in array. Writefunction for sorting array of floating point numbers in ascending order using a) Selection Sort b) Bubble sort and display top five scores.
15	Write a Python program to store second year percentage of students in array. Write function for sorting array of floating point numbers in ascending order using a) Insertion sort b) Shell Sort and display top five scores
16	Write a Python program to store first year percentage of students in array. Write function for sorting array of floating point numbers in ascending order using quick sort and display top five scores.
17	Write a Python program to store 12th class percentage of students in array. Write function for sorting array of floating point numbers in ascending order using bucket sort and display top five scores.
18	Write Python program to store 10th class percentage of students in array. Write function for sorting array of floating point numbers in ascending order using radix sort and display top five scores
	Group C
19	Department of Computer Engineering has student's club named 'Pinnacle Club'. Students of second, third and final year of department can be granted membership on request. Similarly one may cancel the membership of club. First node is reserved for president of club and last node is reserved for secretary of club. Write C++ program to maintain club member's information using singly linked list. Store student PRN and Name. Write functions to: a) Add and delete the members as well as president or even secretary. b) Compute total number of members of club c) Display members d) Two linked lists exists for two divisions. Concatenate two lists.
20	The ticket booking system of Cinemax theater has to be implemented using C++ program. There are 10 rows and 7 seats in each row. Doubly circular linked list has to be maintained to keep track of free seats at rows. Assume some random booking to start with. Use array to store pointers (Head pointer) to each row. On demand a) The list of available seats is to be displayed b) The seats are to be booked c) The booking can be cancelled.
21	Write C++ program for storing appointment schedule for day. Appointments are booked randomly using linked list. Set start and end time and min and max duration for visit slot. Write functions for- A) Display free slots B) Book appointment C) Sort list based on time D) Cancel appointment (check validity, time bounds, availability) E) Sort list based on time using pointer manipulation
22	Second year Computer Engineering class, set A of students like Vanilla Ice-cream and set B of students like butterscotch ice-cream. Write C++ program to store two sets using linked list. compute and display- a) Set of students who like both vanilla and butterscotch b) Set of students who like either vanilla or butterscotch or not both c) Number of students who like neither vanilla nor butterscotch

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23	Write C++ program for storing binary number using doubly linked lists. Write functions- a) To compute 1‘s and 2‘s complement b) Add two binary numbers
24	Write C++ program to realize Set using Generalized Liked List (GLL) e.g. A ={ a, b, {c, d,e, {}, {f,g}, h, I, {j,k}, l, m}. Store and print as set notation.
	Group D
25	A palindrome is a string of character that‘s the same forward and backward. Typically, punctuation, capitalization, and spaces are ignored. For example, “Poor Dan is in a droop” is a palindrome, as can be seen by examining the characters “poor danisina droop” and observing that they are the same forward and backward. One way to check for a palindrome is to reverse the characters in the string and then compare with them the original-in a palindrome, the sequence will be identical. Write C++ program with functions- a) To print original string followed by reversed string using stack b) To check whether given string is palindrome or not
26	In any language program mostly syntax error occurs due to unbalancing delimiter such as(), {}, []. Write C++ program using stack to check whether given expression is well parenthesized or not.
27	Implement C++ program for expression conversion as infix to postfix and its evaluation using stack based on given conditions: 1. Operands and operator, both must be single character. 2. Input Postfix expression must be in a desired format. 3. Only '+', '-', '*' and '/ ' operators are expected.
28	A classic problem that can be solved by backtracking is called the Eight Queens problem, which comes from the game of chess. The chess board consists of 64 square arranged in an 8 by 8 grid. The board normally alternates between black and white square, but this is not relevant for the present problem. The queen can move as far as she wants in any direction, as long as she follows a straight line, Vertically, horizontally, or diagonally. Write C++ program with recursive function for generating all possible configurations for 4-queen's problem.
	Group E
29	Queues are frequently used in computer programming, and a typical example is the creation of a job queue by an operating system. If the operating system does not use priorities, then the jobs are processed in the order they enter the system. Write C++ program for simulating job queue. Write functions to add job and delete job from queue.
30	Write program to implement a priority queue in C++ using an inorder list to store the items in the queue. Create a class that includes the data items (which should be template) and the priority (which should be int). The inorder list should contain these objects, with operator <= overloaded so that the items with highest priority appear at the start of the list (which will make it relatively easy to retrieve the highest item.)
31	A double-ended queue (deque) is a linear list in which additions and deletions may be made at either end. Obtain a data representation mapping a deque into a one- dimensional array. Write C++ program to simulate deque with functions to add and delete elements from either end of the deque.
32	Pizza parlor accepting maximum M orders. Orders are served in first come first served basis. Order once placed cannot be cancelled. Write C++ program to simulate the system using circular queue using array.

@The CO-PO Mapping Matrix												
CO\PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	1	2	1	-	-	-	-	-	-	-	-
CO2	2	2	2	1	-	-	-	-	-	-	-	-
CO3	-	2	1	1	-	-	-	-	-	-	-	-
CO4	1	2	2	1	-	-	-	-	-	-	-	-

Savitribai Phule Pune University

Second Year of Computer Science and Design (2021 Course)

210247: OOP and Computer Graphics Laboratory

Teaching Scheme Practical:	Credit Scheme : 02	Examination Scheme and Marks
04 Hours/Week		Term Work:25 Marks Practical:25 Marks

Companion Course : 210243: Object Oriented Programming(OOP), 210244: Computer Graphics

Course Objectives:

- To understand basics of Computer Graphics, apply various methods and techniques for implementing line-circle drawing, projections, animation, shading, illumination and lighting using concepts of Object Oriented Programming.

Course Outcomes:

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

CO1: U**nderstand** and **apply** the concepts like inheritance, polymorphism, exception handling and generic structures for implementing reusable programming codes.

CO2: Analyze the concept of file and **apply** it while storing and retrieving the data from secondary storages

CO3: Analyze and **apply** computer graphics algorithms for line-circle drawing, scan conversion and filling with the help of object oriented programming concepts.

CO4: Understand the concept of windowing and clipping and **apply** various algorithms to fill and clip polygons.

CO5: Apply logic to implement, curves, fractals, animation and gaming programs.

Guidelines for Instructor's Manual

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

Guidelines for Student's Laboratory Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, Date of Completion, Objectives, Problem Statement, Software and Hardware requirements, Assessment grade/marks and assessor's sign, Theory- Concept in brief, algorithm, flowchart, test cases, Test Data Set(if applicable), mathematical model (if applicable), conclusion/analysis. Program codes with sample output of all performed assignments are to be submitted as softcopy. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal must be avoided. Use of DVD 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.

Guidelines for Laboratory /Term Work Assessment

Continuous assessment of laboratory work should be based on overall performance of Laboratory assignments by a student. Each Laboratory assignment will assign grade/marks based on parameters, such as timely completion, performance, innovation, efficient codes, punctuality.

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. Useof open source software is encouraged. Based on the concepts learned. Instructor may also set

one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus.
Operating System recommended :- 64-bit Open source Linux or its derivative
Programming tools recommended: - Open Source C++ Programming tool like G++/GCC, OPENGL.

Guidelines for Practical Examination

Problem statements must be decided jointly by the internal examiner and external examiner. During practical assessment, maximum weightage should be given to satisfactory implementation of the problem statement. Relevant questions may be asked at the time of evaluation to test the student's understanding of the fundamentals, effective and efficient implementation. This will encourage, transparent evaluation and fair approach, and hence will not create any uncertainty or doubt in the minds of the students. So adhering to these principles will consummate our team efforts to the promising start of student's academics.

Virtual Laboratory:

- http://cse18- iiith.vlabs.ac.in/Introduction.html?domain=Computer%20Science
- http://vlabs.iitb.ac.in/vlabs-dev/labs/cglab/index.php

Part I : Object Oriented Programming

Suggested List of Laboratory Experiments/Assignments

(All assignments are compulsory)

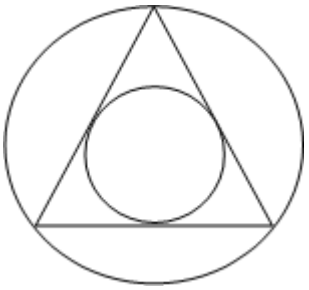
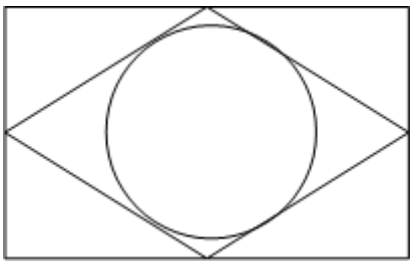
Sr.No.	Group A
1.	Implement a class Complex which represents the Complex Number data type. Implement the following 1. Constructor (including a default constructor which creates the complex number 0+0i). 2. Overload operator+ to add two complex numbers. 3. Overload operator* to multiply two complex numbers. 4. Overload operators << and >> to print and read Complex Numbers.
2.	Develop a program in C++ to create a database of student's information system containing the following information: Name, Roll number, Class, Division, Date of Birth, Blood group, Contact address, Telephone number, Driving license no. and other. Construct the database with suitable member functions. Make use of constructor, default constructor, copy constructor, destructor, static member functions, friend class, this pointer, inline code and dynamic memory allocation operators-new and delete as well as exception handling.
3.	Imagine a publishing company which does marketing for book and audio cassette versions. Create a class publication that stores the title (a string) and price (type float) of publications. From this class derive two classes: book which adds a page count (type int) and tape which adds a playing time in minutes (type float). Write a program that instantiates the book and tape class, allows user to enter data and displays the data members. If an exception is caught, replace all the data member values with zero values.
	Group B
4.	Write a C++ program that creates an output file, writes information to it, closes the file, open it again as an input file and read the information from the file.
5.	Write a function template for selection sort that inputs, sorts and outputs an integer array and a float array.
	Group C

6.	Write C++ program using STL for sorting and searching user defined records such as personal records (Name, DOB, Telephone number etc) using vector container. **OR** Write C++ program using STL for sorting and searching user defined records such as Item records (Item code, name, cost, quantity etc) using vector container.
7.	Write a program in C++ to use map associative container. The keys will be the names of states and the values will be the populations of the states. When the program runs, the user is prompted to type the name of a state. The program then looks in the map, using the state name as an index and returns the population of the state.

Part II : Computer Graphics

Suggested List of Laboratory Experiments/Assignments

(All assignments are compulsory)

Sr.No.	Group A
1.	Write C++ program to draw a concave polygon and fill it with desired color using scanfill algorithm. Apply the concept of inheritance.
2.	Write C++ program to implement Cohen Southerland line clipping algorithm.
3.	a) Write C++ program to draw the following pattern. Use DDA line and Bresenham's circle drawing algorithm. Apply the concept of encapsulation.  **OR** b) Write C++ program to draw the following pattern. Use DDA line and Bresenham's circle drawing algorithm. Apply the concept of encapsulation. 
	Group B
4.	a) Write C++ program to draw 2-D object and perform following basic transformations, Scaling b) Translation c) Rotation. Apply the concept of operator overloading. **OR** b) Write C++ program to implement translation, rotation and scaling transformations on equilateral triangle and rhombus. Apply the concept of operator overloading.
5.	a) Write C++ program to generate snowflake using concept of fractals. **OR** b) Write C++ program to generate Hilbert curve using concept of fractals.

	OR c) Write C++ program to generate fractal patterns by using Koch curves.
	Group C
6.	a) Design and simulate any data structure like stack or queue visualization using graphics. Simulation should include all operations performed on designed data structure. Implement the same using OpenGL. **OR** b) Write C++ program to draw 3-D cube and perform following transformations on it using OpenGL i) Scaling ii) Translation iii) Rotation about an axis (X/Y/Z). **OR** c) Write OpenGL program to draw Sun Rise and Sunset.
7.	a) Write a C++ program to control a ball using arrow keys. Apply the concept of polymorphism. **OR** b) Write a C++ program to implement bouncing ball using sine wave form. Apply the concept of polymorphism. **OR** c) Write C++ program to draw man walking in the rain with an umbrella. Apply the concept of polymorphism. **OR** d) Write a C++ program to implement the game of 8 puzzle. Apply the concept of polymorphism. **OR** e) Write a C++ program to implement the game Tic Tac Toe. Apply the concept of polymorphism.
	Mini-Projects/ Case Study
8.	Design and implement game / animation clip / Graphics Editor using open source graphics library. Make use of maximum features of Object Oriented Programming.

@The CO-PO Mapping Matrix

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

Savitribai Phule Pune University

Second Year of Computer Science and Design (2021 Course)

218248: Logic Design and Computer Architecture Laboratory

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Practical: 02 Hours/Week	01	Term Work: 25 Marks Practical: 25 Marks

Companion Course : Basic Electronics Engineering

Course Objectives :

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

Course Outcomes :

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

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

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

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

Guidelines for Instructor's Manual

The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/assistant. The instructor's manual should include prologue, university syllabus, conduction& Assessment guidelines, topics under consideration concept, objectives, outcomes, algorithms, sample test cases, data sheets of various elements of computer system, ICs, tools and references.

Guidelines for Student's Laboratory Journal

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

Guidelines for Laboratory /Term Work Assessment

1. Examiners will assess the term work based on performance of students; methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.

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

3. Appropriate knowledge of usage of necessary tools software and hardware such as ICs, digital trainer kits, IC tester& simulation software, should be checked by the faculty member.

Guidelines for Laboratory Conduction

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

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. Student should perform at least 9 experiments with all experiments 5 from group A, 2 assignments from group B and 2 from group C assignments.

Virtual Laboratory:

- http://vlabs.iitb.ac.in/vlabs-dev/labs/dldgates/index.html
- http://vlabs.iitb.ac.in/vlabs-dev/labs/dldesignlab/index.html

Suggested List of Laboratory Experiments/Assignments

Sr. No.	Group A
1	To Realize Full Adder/ Subtractor using a) Basic Gates and b) Universal Gates
2	Design and implement Code Converters-Binary to Gray and BCD to Excess-3
3	Design and Realization of BCD Adder using 4-bit Binary Adder (IC 7483).
4	Realization of Boolean Expression for suitable combination logic using MUX 74151/74153, DMUX 74154/74138
5	To Verify The Truth Table Of Two Bit Comparators Using Logic Gates.
6	Design and Implement Parity Generator and checker using EX-OR.
	Group B
1	Design and implement 3 bit Up and 3 bit Down Asynchronous Counters using master slave JK flip-flop IC 7476
2	Design and implement 3 bit Up and 3 bit Down Synchronous Counters using master slave JK flip-flop IC 7476
3	Design and implement Modulo 'N' counter using IC7490. (N= 100 max)
	Group C
1	Design & simulate single bit RAM cell OR 4 address*2bit memory using 8 single bit RAM cells.
2	Design & simulate single bit ALU with four functions (AND, OR, XOR, ADD).
3	Design & simulation of single instruction CPU.

@The CO-PO Mapping Matrix

PO/ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	2	2	-	-	-	-	-	-	-	-	-
CO2	3	2	3	-	-	-	-	-	-	-	-	-
CO3	3	2	2	1	-	-	-	-	-	-	-	-

Savitribai Phule Pune University Second Year Computer Science & Design (2021 Course) 218249: 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 knowledgeof 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, Dhanpat Rai, 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 e.g. – Team Building Activity can highlight 'open communication', 'group discussion', 'respecting perspectives', 'leadership skills', 'focus on goals' which can help students improve their inherent interpersonal skills.

At least 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. b) 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. c) Explain to students how to plan short term and long term goals. d) 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. Someof 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 tofind 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.

Savitribai Phule Pune University
Second Year of Computer Science and Design (2021 Course)
210250: Humanity and Social Science

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 01 Hours/Week	01	Term work : 25 Mark

Course Objectives:

- To enable the students to explore aspects of human society and to acquire the intellectual, communication skills and develop characteristics that encourages personal fulfilment, meaningful professional life and responsible citizenship.
- To facilitate Holistic growth;
- To Educate about Contemporary, National and International affairs;
- To bring awareness about the responsibility towards society.
- To give an insight about the emergence of Indian society and the relevance of Economics.

Course Outcomes:

On completion of the course, learner will be–

CO1: Aware of the various issues concerning humans and society.
CO2: Aware about their responsibilities towards society.
CO3: Sensitized about broader issues regarding the social, cultural, economic and human aspects, involved in social changes.
CO4:Able to understand the nature of the individual and the relationship between self and the community.
CO5: Able to understand major ideas, values, beliefs, and experiences that have shaped human history and cultures.

Course Contents

Preamble:

As applied sciences, Engineering and Technology are meant to come up with effective solutions to social problems making it imperative that the present generation of engineers and technologists understand the society they live in. Studying the social sciences can provide individuals with crucial answers and observations that could certainly help in understanding of one's life which can alleviate social relations. A broad perspective of nationalistic thinking will provide the students with the ability to be socially conscientious, more resilient and open to building an inclusive society.

Experiencing real-life situations and complex scenarios that arise in each situation will help the budding professions to contribute their skills and knowledge to helping people improve and understand their behaviour or psychological processes. Understanding how the world works begins with an understanding of oneself and gaining hands-on experience and/or thinking about human values and ethics will help trigger a sense of responsibility among the students and lead them to finding effective solutions.

Course Structure: The tutorial sessions to be divided into 2 groups

1. Interactive Sessions to be conducted in classroom
2. Interactive Activities to be conducted Outside Classroom

MOOC/ Video Lectures available at[$]:

- https://nptel.ac.in/courses/109/103/109103023/
- https://nptel.ac.in/courses/109/107/109107131/

- Teachers will play the role of interventionists and instigating students to applytheir thinking abilities on social concepts
- As facilitators and mentors teachers will coax the students to thinking out-of-the-box to come up with creative solutions

- Teachers should focus on instilling a sense of social consciousness through theactivities conducted indoors and outdoors.

Change of Mindset

- Since the course deviates from technical subjects, students will have to be counseled into the importance of social sciences
- A background understanding of the importance of this course in their professional and personal life will have to be enumerated to the students
- Teachers will have to rationalize the course outcomes to get the students invested in the activities being conducted

Designing of Course

- Since students lack prior knowledge, it is imperative that the tutorials conducted be engaging in its activities
- Focus of the sessions should be the learning outcome of each activity conducted either in the class or outside the class
- All activities designed should be as close to real-life making them relatable and applicable
- Student-engagement should be a priority so that the knowledge internalized will be higher
- The activities chosen can be modified to cater to the college location and social context
- The learning should be focused on application of ethics and values during each activity
- The chosen sessions should cater to giving the students the opportunity to be involved and engaged in their role as contributors to society and the nation at large

Basic function of the tutor

- To present a holistic view of the curriculum and the role of this course in it and emphasizing the benefit of the sessions towards developing communications kills, critical thinking and problems solving

Grouping

- The class will be divided into groups of 20 students
- The blend of cultural and social diversity will enhance the learning at the end of each activity
- Teachers will have to be mentored to handle sensitive issues diplomatically while encouraging students to stand up for their beliefs
- The groups will have to have inter-personal sessions so that they get to understand their team members better and work cohesively
- Management support and encouragement to engage students in life-enriching experiences is important

Assessment of Learning

- It is important for tutors to make sure that assessment is consistent with learning objectives of each activity
- Assessment of students should be focused on the students' ability to internalize the learning
- Tutors need to understand meaningful ways of assessing students' work to motivate learning

Tutorial Conduction and Term Work guidelines

Interactive Sessions to be conducted during Tutorial (in classroom)

1. Prepared Speech on Current Affairs

a. Purpose – Get students to stay abreast and invested in national current affairs

b. Method – Each student has to read an editorial from any national paper (English), find out more information on the topic and present it to the class; ending the session with his/her opinion on the matter

c. Outcome – Awareness of national state of affairs. Improve on oratory skills. Instil the thinking and contemplative skills and form non-judgmental opinions about an issue

2. UNDERSTANDING INDIA'S CULTURAL DIVERSITY

a. Purpose – Expose students to the intricacies of Indian cultural across various states

b. Method – Each student (or a small group of students in case the number of students is large) has to pick a state and come to the tutorial session prepared with a PPT that will showcase the demographic, sociographic and cultural information of thatstate

c. Outcome – Information about the beauty of Indian cultural diversity. Enhance exploratory skill, communication skills and learn to present using technological tools.

3. WRITING AN ARTICLE ON ANY SOCIAL ISSUE

a. Purpose – Highlight various social and cultural evil malevolence existing in our country and express one's opinion on how it can be changed

b. Method – Each student will have to write a 200 word essay on any of existing social malice that is prevalent in society. On evaluation, the top 5 essays can be displayed on the college wall magazine and rewarded if deemed appropriate

c. Outcome – Learn to raise one's voice against the wrong doings in communities. Build writing skills, improve language and gain knowledge about how to write an impactful essay

4. GROUP DISCUSSION ON COMMUNAL TOPIC

a. Purpose – Make students aware of the issues that are pertinent in a society and express a learned opinion about it

b. Method – Students in groups of 20 each will discuss a relevant and grave issue that is dogging the nation. Alternatively, topics from current affairs (National budget, democratic process, economical strengthening of the country).

c. Outcome – Develop group communication skills. Learn to speak up one's opinion in a forum. Cultivate the habit of presenting solution-driven arguments making them contributors in any team

5. QUIZ ON SOCIAL BEHAVIOR

a. Purpose – Augment proper social etiquette among students and make them responsible citizens

b. Method – Conduct a quiz on traffic rules using audio-visual aids or using dumb charades where one student has to enact the traffic rule and the others have to guess that rule

c. Outcome – Grasp of various traffic rules and driving etiquette. Build verbal and non-verbal communication skills

6. SCREEN A MOVIE (FOCUS ON POSITIVITY AND POWER OF THE MIND)

a. Purpose – Expose students to introspective skills and try to develop a positive thinking inlife

b. Method – Screen a movie / a documentary / a video that focuses on the power of the mind and how to create affirmations in one's life. At the end of the movie, students can be asked to express their opinions and write down what changes / improvements they plan to take in their choices thereafter. This can be followed by a guest lecture by expert/s or workshop

c. Outcome – Comprehend the areas of improvement within themselves. Understand the importance of staying positive and develop affirmations

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c. Outcome – Comprehend the areas of improvement within themselves. Understand the importance of staying positive and develop affirmations

9. DEBATE ON A TOPIC FROM SOCIAL SCIENCES

a. Purpose – Educate students about various domains in social sciences and develop an interest towards gaining knowledge about these topics

b. Method – Various topics from various domains of social sciences can be chosen and students in pairs can pick a topic and present their arguments for or against the topic. Time for each debate will be 10 minutes maximum

c. Outcome – Recognize the significance of social sciences in our lives. Cultivate the habit to present forceful arguments while respecting the opponent's perspective and enhance verbal skills.

Interactive Activities to be conducted during Tutorial (Outside Classroom)

1. WASTE MANAGEMENT and CLEAN CAMPUS

Purpose: Create awareness among students about the significance of a clean environment and social responsibility to deter littering and segregate waste

Method: Students (in groups) will be given charge of areas of campus and will be expected to clean that segment. Also, they will be entrusted with the responsibility to collect, separate waste and hand over to the housekeeping authority

Outcome: Develop the habit to maintain cleanliness at home as well as learn to respect community areas at college or workplace. It will also encourage them become ambassadors among their peers to advocate protection of the environment

2. MAKING A VIDEO ON SOCIAL WASTAGES.

Purpose: Instil among students a sense of responsibility towards judiciously using natural resources like water and electricity

Method: Using their phones / hand-held devices, groups of students will make a 3 – 4 minute short film that will highlight irresponsible behavior in terms of wastage of water, leaving lights, fans and other electrical appliances on when not in use, defacing public and campus property by scribbling on walls and common areas. They will make awareness for the same among students. The creative videos will be posted on the college website and social media as an encouragement

Outcome: Conscientious behavior towards saving public utility resources. Explore theuse of audio-visual tools to create more meaningful messages that can effect a change in society

3. RELAY MARATHON (3 – 5 kms)

Purpose: Propagate a social message by way of a sport activity

Method: A group of students will begin the race with banner / placard in hand that contains a social message. The group runs for 500 meters and hands over the banner / placard to the next group of students. This chain of exchange will continue for 3 – 5 kms.

Outcome: Become aware of the need for fitness and encouragement towards healthier

Life style. Students will also be able to express their creativity in terms of meaningful messages and gain attention towards worthy social causes from the community in and around the campus.

4. TREE PLANTATION ON CAMPUS

a. Purpose: Involve students to actively participate in environment protection and develop greener surroundings
b. Method: Each student will plant a sapling and take care of that plant until it is able to sustain itself. Alternatively, students can organize a tree plantation drive in a public area and nurture it
c. Outcome: Besides increase in plants in the locality, students will feel a sense of empowerment and become social contributors towards protecting the environment.

5. VISIT TO AN OLD AGE HOME / ORPHANAGE

a. Purpose: Build a sense of responsibility towards the less fortunate in our society and feel privileged to be able to effect real change in the world around us
b. Method: Students have to visit an old age home or orphanage in the vicinity of the college. They can interact with the inmates, probably donate utilities to the charity organization and/or probably stage a few inclusive activities with the residents of the place. After the visit, students can submit a brief report about their experience
c. Outcome: Learn first-hand about the conditions and social situations that the no-so-privileged members of our society have to endure to survive and go beyond their embarrassment to interact with the destitute which will help students appreciate the importance of Indian family values

6. STREET PLAY ACTIVITY

a. Purpose: Create awareness in themselves as well as people in the community on various social evils that need to be eradicated
b. Method: Students will prepare and enact a street play on any pertinent issues in society. The topics suggested can be perils of mobile phones / online fraud / safety for girls /mental and physical health of the youth.
c. Outcome: Allow students to deliberate and think deeply about the looming issues that is dogging our society and the future of the youth. This will also bring out the creative skills among the students and allow them to showcase their talent.

7. BUDDY / BIG BROTHER SYSTEM

a. Purpose: Include and involve the less fortunate children making them feel wanted and cared for as well as use the opportunity to share knowledge among school students.
b. Method: Students have to go to nearby schools after procuring appropriate permissions to teach a particular topic on either technical or non technical domains. Each student can choose to adopt 5 students from the class to be their mentor over a period of 1 year by staying in touch with them and helping them resolve their issues on academic or other matters.
c. Outcome: Appreciation and respect towards the responsibility of teaching. They will learn to be accountable as social contributors and bring about some change in the lives of the young students they mentor as Buddies or Big Brother.

Term Work Assessment Guidelines

Students must submit the report of all conducted activities conducted during Tutorial (Outside Classroom) of at least 04 activities (out of 07 activities) from group (of 02-03) students.

The brief guidelines for report preparations are as follows:

1. One activity report must be of maximum 3 pages;
2. Combined Report of all activities with cover pages, table of contents and certificate (signed by instructor) is to be submitted in soft copy (pdf) format only.

3. The report must contain:
    - General information about the activity;
    - Define the purpose of the activity;
    - Detail out the activities carried out during the visit in chronological order;
    - Summarize the operations / process (methods) during the activities;
    - Describe what you learned (outcomes) during the activities as a student;
    - Add photos of the activity;(optional)
    - Add a title page to the beginning of your report;
    - Write in clear and objective language; and
    - Get well presented, timely and complete report submitted.

Recommended Assessment and Weightage Parameters:

(Attendance 30%, Assignments/Activities-Active participation and proactive learning 50% and report 20%)

Learning Resources

Books:

1. A. Alavudeen, M. Jayakumaran, and R Kalil Rahman, "Professional Ethics and Human Values"
2. Ram Ahuja, "Social Problems in India" (third edition)
3. Shastry, T. S. N., "India and Human rights: Reflections", Concept Publishing Company India Pvt. Ltd., 2005.
4. Nirmal, C.J., "Human Rights in India: Historical, Social and Political Perspectives (Law in India)", Oxford India
5. Rangarajan, "Environmental Issues in India", Pearson Education.
6. University of Delhi, The Individual and Society, Pearson Education.
7. Wikipedia.org / wiki /social studies.
8. M. N. Srinivas, "Social change in modern India", 1991, Orient Longman.
9. David Mandelbaum, Society in India, 1990, Popular.
10. Dr. Abha Singh, "Behavioral Science: Achieving Behavioral Excellence for Success", Wiley.

e-B ooks:

- https://www.moteoo.org/en/products/social-science-and-humanities-student-book-english
- https://www.springeropen.com/books
  (SpringerOpen open access books; download them free of charge from SpringerLink)
- https://muse.jhu.edu/article/541846/pdf
  (This content has been declared *free* to read by the publisher during the COVID-19)

@The CO-PO Mapping Matrix

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

Home

Savitribai Phule Pune University
Second Year of Computer Science and Design Engineering (2021 Course)
210251: Audit Course 3

In addition to credits, it is recommended that there should be audit course, in preferably in each semester starting from second year in order to supplement students' knowledge and skills. Student will be awarded the bachelor's degree if he/she earns specified total credit [1] and clears all the audit courses specified in the curriculum. The student will be awarded grade as AP on successful completion of audit course. The student may opt for one of the audit courses per semester, starting in second year first semester. Though not mandatory, such a selection of the audit courses helps the learner to explore the subject of interest in greater detail resulting in achieving the very objective of audit course's inclusion. List of options offered is provided. Each student has to choose one audit course from the list per semester. Evaluation of audit course will be done at institute level itself. Method of conduction and method of assessment for audit courses are suggested.

Criteria:

The student registered for audit course shall be awarded the grade AP (Audit Course Pass) and shall be included such AP grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory performance and secured a passing grade in that audit course. No grade points are associated with this 'AP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA. Evaluation of audit course will be done at institute level itself [1]

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

- Lectures/ Guest Lectures
- Visits (Social/Field) and reports
- Demonstrations
- Surveys
- Mini-Project
- Hands on experience on focused topic

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

- Written Test
- Demonstrations/ Practical Test
- Presentations, IPR/Publication and Report

Audit Course 3 Options

Audit Course Code	Audit Course Title
AC3-I	Green Construction and Design
AC3-II	Social Awareness and Governance Program
AC3-III	Environmental Studies
AC3-IV	Smart Cities
AC3-V	Foreign Language (one of Japanese/Spanish/French/German). Course contents for **Japanese (Module 1)** are provided. For other languages institute may design suitably.

Note: It is permitted to opt one of the audit courses listed at SPPU website too, if not opted earlier.
http://collegecirculars.unipune.ac.in/sites/documents/Syllabus%202017/Forms/AllItems.aspx
http://www.unipune.ac.in/university_files/syllabi.htm

AC3-I: Green Construction and Design

Prerequisites: General awareness of environment and eco system.

Course Objectives:

1. To motivate students for undertaking green construction projects, technical aspects of their design,obstacles to getting them done, and future directions of the field.
2. To increase awareness of green construction issues, so that students will know the range of i- existing knowledge and issues.
3. Proper use of energy, water and other resources without harming environment.
4. To reduce waste pollution and Environment Degradation.

Course Outcomes:

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

CO1: Understand the importance of environment friendly society.

CO2: Apply primary measures to reduce carbon emissions from their surroundings.

CO3: Learn role of IT solutions in design of green buildings.

CO4: Understand the use of software systems to complete statutory compliances involved in the design of a new home or office building through green construction.

Course Contents

1. Introduction to Green Construction, need of green construction, Importance, Government Initiatives, your role in the Green Environment.
2. How to do Green Construction, Project Definition, Team Building, Education and Goal Setting,Documents and Specification.
3. Elements of Green Construction, Materials Construction Waste Management, Indoor Air Quality, Energy Efficiency.
4. Indian Green Building Council (IGBC), Introduction to IGBC, IGBC rating system, Green building projects in India, Benefits of green building, effects on natural resources.

Team Projects:

Students will be formed into groups to research green construction and design in a particular construction context and report their results to the class. What are the particular obstacles and opportunities to integrating green construction techniques into the following sectors? Be sure to consider technical, social, political and economic issues: Hotels (economy, luxury, resorts), Hospitals, Retail (big box, malls, small scale downtown retail),Office, Government, ,Schools, Universities, Housing, Transportation Stations (Airport Terminals, Train Stations).

References :

1. Kibert, C. (2008) Sustainable Construction: Green Building Design and Delivery, 2nd edition (Hoboken, NJ: John Wiley and Sons.
2. Handbook of Green Building Design and Construction 1st Edition, by Sam Kubba, eBook ISBN:9780123851291.
   IGBC Green New Buildings Rating System, Version 3.0, Abridged Reference Guide September 2014.Available:https://igbc.in/igbc/html_pdfs/abridged/IGBC%20Green%20New%20Buildings%20Rating%20System%20(Version%203.0).pdf

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	-	-	2	-	-	3	3	-	-	-	-	-
CO2	-	-	2	-	-	3	3	-	-	-	-	-
CO3	-	-	-	-	3	-	2	-	-	-	-	-
CO4	-	-	1	-	3	-	2	-	-	-	-	-

AC3-II: Social Awareness and Governance Program

Prerequisites:

Awareness about basic terms in Social Science and Governance

Course Objectives:

1. To Increase community awareness about social issues and to promote the practice of good governance in both private and public institutions, through policy advocacy and awareness creationin order to ensure proper utilization of public resources and good service delivery.
2. Increase community awareness on health, education, and human rights.
3. Transferring costs of social activities to other various segments of society.
4. To enhance youth participation in decision-making, democracy and economic development.

Course Outcomes:

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

CO1: Understand social issues and responsibilities as member of society.
CO2: Apply social values and ethics in decision making at social or organizational level
CO3: Promote obstacles in national integration and role of youth for National Integration
CO4: Demonstrate basic features of Indian Constitution.

Course Contents

1. Indian Society as Pluralistic, Fundamentals of unity in diversity, diversity and disparity in Indian society, women in mass media, disparities due to disability.
2. The Indian constitution as unifying factor, Introduction Making of Indian Constitution, Basic features of Indian Constitution, Strengths of Indian Constitution, and Fundamental Duties.
3. National Integration: Introduction, The Value of Tolerance, Minority Classes And Constitution, Pre-Requisites of National Integration, Obstacles To National Integration, Promotion of Nationa Integration, Role of Youth In Promoting Communal Harmony.
4. Socialization, Ethics, Values and Prejudices, Meaning of Socialization, Functions of Socialization, Agents of Socialization, Importance of Socialization, Role of Ethics In Individual Development, Role of Basic Human Values In Individual Development, Relative Value System.

Activities:

1. Conducting training/workshops/debates on HIV/AIDS prevention and stigma reduction.
2. Public shows on girls' education and empowerment.
3. Conducting campaigns on adult/disabled education.
4. To support the government to develop policy that encourages youth participation In decision-making through government agencies.

References:

1. Devidas M. Muley , S Chand, " Social Awareness and Personality Development", ISBN: 812193074X.
2. Bhagabati Prosad Banerjee, Durga Das Basu, Shakeel Ahmad Khan, V. R. Manohar, "Introduction to the Constitution of India", ISBN : 9788180385599.

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	-	-	-	-	-	-	-	2	-	-	-	-
CO2	-	-	-	-	-	-	-	3	2	-	-	-
CO3	-	-	-	-	-	-	-	2	2	-	-	-
CO4	-	-	-	-	-	-	-	1	1	-	-	-

AC3-III: Environmental Studies

Environmental studies are the field that examines this relationship between people and the environment. An environmental study is an interdisciplinary subject examining the interplay between the social, legal, management, and scientific aspects of environmental issues.

Course Objectives:

1. Understanding the importance of ecological balance for sustainable development.
2. Understanding the impacts of developmental activities and mitigation measures.
3. Understand and realize the multi-disciplinary nature of the environment, its components, and inter-relationship between man and environment
4. Understand the relevance and importance of the natural resources in the sustenance of life on earth and living standard

Course Outcomes:

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

CO1: Comprehend the importance of ecosystem and biodiversity

CO2: Correlate the human population growth and its trend to the environmental degradation and develop the awareness about his/her role towards environmental protection and prevention

CO3: Identify different types of environmental pollution and control measures

CO4: Correlate the exploitation and utilization of conventional and non-conventional resources

Course Contents

1. **Natural Resources:** Introduction, Renewable and non-renewable, Forest, water, mineral, food, energy and land resources, Individual and conservation of resources, Equitable use of resources.
2. **Ecosystems:** Concept, Structure, Function, Energy flow, Ecological succession, Forest, grassland, desert and aquatic ecosystems - Introduction, characteristic features, structure and function.
3. **Biodiversity:** Genetic, Species and ecological diversity, Bio Geographical classification of India, Value and hot spots, Biodiversity at global, national and local levels, India as mega- biodiversity nation, Threats to biodiversity, Endangered and endemic species of India, Conservation of Biodiversity, Endangered and endemic species, Conservation of biodiversity.
4. **Pollution:** Definition, Causes, effects and control measures of the pollution – Air, soil, Noise, Water, Marine and Thermal and Nuclear Pollution, Solid waste management, Role of Individual in Prevention of Pollution, Pollution #Exemplar/Case Studies, Disaster management

Reference:

1. Bharucha, E.,-Textbook of "Environmental Studies", Universities Press(2005),ISBN-10:8173715408
2. Mahua Basu, "Environmental Studies", Cambridge University Press, ISBN-978-1-107-5317-3

@The CO-PO Mapping Matrix

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

AC3-IV: Smart Cities

We breathe in a world defined by urbanization and digital ubiquity, where mobile broadband connections outnumber fixed ones, machines dominate a new "internet of things," and more people live in cities than in the countryside. This course enables us to take a broad historical look at the forces that have shaped the planning and design of cities and information technologies from the rise of the great industrial cities of the nineteenth century to the present. This course considers the motivations, aspirations, and shortcomings of them all while offering a new civics to guide our efforts as we build the future together, one click at a time.

Course Objectives

- To identify urban problems
- To study Effective and feasible ways to coordinate urban technologies.
- To study models and methods for effective implementation of Smart Cities.
- To study new technologies for Communication and Dissemination.
- To study new forms of Urban Governance and Organization.

Course Outcomes

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

CO1: Understand the dynamic behavior of the urban system by going beyond the physical appearance and by focusing on representations, properties and impact factors

CO2: Explore the city as the most complex human-made organism with a metabolism that can be modeled in terms of stocks and flows

CO3: Knowledge about data-informed approaches for the development of the future city, based on crowd sourcing and sensing

CO4: Knowledge about the latest research results in for the development and management of future cities

CO5: Understand how citizens can benefit from data-informed design to develop smart and responsive cities

Course Contents

Urbanization and Ubiquity - The slow emergence of learning cities in an urbanizing world. Cities as collective learners, what do we know?- Framing a view -A gamut of learning types - Secrets of knowing and accelerating change - Why some cities learn and others do not.

References:

1. Anthony M. Townsend, W. W. Nortonand Company “Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia”, ISBN: 0393082873,9780393082876.
2. Tim Campbell, Routledge, “Beyond Smart Cities: How Cities Network, Learn and Innovate”‖, Routledge, ISBN:9781849714266.
3. StanGeertman, JosephFerreira, Jr.Robert Goodspeed, JohnStillwell, “Planning Support System ms and Smart Cities”, Lecture notes in Geo information and Cartography, Springer.

@The CO-PO Mapping Matrix

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

AC3-V: Foreign Language- Japanese (Module 1)

About course:

With changing times, the competitiveness has gotten into the nerves and "Being the Best "at all times is only the proof of it. Nonetheless, 'being the best' differs significantly from 'Communicating the best'! The best can merely be communicated whilst using the best… suited Language!!

Japanese is the new trend of 21st century. Not only youngsters but even the professionals seek value in it. It is the engineer's companion in current times with an assertion of a thriving future. Pune has indisputably grown to become a major center of Japanese Education in India while increasing the precedence for Japanese connoisseurs.

Japanese certainly serves a great platform to unlock a notoriously tough market and find a booming career. While the companies prefer candidates having the knowledge of the language, it can additionally help connect better with the native people thus prospering in their professional journey. Learning Japanese gives an extra edge to the 'resume' since the recruiters consciously make note of the fact it requires real perseverance and self-discipline to tackle one of the most complex languages.

It would be easy for all time to quit the impossible; however it takes immense courage to reiterate the desired outcomes, recognize that improvement is an ongoing process and ultimately soldier on it. The need of an hour is to introduce Japanese language with utmost professionalism to create awareness about the bright prospects and to enhance the proficiency and commitment. It will then prove to be the ultimate path to the quest for professional excellence!

Course Objectives:

- To meet the needs of ever growing industry with respect to language support.
- To get introduced to Japanese society and culture through Language.

Course Outcomes:

On completion of the course learner will able to-

CO1: Will have ability of basic communication.

CO2: Will have the knowledge of Japanese script.

CO3: Will get introduced to reading , writing and listening skills

CO4: Will develop interest to pursue professional Japanese Language course.

Course Contents

1. Introduction to Japanese Language. Hiragana basic Script, colors, Days of the week
2. Hiragana : modified Kana, double consonant, Letters combined with ya, yu, yoLong vowels, Greetings and expressions
3. Self Introduction, Introducing other person, Numbers, Months, Dates, Telephone numbers, Stating on 'sage.

Reference:

1. Minna No Nihongo,"Japanese for Everyone", Elementary Main Text book1-1 (Indian Edition), Goyal Publishers and Distributors Pvt.Ltd.
2. http://www.tcs.com (http://www.tcs.com/news_events/press_releases/Pages/TCS-Inaugurates-Japan-centric-Delivery-Center-Pune.aspx)

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO1	-	-	-	-	-	-	-	-	1	3	1	1
CO2	-	-	-	-	1	-	-	-	-	3	1	1
CO3	-	-	-	-	1	-	-	-	-	3	2	2
CO4	-	-	-	-	-	-	-	-	-	1	-	1

Semester IV

Savitribai Phule Pune University

Second Year of Computer Science and Design (2021 Course)

207003: Engineering Mathematics-III

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week **Tutorial: 01 Hour/ Week**	**Theory: 03** **Tutorial: 01**	**Mid_Semester(TH): 30 Marks** **End_Semester(TH): 70 Marks** **Term Work: 25 Marks**

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

Companion Course : ----

Course Objectives:

To make the students familiar with concepts and techniques in Linear differential equations, Fourier transform and 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 discipline

Course Outcomes:

On completion of the course learner will 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 and regression analysis and probability theory for data analysis and predictions in machine learning.

CO4: Solve Algebraic and 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 Hours)

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

Unit II	Transforms	(08 Hours)

Fourier Transform (FT): Complex exponential form of Fourier series, Fourier integral theorem, Fourier Sine and Cosine integrals, Fourier transform, Fourier Sine and Cosine transforms & their inverses, Discrete Fourier Transform.

Z - Transform (ZT): Introduction, Definition, Standard properties, ZT of standard sequences and their inverses. Solution of difference equations.

Unit III	Statistics	(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 Distributions	(07 Hours)
Probability, Theorems on Probability, Bayes theorem, Random variables, Mathematical Expectation, Probability density function, Probability distributions: Binomial, Poisson, Normal and Hype rgeometric, Sampling distributions, Test of Hypothesis: Chi-Square test, t-test.		
Unit V	**Numerical Methods**	**(08 Hours)**
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**	**(08Hours)**
Interpolation: Finite Differences, Newton's and Lagrange's Interpolation formulae, Numerical Differentiation. Numerical Integration: Trapezoidal and Simpson's rules, Bound of truncation error. Solution of Ordinary differential equations: Euler's, Modified Euler's, Runge-Kutta 4^{th} order methods and Predictor-Corrector methods.		

Learning Resources

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. IyengarAnd R. K. Jain, 5e, (New Age International Publication)

MOOC Link:

1. NPTEL Course "Transform Calculus And its applications in differential equations" https://nptel.ac.in/courses/111/105/111105123/
2. NPTEL Course on "Numerical Methods" https://nptel.ac.in/courses/111/107/111107105/

Virtual LAB Link:

1. Numerical Methods: http://vlabs.iitb.ac.in/vlabs-dev/labs/numerical_lab/index.php

Guidelines for Tutorial and Term Work:

i) Tutorial shall be engaged in batches (batch size as per norms) per division.

ii) Term work shall be based on continuous assessment of six assignments (one per each unit) and performance in internal tests.

Savitribai Phule Pune University Second Year of Computer Science and Design Engineering (2021 Course) 218253: Data Structures and Files		
Teaching Scheme: **TH:03 Hours/Week**	**Credit: 03**	**Examination Scheme:** **Mid-Sem (TH) : 30 Marks** **End-Sem (TH): 70 Marks**

Prerequisites Courses: 110005: Programming and Problem Solving
218242: Data Structure and Algorithms

Companion Course: Data Structures and Files Laboratory (218257)

Course Objectives:

The course is intended to provide the foundations of the practical implementation and usage of Data Structures and Algorithms to ensure that the learner evolves into a competent programmer capable of designing and analyzing implementations of data structures and algorithms for different kinds of problems.

- To develop a logic for graphical modeling of the real life problems.
- To suggest appropriate data structure and algorithm for graphical solutions of theproblems.
- To understand advanced data structures to solve complex problems in variousdomains.
- To operate on the various structured data
- To build the logic to use appropriate data structure in logical and computationalsolutions.
- To understand various algorithmic strategies to approach the problem solution.

Course Outcomes:

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

CO1: **Identify and articulate** the complexity goals and benefits of a good hashing scheme for real-world applications.

CO2: **Apply** non-linear data structures for solving problems of various domain.

CO3: **Design and specify** the operations of a nonlinear-based abstract data type and implement the min a high-level programming language.

CO4:**Analyze** the algorithmic solutions for resource requirements and optimization

CO5: **Use** efficient indexing methods and multiway search techniques to store and maintain data.

CO6:U**se** appropriate modern tools to understand and analyze the functionalities confined to the secondary storage.

Course Contents

Unit I	**Hashing**	**07 Hours**

Hash Table- Concepts-hash table, hash function, basic operations, bucket, collision, probe, synonym, overflow, open hashing, closed hashing, perfect hash function, load density, full table, load factor, rehashing, issues in hashing, hash functions- properties of good hash function, division, multiplication, extraction, mid-square, folding and universal, Collision resolution strategies- open addressing and chaining, Hash table overflow- open addressing and chaining, extendible hashing, closed addressing and separate chaining.

Skip List- representation, searching and operations- insertion, removal

#Exemplar/Case Studies	Book Call Number and Dictionary
***Mapping of Course Outcomes for Unit I**	CO1, CO4

Unit II	Trees	08 Hours
Tree- basic terminology, General tree and its representation, representation using sequential and linked organization, Binary tree- properties, converting tree to binary tree, binary tree traversals(recursive and non-recursive)- inorder, preorder, post order, depth first and breadth first, Operations on binary tree. Huffman Tree (Concept and Use), Binary Search Tree (BST), BST operations, Threaded binary search tree- concepts, threading, insertion and deletion of nodes in in-order threaded binary search tree, in order traversal of in-order threaded binary search tree.		
#Exemplar/CaseStudies	Use of binary tree in expression tree-evaluation and Huffman's coding	
***Mapping of Course Outcomes for Unit II**	CO2, CO3,CO4	

Unit III	Graphs	07 Hours
Basic Concepts, Storage representation, Adjacency matrix, adjacency list, adjacency multi list, inverse adjacency list. **Traversals**-depth first and breadth first, Minimum spanning Tree, Greedy algorithms for computing minimum spanning tree- Prims and Kruskal Algorithms, Dikjtra's Single source shortest path, All pairs shortest paths- Flyod-Warshall Algorithm Topological ordering.		
#Exemplar/Case Studies	Data structure used in Webgraph and Google map	
***Mapping of Course Outcomes for Unit III**	CO2,CO3, CO4	

Unit IV	Search Trees	08 Hours
Symbol Table-Representation of Symbol Tables- Static tree table and Dynamic tree table, Weight balanced tree - Optimal Binary Search Tree (OBST), OBST as an example of Dynamic Programming, Height Balanced Tree- AVL tree. Red-Black Tree, AA tree, K-dimensional tree, Splay Tree		
#Exemplar/Case Studies	Keyword search in a document using OBST	
***Mapping of Course Outcomes for Unit IV**	CO2, CO3, CO5	

Unit V	Indexing and Multiway Trees	07 Hours
Indexing and Multiway Trees- Indexing, indexing techniques-primary, secondary, dense, sparse, Multiway search trees, B-Tree- insertion, deletion, B+Tree - insertion, deletion, use of B+ tree in Indexing, Tree.		
#Exemplar/Case Studies	Heap as a Priority Queue	
***Mapping of Course Outcomes for Unit V**	CO2, CO3, CO5	

Unit VI	File Organization	07 Hours
Files: concept, need, primitive operations. **Sequential file organization-** concept and primitive operations, **Direct Access File-** Concepts and Primitive operations, **Indexed sequential file organization-** concept, types of indices, structure of index sequential file, **Linked Organization-** multi list files, coral rings, inverted files and cellular partitions.		
#Exemplar/Case Studies	**External Sort-** Consequential processing and merging two lists, multiway Merging- a k way merge algorithm.	

*Mapping of Course Outcomes for Unit VI	CO4, CO6

Learning Resources

Text Books :

1. Horowitz, Sahani, Dinesh Mehata, "Fundamentals of Data Structures in C++", Galgotia Publisher, ISBN: 8175152788, 9788175152786.
2. M Folk, B Zoellick, G. Riccardi, "File Structures, Pearson Education", ISBN:81-7758-37-5
3. Peter Brass, "Advanced Data Structures", Cambridge University Press, ISBN: 978-1-10743982-5

Reference Books :

1. A. Aho, J. Hopcroft, J. Ulman, "Data Structures and Algorithms", Pearson Education, 1998, ISBN-0-201-43578-0.
2. Michael J Folk, "File Structures an Object Oriented Approach with C++", Pearson Education, ISBN: 81-7758-373-5.
3. Sartaj Sahani, "Data Structures, Algorithms and Applications in C++", Second Edition, University Press, ISBN:81-7371522 X.
4. G A V Pai, "Data Structures and Algorithms", McGraw-Hill Companies, ISBN -9780070667266.
5. Goodrich, Tamassia, Goldwasser, "Data Structures and Algorithms in Java", Wiley Publication, ISBN: 9788126551903

e-Books :

- https://www.ebooks.com/en-us/book/95777110/Python-data-structures-and-algorithms/benjamin-baka/
- https://www.ebookphp.com/advanced-data-structures-epub-pdf/
- https://www.ebookphp.com/data-structures-and-algorithms-professional-edition-beginners-guide-epub-pdf/

MOOCs Courses Links:

- https://nptel.ac.in/courses/106/102/106102064/
- https://nptel.ac.in/courses/106/105/106105085
- https:// nptel.ac.in/courses/106/106/106106127

@The CO-PO Mapping Matrix

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

Savitribai Phule Pune University
Second Year of Computer Science and Design Engineering (2021 Course)
218254: Operating Systems

Teaching Scheme:	Credit: 03	Examination Scheme:
TH: 03Hours/Week		Mid-Sem (TH) : 30 Marks End-Sem (TH): 70 Marks

Prerequisites Courses: Programming and Problem solving (110005)

Companion Course: Software Laboratory (218258)

Course Objectives:

- To understand functions of operating system
- To learn and understand process, resource and memory management.
- To learn and understand file and I/O management.

Course Outcomes:

On completion of the course, learners should be able to

CO1: Enlist functions of OS and types of system calls
CO2: Apply process scheduling algorithms to solve a given problem
CO3: Illustrate deadlock prevention, avoidance and recovery
CO4: Explain memory management technique
CO5: Illustrate I/O and file management policies
CO6: Describe Linux process management

Course Contents

Unit I	Fundamental Concepts of Operating system	(06 Hours)

Operating system functions and characteristics, historical evolution of operating systems, issues in operating system design, User's view of the OS, Types of OS: Batch, time sharing, multiprogramming, distributed, network and real-time systems, Operating-System Services, Types of System Calls, System Programs. BASH Shell scripting: Basic shell commands, shell as a scripting language.

#Exemplar/Case Studies	Virtual Machines
*Mapping of Course Outcomes for Unit I	CO1

Unit II	Process Management	(06 Hours)

Process concept, Process Control Block (PCB), Process Operations, Process Scheduling: Types of process schedulers, Types of scheduling: Preemptive, Non preemptive. Scheduling algorithms: FCFS, SJF, RR, Priority, Inter process Communication (IPC). Threads: multithreaded model, implicit threads, threading issues

#Exemplar/Case Studies	Thread programming Using Pthreads
*Mapping of Course Outcomes for Unit II	CO2

Unit III	Process Coordination	(08 Hours)

Synchronization: Principles of Concurrency, Requirements for Mutual Exclusion, Mutual Exclusion: Hardware Support, Operating System Support (Semaphores and Mutex), Programming Language Support (Monitors).Classical synchronization problems: Readers/Writers Problem, Producer and Consumer problem, Inter-process communication (Pipes, shared memory: system V) Deadlock: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock

#Exemplar/Case Studies	Process coordination in Unix operating system
***Mapping of Course Outcomes for Unit III**	CO3

Unit IV	**Memory Management**	**(06 Hours)**

Memory Management: Memory Management Requirements, Memory Partitioning: Fixed Partitioning, Dynamic Partitioning, Buddy System, Relocation, Paging, Segmentation. Virtual Memory: Hardware and Control Structures, Operating System Software

#Exemplar/Case Studies	Memory Management in Unix operating system
***Mapping of Course Outcomes for Unit IV**	CO4

Unit V	**I/O and File Management**	**(06 Hours)**

I/O Management: I/O Devices, Organization of I/O function, I/O Buffering, Disk Scheduling Disk Scheduling policies like FIFO, LIFO, STTF, SCAN, C-SCAN.
File Management: Concept, Access methods, Directory Structure, Protection, File System implementation, Directory Implementation, Allocation methods, Free Space management.

#Exemplar/CaseStudies	I/O Management in Unix operating system
***Mapping of Course Outcomes for Unit V**	CO5

Unit VI	**Linux**	**(06 Hours)**

History Of Unix and Linux , Overview Of Linux - Linux Goals, Interfaces to Linux, The Shell, Linux Utility Programs, Kernel structure, Processes in Linux – Process management system calls in Linux, Implementation of process and threads in Linux, Process scheduling Linux, Booting

#Exemplar/Case Studies	Ubuntu design principles
***Mapping of Course Outcomes for Unit VI**	CO6

Learning Resources

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, WILEY,ISBN978-1-118-06333-0, 9th Edition
2. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, ISBN-10:0-13-380591-3, ISBN-13: 978-0-13-380591-8, 8th Edition
3. Andrew S. Tanenbaum & Herbert Bos, Modern Operating System, Pearson, ISBN-13: 9780133592221, 4th Edition

Reference Books:

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

e-Books :

- https://repository.dinus.ac.id/docs/ajar/Operating_System.pdf

MOOCs Courses Links:

1. https://nptel.ac.in/courses/106/105/106105214/
2. https://nptel.ac.in/courses/106/106/106106144/

@The CO-PO Mapping Matrix

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

Savitribai Phule Pune University
Second Year of Computer Science and Design Engineering (2021 Course)
218255: Computer Networks

Teaching Scheme: TH: 03 Hours/Week	Credit: 03	Examination Scheme: Mid-Sem (TH) : 30 Marks End-Sem (TH): 70 Marks

Prerequisites Courses: --

Companion Course: - Software Laboratory(218258)

Course Objectives:

- To understand the fundamental concepts of networking standards, protocols and technologies
- To learn different techniques for framing, error control, flow control and routing
- To learn different layer protocols in the protocol stacks
- To understand modern network architectures with respect to design and performance
- To learn the fundamental concepts of Information Security

Course Outcomes:

On completion of the course, learners should be able to

CO1: Summarize fundamental concepts of Computer Networks, architectures, protocolsand technologies
CO2: Illustrate the working and functions of data link layer
CO3: Analyze the working of different routing protocols and mechanisms
CO4: Implement client-server applications using sockets
CO5: Illustrate role of application layer with its protocols, client-server architectures
CO6: Comprehend the basics of Network Security

Course Contents

Unit I	Introduction To Computer Networks	06 Hours

Definition, **Types of Networks**: Local area networks (LAN), Metropolitan area networks (MAN), Wide area networks (WAN), Wireless networks, Networks Software, Protocol, Design issues for the Network layers. **Network Models**: The OSI Reference Model, TCP/IP Model, Network Topologies, Types of Transmission Medium. **Network Architectures**: Client-Server, Peer To Peer, Hybrid. **Network Devices**: Bridge, Switch, Router, Gateway, Access Point. **Line Coding Schemes**: Manchester and Differential Manchester Encodings, Frequency Hopping (FHSS) and Direct Sequence Spread Spectrum (DSSS).

#Exemplar/Case Studies	Study of Campus wide networking.
*Mapping of Course Outcomes for Unit I	CO1

Unit II	Data Link Layer	08 Hours

Introduction, functions. **Design Issues**: Services to Network Layer, Framing. **ARQ strategies**: Error Detection and correction, Parity Bits, Hamming Codes (11/12-bits) and CRC. **Flow Control Protocols**: Unrestricted Simplex, Stop and Wait, Sliding Window Protocol. **WAN Connectivity**: PPP and HDLC. **MAC Sub layer**: Multiple Access Protocols: Pure and Slotted ALOHA, CSMA, WDMA, CSMA/CD, CSMA/CA, Binary Exponential Back-off algorithm, Introduction to Ethernet
IEEE 802.3, IEEE 802.11 a/b/g/n, IEEE 802.15 and IEEE 802.16 Standards.

#Exemplar/Case Studies	Demonstration of DLL protocols on Simulator
*Mapping of Course Outcomes for Unit II	CO2

Unit III	Network Layer	08 Hours
Introduction: Functions of Network layer. **Switching Techniques**: Circuit switching, Message Switching, Packet Switching. **IP Protocol**: Classes of IP (Network addressing), IPv4 , IPv6, Network Address Translation, Sub-netting , CIDR. **Network layer Protocols**: ARP, RARP, ICMP,IGMP. **Network Routing and Algorithms**: Static Routing, Dynamic Routing, Distance Vector Routing, Link State Routing, Path Vector. **Routing Protocols**: RIP, OSPF, BGP, MPLS. **Routing in MANET**: AODV, DSR, Mobile IP.		
#Exemplar/Case Studies	Demonstration of Routing Protocols on simulator.	
***Mapping of Course Outcomes for Unit III**	CO3	
Unit IV	**Transport Layer**	**07 Hours**
Process to Process Delivery, Services, Socket Programming. **Elements of Transport Layer Protocols**: Addressing, Connection establishment, Connection release, Flow control and buffering, Multiplexing, Congestion Control. **Transport Layer Protocols**: TCP and UDP, SCTP, RTP, Congestion control and Quality of Service (QoS), Differentiated services, TCP and UDP for Wireless networks.		
#Exemplar/Case Studies	Demonstration of Transport layer protocols on Simulator.	
***Mapping of Course Outcomes for Unit IV**	CO4	
Unit V	**Application Layer**	**06 Hours**
Introduction, Web and HTTP, Web Caching, DNS, Email: SMTP, MIME, POP3, Webmail, FTP, TELNET,DHCP, SNMP.		
#Exemplar/Case Studies	Study of Application Layer protocols using network protocol analyzer. e.g. Wireshark	
***Mapping of Course Outcomes for Unit V**	CO5	
Unit VI	**Security**	**07 Hours**
Introduction, Security services, Need of Security, Key Principles of Security, Threats and Vulnerabilities, Types of Attacks, ITU-T X.800 Security Architecture for OSI, Security Policy and mechanisms, Operational Model of Network Security, Symmetric and Asymmetric Key Cryptography. Security in Network, Transport and Application: Introduction of IPSec, SSL, HTTPS, S/MIME, Overview of IDS and Firewalls.		
#Exemplar/Case Studies	Study of security protocols in Network, Transport and Application Layer using network protocol analyzer. e.g. Wireshark	
***Mapping of Course Outcomes for Unit VI**	CO6	

Learning Resources

Text Books :

1. Fourauzan B.,"Data Communications and Networking", 5th Edition, Tata McGraw-Hill, Publications, ISBN:0–07 – 058408 – 7
2. Andrew S. Tanenbaum, Computer Networks, 5th Edition, Pearson India, 2012.

Reference Books :

1. Kurose, Ross, “Computer Networking a Top Down Approach Featuring the Internet”, Pearson, ISBN-10: 0132856204
2. L. Peterson and B. Davie, “Computer Networks: A Systems Approach”, 5th Edition, Morgan-Kaufmann, 2012.
3. Douglas E. Comer & M.S Narayanan, ”Computer Network & Internet”, Pearson Education
4. William Stallings, “Cryptography and Network Security: Principles and Practice”, 4th Edition
5. Pachghare V. K., “Cryptography and Information Security”, 3rd Edition, PHI,

e-Books :

- https://people.cs.clemson.edu/~jmarty/courses/kurose/KuroseCh1-2.pdf
- http://eti2506.elimu.net/Introduction/Books/Data Communications and Networking By Behrouz A.Forouzan.pdf
- http://intronetworks.cs.luc.edu/current/ComputerNetworks.pdf
- https://www.tutorialspoint.com/data_communication_computer_network/data_communi cati on_computer_network_tutorial.pdf

Case Study:

- https://slideplayer.com/slide/6106945
- http://www.worldcolleges.info/sites/default/files/Cisco_-_Ccie_Fundamental_-Network_Design_And_Case_Studies.PDF
- http://vlabs.iitb.ac.in/vlabs-dev/labs_local/computer-networks/labs/explist.php

MOOCs Courses link:

- nptel.ac.in/courses/106/105/106105183
- nptel.ac.in/courses/106/105/106105080
- nptel.ac.in/courses/106/105/106105081
- nptel.ac.in/courses/106/106/106106091
- nptel.ac.in/courses/106/105/106105031
- https://www.mooc-list.com/tags/computer-networking
- https://www.coursera.org/courses?query=computer%20network

@The CO-PO Mapping Matrix

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

Savitribai Phule Pune University
Second Year of Computer Science and Design (2021 Course)
218256: Design Thinking

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	03	Mid_Semestr(TH): 30 Mark End_Semester(TH): 70 Marks

Prerequisite Courses :NIL

Companion Course

Course Objectives:

- To learn design thinking concepts and principles
- To learn the different phases of design thinking

Course Outcomes:

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

CO1: Understand(identify) the fundamentals of Design Thinking concepts, process and Principles
CO2: Identify the methods to empathize and define the problem
CO3: Apply the ideation techniques for problem solving
CO4: Construct the prototype to evaluate a design
CO5: Identify various techniques for testing to improve the performance.
CO6: Apply the Design Thinking approach and model to real world situations

Course Contents

Unit I	Introduction	(07 Hours)
Introduction to Design Thinking, Design Thinking as a problem solving tool, Principles of Design Thinking, Process of Design Thinking, Tools and techniques for Design Thinking process, Planning a Design Thinking project.		
#Exemplar/Case Studies	Design Thinking to enhance urban redevelopment	
****Mapping of Course Outcomes for Unit 1***	CO1,CO6	
Unit II	**Empathize and Define**	**(07 Hours)**
Search field determination, Problem clarification, Understanding of the problem, Problem analysis, Reformulation of the problem, Observation Phase, Empathetic design, Tips for observing, Methods for Empathetic Design, Artifact Analysis, Behavioral Mapping and Tracking, Empathy Map, Cognitive Walkthrough, Heuristic Evaluation, Point-of-View Phase, Characterization of the target group, Description of customer needs, Persona, Define- Analysis and Drawing Inferences from Research		
#Exemplar/Case Studies	IBM: Design Thinking	
***Mapping of Course Outcomes for Unit II**	CO2,CO6	
Unit III	**Idea Generation**	**(07 Hours)**
Idea generation Basic design directions, Themes of thinking, Inspiration and references, Brainstorming, Value, Inclusion, Sketching, presenting ideas Refinement Thinking in images, thinking in signs, Appropriation, Humour, Personification, Visual metaphors, Modification, thinking in words, Words and language, Type 'faces', thinking in shapes, thinking in proportions, Thinking in colours, Ideation tools & exercises. Storytelling and Tools for Innovation Evaluation of ideas		
#Exemplar/Case Studies	Philips: Improving Patient experience	
***Mapping of Course Outcomes for Unit III**	CO3,CO6	
Unit IV	**Prototype**	**(07 Hours)**
Prototype Phase - Lean Startup Method for Prototype Development, Visualization and presentation		

techniques, Ideas to presentable concepts, Storyboards, Developing mock-ups, models and prototypes, Quick and Dirty Prototyping	
#Exemplar/Case Studies	Developing Environmental sustainable strategy
Mapping of Course Outcomes for Unit IV	CO4,CO6

Unit V	**Testing and Implementation**	**(07 Hours)**
Test Phase – Technique for interviews and surveys, Kano Model, Desirability Testing, Presenting Prototypes ,testing prototypes, Obtaining feedback to refine product Usability and Ergonomic testing		
#Exemplar/Case Studies	Saving Product X	
Mapping of Course Outcomes for Unit V	CO5,CO6	

Unit VI	**Design Thinking and Innovation**	(07 Hours)
Design and Innovation as an Organizational Strategy : Design Thinking meets the corporation, Design Thinking a systematic approach to innovation, using design thinking to manage an innovation portfolio, Transforming Organization, The New Social Contract, Design Activism, Designing tomorrow		
#Exemplar/Case Studies	Scaling design thinking in the enterprise	
Mapping of Course Outcomes for Unit VI	CO6	

Learning Resources

Text Books:

1. " Design Thinking" , Gavin Ambrose, Paul Harris, AVA Publishing
2. "Handbook of Design Thinking - Tips & Tools for how to design thinking", Christian Mueller-Rotenberg.
3. "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation" by TimBrown

Reference Books:

1. "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", Idris Mootee, Wiley.
2. "Designing for Growth: a design thinking tool kit for managers", Jeanne Liedtka and Tim Ogilvie

eBooks:

1. https://www.researchgate.net/publication/332869635_Case_Study_The_Use_of_IBM_Design_Thinking_Methodology_in_Designing_User-Oriented_Learning_Environment_in_hebrew
2. https://www.design-thinking-association.org/explore-design-thinking-topics/design-thinking-case- studies
3. https://onlinecourses.nptel.ac.in/noc22_mg32/preview

@The CO-PO Mapping Matrix

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

Savitribai Phule Pune University
Second Year of Computer Science and Design Engineering (2021 Course)
218257: Data Structures and Files Laboratory

Teaching Scheme	Credit Scheme: 02	Examination Scheme and Marks
Practical: 04 Hours/Week		Term work: 25 Marks Practical: 25 Marks

Companion Course: 218253: Data Structures and Files ,
110005: Programming and Problem solving

Course Objectives:

- To **understand** practical implementation and usage of nonlinear data structures for solving problems of different domain.
- To strengthen the ability to identify and **apply** the suitable data structure for the given real world problems.
- To **analyze** advanced data structures including hash table, dictionary, trees, graphs, sorting algorithms and file organization.

Course Outcomes:

On completion of the course, learners will be able to

CO1: Understand the ADT/libraries, hash tables and dictionary to design algorithms for specific problem.

CO2: Choose most appropriate data structures and **apply** algorithms for graphical solutions of the problems.

CO3: Apply and **analyze** nonlinear data structures to solve real world complex problems.

CO4: Apply and **analyze** algorithm design techniques for indexing, sorting, multi-way searching, file organization and compression.

CO5: Analyze the efficiency of most appropriate data structure for creating efficient solutions for engineering design situations.

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), curriculum of course, conduction and Assessment guidelines, topics under consideration-concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references.

Guidelines for Student's Laboratory Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of prologue, Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Objectives, Problem Statement, Outcomes, software and Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept in brief, algorithm, flowchart, test cases, Test Data Set(if applicable), mathematical model (if applicable), conclusion/analysis. **Program codes with sample output of all performed assignments are to be submitted as softcopy.**

As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Use of DVD containing students programs maintained by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

Guidelines for Laboratory /Term Work Assessment

Continuous assessment of laboratory work should be done based on overall performance and Laboratory assignments performance of student. Each Laboratory assignment assessment should be assigned grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each Laboratory 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. Consequently encouraging efforts, transparent evaluation and fair approach of the evaluator will not create any uncertainty or doubt in the minds of the students. Therefore adhering to these principles will consummate our team efforts to the promising start of the student's academics.

Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications. Encourage students for appropriate use of Hungarian notation, proper indentation and comments. Use of open source software is to be encouraged.

In addition to these, instructor may assign one real life application in the form of a mini-project based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus.

Set of suggested assignment list is provided in groups- A, B, C, D, E, F and G. Each student must perform at least 12 assignments (at least 02 from group A, 03 from group B, 02 from group C, 2 from group D, 01 from group E, 02 from group F.)

Operating System recommended :- 64-bit Open source Linux or its derivative

Programming tools recommended: - Open Source Python - Group A assignments, C++ Programming tool like G++/GCC

Virtual Laboratory:

- http://cse01-iiith.vlabs.ac.in/Courses%20Aligned.html?domain=Computer%20Science

Suggested List of Laboratory Experiments/Assignments

Sr. No.	Group A
1.	Consider telephone book database of N clients. Make use of a hash table implementation to quickly look up client's telephone number. Make use of two collision handling techniques and compare them using number of comparisons required to find a set of telephone numbers
2.	Implement all the functions of a dictionary (ADT) using hashing and handle collisions using chaining with / without replacement. Data: Set of (key, value) pairs, Keys are mapped to values, Keys must be comparable, Keys must be unique. Standard Operations: Insert(key, value), Find(key), Delete(key)
3.	For given set of elements create skip list. Find the element in the set that is closest to some given value. (note: Decide the level of element in the list Randomly with some upper limit
4	To create ADT that implement the "set" concept. a. Add (new Element) -Place a value into the set , b. Remove (element) Remove the value c. Contains (element) Return true if element is in collection, d. Size () Return number of values in collection Iterator () Return an iterator used to loop over collection, e. Intersection of two sets , f. Union of two sets, g. Difference between two sets, h. Subset
	Group B
5	A book consists of chapters, chapters consist of sections and sections consist of subsections. Construct a tree and print the nodes. Find the time and space requirements of your method
6	Beginning with an empty binary search tree, Construct binary search tree by inserting the values in the order given. After constructing a binary tree - i. Insert new node, ii. Find number of nodes in longest path from root, iii. Minimum data value

	found in the tree, iv. Change a tree so that the roles of the left and right pointers are swapped at every node, v. Search a value
7	Construct an expression tree from the given prefix expression eg. +--a*bc/def and traverse it using post order traversal (non recursive) and then delete the entire tree.
8	Read for the formulas in propositional calculus. Write a function that reads such a formula and creates its binary tree representation. What is the complexity of your function?
9	Convert given binary tree into threaded binary tree. Analyze time and space complexity of the algorithm.
10	Consider threading a binary tree using preorder threads rather than inorder threads. Design an algorithm for traversal without using stack and analyze its complexity.
11	A Dictionary stores keywords and its meanings. Provide facility for adding new keywords, deleting keywords, updating values of any entry. Provide facility to display whole data sorted in ascending/ Descending order. Also find how many maximum comparisons may require for finding any keyword. Use Binary Search Tree for implementation.
12	Implement a file compression algorithm that uses binary tree. Your program should allow the user to compress and decompress messages containing alphabets using the standard Huffman algorithm for encoding and decoding.
Group C	
13	Represent a given graph using adjacency matrix/list to perform DFS and using adjacency list to perform BFS. Use the map of the area around the college as the graph. Identify the prominent land marks as nodes and perform DFS and BFS on that.
14	There are flight paths between cities. If there is a flight between city A and city B then there is an edge between the cities. The cost of the edge can be the time that flight take to reach city B from A, or the amount of fuel used for the journey. Represent this as a graph. The node can be represented by airport name or name of the city. Use adjacency list representation of the graph or use adjacency matrix representation of the graph. Check whether the graph is connected or not. Justify the storage representation used.
15	You have a business with several offices; you want to lease phone lines to connect them up with each other; and the phone company charges different amounts of money to connect different pairs of cities. You want a set of lines that connects all your offices with a minimum total cost. Solve the problem by suggesting appropriate data structures.
16	Tour operator organizes guided bus trips across the Maharashtra. Tourists may have different preferences. Tour operator offers a choice from many different routes. Every day the bus moves from starting city S to another city F as chosen by client. On this way, the tourists can see the sights alongside the route travelled from S to F. Client may have preference to choose route. There is a restriction on the routes that the tourists may choose from, the bus has to take a short route from S to F or a route having one distance unit longer than the minimal distance. Two routes from S to F are considered different if there is at least one road from a city A to a city B which is part of one route, but not of the other route.
17	Consider the scheduling problem. n tasks to be scheduled on single processor. Let t1,...,tn be durations required to execute on single processor is known. The tasks can be executed in any order but one task at a time. Design a greedy algorithm for this problem and find a schedule that minimizes the total time spent by all the tasks in the system. (The time spent by one is the sum of the waiting time of task and the time spent on its execution.)
Group D	
18	Given sequence k = k1 <k2 < … <kn of n sorted keys, with a search probability pi for each key ki .Build the Binary search tree that has the least search cost given the access probability for each key?

19	A Dictionary stores keywords and its meanings. Provide facility for adding new keywords, deleting keywords, updating values of any entry. Provide facility to display whole data sorted in ascending/ Descending order. Also find how many maximum comparisons may require for finding any keyword. Use Height balance tree and find the complexity for finding a keyword
Group E	
20	Consider a scenario for Hospital to cater services to different kinds of patients as Serious (top priority), b) non-serious (medium priority), c) General Checkup (Least priority). Implement the priority queue to cater services to the patients.
21	Implement the Heap/Shell sort algorithm implemented in Java demonstrating heap/shell data structure with modularity of programming language
22	Read the marks obtained by students of second year in an online examination of particular subject. Find out maximum and minimum marks obtained in that subject. Use heap data structure. Analyze the algorithm.
Group F	
23	Department maintains a student information. The file contains roll number, name, division and address. Allow user to add, delete information of student. Display information of particular employee. If record of student does not exist an appropriate message is displayed. If it is, then the system displays the student details. Use sequential file to main the data.
24	Company maintains employee information as employee ID, name, designation and salary. Allow user to add, delete information of employee. Display information of particular employee. If employee does not exist an appropriate message is displayed. If it is, then the system displays the employee details. Use index sequential file to maintain the data.
24	Implementation of a direct access file -Insertion and deletion of a record from a direct access file
26	Assume we have two input and two output tapes to perform the sorting. The internal memory can hold and sort m records at a time. Write a program in java for external sorting. Find out time complexity
	Mini-Projects/ Case Study
27	Design a mini project using JAVA which will use the different data structure with or without Java collection library and show the use of specific data structure on the efficiency (performance) of the code.
28	Design a mini project to implement Snake and Ladders Game using Python.
29	Design a mini project to implement a Smart text editor.
30	Design a mini project for automated Term work assessment of student based on parameters like daily attendance, Unit Test/Prelim performance, Students achievements if any, Mock Practical

@The CO-PO Mapping Matrix												
PO/CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	2	2	-	-	-	-	-	-	-	-	-
CO2	-	2	2	-	-	-	-	-	-	-	-	-
CO3	-	2	2	1	-	-	-	-	-	-	-	-
CO4	1	2	1	1	-	-	-	-	-	-	-	-
CO5	1	1	2	2	-	-	-	-	-	-	-	-

Savitribai Phule Pune University
Second Year of Computer Science and Design Engineering (2021 Course)
218258: Software Laboratory

Teaching Scheme	Credit Scheme: 02	Examination Scheme and Marks
Practical: 04 hours/Week		**Term work: 25 Marks** **Oral: 25 Marks**

Companion Course: Computer Networks (218255), Operating Systems(218254)

Course Objectives:

- To learn computer network hardware and software components
- To learn computer network topologies and types of network
- To develop an understanding of various protocols, modern technologies and applications
- To learn modern tools for network traffic analysis
- To learn network programming
- To learn and understand process, resource and memory management
- To understand shell scripting and shell programming

Course Outcomes:

On completion of the course, learners will be able to

Computer Networks -

CO1: Analyze the requirements of network types, topology and transmission media
CO2: Demonstrate error control, flow control techniques and protocols and analyze them
CO3: Demonstrate the subnet formation with IP allocation mechanism
CO4: Develop Client-Server architectures and prototypes
CO5: Implement web applications and services using application layer protocols
CO6: Use network security services and mechanisms

Operating Systems

CO1: Choose the best CPU scheduling algorithm for a given problem instance
CO2: Demonstrate inter process communication
CO3: Apply deadlock avoidance algorithm
CO4: Compare performance of page replacement algorithms
CO5: Demonstrate the fundamental UNIX commands & system calls

Guidelines for Instructor's Manual

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

Guidelines for Student's Laboratory Journal

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

Guidelines for Laboratory /Term Work Assessment

Continuous assessment of laboratory work should be based on overall performance of Laboratory assignments by a student. Each Laboratory assignment assessment will assign grade/marks based on parameters, such as timely completion, performance, innovation, efficient codes, punctuality and

Guidelines for Oral Examination

Oral examination should be jointly conducted by the internal examiner and external examiner. Relevant questions may be asked at the time of evaluation to test the student's understanding of the fundamentals, effective and efficient implementations in term work. This will encourage, transparent evaluation and fair approach, and hence will not create any uncertainty or doubt in the minds of the students. So, adhering to these principles will consummate our team efforts to the promising start of student's academics.

Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. Use of open source software is encouraged. Based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus.

Operating System recommended: -64-bit Open-source Linux or its derivative Programming tools recommended: - Open-Source C/C++/JAVA Programming tool like G++/GCC, Wireshark/Ethereal and Packet Tracer

Virtual Laboratory:

- http://vlabs.iitb.ac.in/vlab/

Suggested List of Laboratory Experiments/Assignments

Part I: Computer Networks	
Sr. No.	**Any Six Assignments**
1.	Setup a wired LAN using Layer 2 Switch. It includes preparation of cable, testing of cable using line tester, configuration machine using IP addresses, testing using PING utility and demonstrating the PING packets captured traces using Wireshark Packet Analyzer Tool.
2.	Demonstrate the different types of topologies and types of transmission media by using a packet tracer tool.
3.	Setup a WAN which contains wired as well as wireless LAN by using a packet tracer tool. Demonstrate transfer of a packet from LAN 1 (wired LAN) to LAN2 (Wireless LAN).
4.	Write a program for error detection and correction for 7/8 bits ASCII codes using Hamming Codes or CRC.
5.	Write a program to simulate Go back N and Selective Repeat Modes of Sliding Window Protocol in Peer-to-Peer mode.
6.	Write a program to implement link state /Distance vector routing protocol to find suitable path for transmission.
7.	Write a program using TCP socket for wired network for following a. Say Hello to Each other b. File transfer c. Calculator
8	Write a program using UDP Sockets to enable file transfer (Script, Text, Audio and Video one file each) between two machines.

9.	Write a program for DNS lookup. Given an IP address as input, it should return URL and vice-Versa.
10.	Installing and configure DHCP server and write a program to install the software on remote Machine.
11.	Study and Analyze the performance of HTTP, HTTPS and FTP protocol using Packet tracer tool.
12.	To study the SSL protocol by capturing the packets using Wireshark tool while visiting any SSL Secured website (banking, e-commerce etc.).
13.	To study the IPsec (ESP and AH) protocol by capturing the packets using Wireshark tool.
Part II: Operating Systems	
Any Six Assignments	
14	Given the list of processes, their CPU burst times. Display/print the Gantt chart for FCFS , SJF, Priority and Round Robin scheduling algorithm. Compute and print the average waiting time and averageturnaround time
15	Demonstrate Reader-Writer problem with reader priority or writer
16	Implement producer-consumer problem with counting semaphores and mutex
17	Write a program to implement the Bankers Algorithm.
18	Write a program to implement the Bankers Algorithm..
19	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
20	Write a program to implement page Replacement strategies (FIFO, LRU, Optimal)
21	Create a shell program to do mathematical operations.
22	Create a shell program to find string in a file using grep system call.

@The CO-PO Mapping Matrix

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

Savitribai Phule Pune University
Second Year of Computer Science and Design Engineering (2021 Course)
210258: Project Based Learning II

Teaching Scheme	Credit Scheme: 01	Examination Scheme and Marks
Practical: 02 Hours/Week		Term work: 50 Marks

Course Objectives:

- To develop critical thinking and problem solving ability by exploring and proposing solutions to realistic/social problem
- To evaluate alternative approaches, and justify the use of selected tools and methods.
- To emphasizes learning activities that are long-term, inter-disciplinary and student-centric.
- To engages students in rich and authentic learning experiences.
- To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism.
- To develop an ecosystem that promotes entrepreneurship and research culture among the students.

Course Outcomes:

CO1: Identify the real life problem from societal need point of view
CO2: Choose and compare alternative approaches to select most feasible one
CO3: Analyze and synthesize the identified problem from technological perspective
CO4: Design the reliable and scalable solution to meet challenges
CO5: Evaluate the solution based on the criteria specified
CO6: Inculcate long life learning attitude towards the societal problems

Part-I Project Based Learning

Preamble:

Project-based learning is an instructional approach designed to give students the opportunity to develop knowledge and skills through engaging projects set around challenges and problems they may face in the real world. PBL, is more than just projects. With PBL students "investigate and respond to an authentic, engaging, and complex problem, or challenge" with deep and sustained attention. PBL is "learning by doing." The truth is, many in education are recognizing we live in a modern world sustained and advanced through the successful completion of projects. In short, If students are prepared for success in life, we need to prepare them for a project-based world. It is a style of active learning and inquiry-based learning. (Reference: Wikipedia). Project based learning will also redefine the role of teacher as mentor in learning process. Along with communicating knowledge to students, often in a lecture setting, the teacher will also to act as an initiator and facilitator in the collaborative process of knowledge transfer and development. The PBL model focuses the student on a big open-ended question, challenge, or problem to research and respond to and/or solve. It Brings what students should academically know, understand, and be able to do and requires students to present their problems, research process, methods, and results.[1]

Project based learning (PBL) requires regular mentoring by faculty throughout the semester for successful completion of the idea/project tasks selected by the students per batch. For the faculty involved in PBL , teaching workload of 4 Hrs/week/batch needs to be considered. The Batch should be divided into sub-groups of 4 to 5 students. Idea implementation /Real life problem/Complex assignments / activities / projects. under project based learning is to be 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

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/group of 4-5 students

2. A supervisor/mentor teacher assigned to individual groups

Selection of Project/Problem:

The problem-based project oriented model for learning is recommended. The model begins with the identifying of a problem, often growing out of a question or "wondering". This formulated problem then stands as the starting point for learning. Students design and analyze the problem/project within an articulated interdisciplinary or subject frame.

A problem 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.

A few hands-on activities that may or may not be multidisciplinary.

Use of technology in meaningful ways to help them investigate, collaborate, analyse, synthesize, and present their learning.

Activities may include- Solving real life problem, investigation, /study and Writing reports of in depth study, field work.

Assessment:

The institution/head/mentor is committed to assessing and evaluating both student performance and program effectiveness.

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

It is recommended that all activities should to be recorded regularly, regular assessment of work need to be done and proper documents need to be maintained at college end by both students as well as mentor (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 and Awareness /Consideration of -Environment/ Social /Ethics/ Safety measures/Legal aspects (10%)
2. Outcomes of PBL/ Problem Solving Skills/ Solution provided/ Final product

(Individual assessment and team assessment) (40%)

3. Documentation (Gathering requirements, design and modelling, implementation/execution, use of technology and final report, other documents) (15%)
4. Demonstration (Presentation, User Interface, Usability) (20%)
5. Contest Participation/ publication (15%)

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

Note :

- While planning for the assessment, choose a valid method based on your context. It should beable to understand by both the students as well as the faculty.
- The student group must follow the principles of Software Engineering (Scoping out the problem, the solution implementation and related documentation).
- Researching the problem and outlining various approaches is key here and should be emphasized by the tutor and the mentor.
- Aspects of design thinking (from the point of view of the person facing the problem) are very important. Students should not jump into the technology aspects first.
- The team can follow the principles of Agile Software Development. The weekly meetings could be used as a Scrum meeting.
- The tutor and mentor should actively help the students to scope the work and the approach. They must validate the technology choices.
- If the implementation code is is well documented, the project can be continued by subsequent batch – which will help solve a bigger problem.

Use software such as Mind map, Storyboard, Empathy map etc while working on projects

Part –II Design Thinking

1	a. Draw a mind map for planning an event in the college b. Thirty circle Exercise ---ideation Take the Thirty Circles sheet and a pen. Draw recognizable objects in as many circles as possible. That could be a pizza, clock, apple, etc. discuss the outcome. Reference: https://www.mindmeister.com/blog/mind-map-examples/ https://innovationlab.net/blog/9-best-exercises-to-spark-creativity-in-ideation/
2	a. Draw out the Empathy map The map is composed of 4 quadrants: 1. What I hear from others 2. What I see others doing 3. What I say and do 4. What I understand and feel Decide on the Subject and the Scope of Your Empathy Map, Collect Relevant Data, Start to Fill in the Map, Complete the Outer Sections of the Map, Complete the Center Section of the Map, Reflect on What You have Discovered, Draw Conclusions and Take Action Reference: https://www.mindtools.com/pages/article/empathy-mapping. **OR** b. Draw customer journey map for an online course website. Reference: https://visme.co/blog/customer-journey-map/

Text Books:

1. A new model of problem based learning. By Terry Barrett. All Ireland Society for higher education (AISHE). ISBN:978-0-9935254-6-9; 2017
2. Problem Based Learning. By Mahnazmoallem, woei hung and Nada Dabbagh, Wiley Publishers.2019.
3. Stem Project based learning and integrated science, Technology, Engineering and mathematics approach. By Robert Capraro, Mary Margaret Capraro

Reference Books:

1. De Graaff E, Kolmos A., red.: Management of change: Implementation of problem-based and project-based learning in engineering. Rotterdam: Sense Publishers. 2007.
2. Gopalan," Project management core text book", 2 Indian Edition
3. James Shore and Shane Warden, " The Art of Agile Development"

Tutors Role in Project Based Learning

- The fundamentals of problem based learning, lies with the Tutors role.
- Tutors are not the source of solutions rather they act as the facilitator and mentor.
- The facilitator skills of the Tutors / Teacher are central to the success of PBL.

Change of Mindset

- Students are not used to the constructivist approach to learning, it is important that they are carefully told what to expect in PBL.
- Tutors need to explain the differences between PBL and traditional learning.
- Tutors need to explain the principals involved and role of the students in PBL learning.

Designing Problem

- Considering the prior knowledge of the students, their ability and creativity, problem statement should be designed.
- For 2nd year PBL students the tutor should place more emphasis on getting the students to perform higher-level tasks.
- It is important for tutors to design problems that are anchored in authentic contexts only
- Students should take ownership of the problem.
- Problems should not be over simplified or well defiled
- Learning should not be the sequencing of instructional events, but the application of principles for responding to the needs of the situation.
- The problems given to students in PBL should be realistic, complex, and should reflect, as much as possible, the actual problems that students would encounter in real life.

Basic function of the tutor

- A good understanding of the overall curriculum the students have to study, the principlesof problems solving, critical thinking and meta-cognitive skills.

Grouping

- Study the background and profile of each student.
- Make sure that students of different backgrounds and experience are assigned in a group
- It is useful to group students of different abilities, gender, and nationalities together.
- Tutors must have the commitment to devote the time to the tutorial process.
- A good tutor is always interested in helping students to learn better.
- Sufficient resources should be made available for students to take part the PBL tutorial.
- Time management is important.

Assessment of Learning

- It is important for tutors to make sure that assessment is consistent with learning objectives of the groups in PBL
- Assessment of students should not be focused only on the final leaning product.

- PBL tutors need to understand meaningful ways of assessing students' work to motivate learning.
- For assessment to be implemented properly there should be well designed and clearly defined goals and objectives and well thought out strategies, techniques, criteria, and marking schemes.

Student's Role in PBL

- Prepare students for PBL before starting the sessions.
- Students must have ability to initiate the task/idea .they should not be mere imitators.
- They must learn to think.
- Students working in PBL must be responsible for their own learning.
- Throughout the PBL process, students have to define and analyze the problem, generate learning issues and apply what they have learned to solve the problem and act for them- selves and be free.
- Students must quickly learn how to manage their own learning, Instead of passively receiving instruction.
- Students in PBL are actively constructing their knowledge and understanding of the situation in groups.
- Students in PBL are expected to work in groups.
- They have to develop interpersonal and group process skills, such as effective listening or coping creatively with conflicts.

Inquiry Skills

- Students in PBL are expected to develop critical thinking abilities by constantly relating:
- What they read to do?
- What they want to do with that information?
- They need to analyze information presented within the context of finding answers. Modeling is required so that the students can observe and build a conceptual modelof the required processes.
- Formative and summative questions for evaluation:
- How effective is …….?
- How strong is the evidence for ……?
- How clear is ……?
- What are the justifications for thinking?
- Why is the method chosen?
- What is the evidence given to justify the solution?

Information Literacy

- Information literacy is an integral part of self- directed learning

Information literacy involves the ability to:

- Know when there is a need for information
- Identify the information needed to solve a given problem or issue
- Be able to locate the needed information
- Use the information to solve the given problem effectively.
- Skills required by students in information literacy include:
- How to prepare the search , How to carry out the research,
- Sorting and assessing of information in general

Collaborative learning

- It is an educational approach to teaching and learning that involves
- groups of students working together to solve a problem or complete a project
- In collaborative learning, learners have the opportunity to talk with peers, exchange diverse beliefs present and defend ideas, as well as questioning other ideas.

Interpersonal Skills

- Interpersonal skills relating to group process are essential for effective problem solving andlearning.
- It is important that students are made aware of these inter personal skills.
- Consensual decision making skills, Dialogue and discussion skills, Team maintenance skills
- Conflict management skills and Team leadership skills.
  Students who have these skills have a better opportunity to learn than students who do not have these skills and Time Management

Resources

- Students need to have the ability to evaluate the resources used

Students have to evaluate the source of the resources used by asking the following questions:

- How current is it?, Is there any reason to suspect bias in the source?
- How credible and accurate is it?

Meta-cognitive Skills

- Students need to reflect on the processes they are using during the learning process,
- Compare one strategy with another, and evaluate the effectiveness of the strategy used

Reflection Skills

- Reflection helps students refine and strengthen their high-level thinking skills and abilities through self-assessment.
- Reflection gives students opportunities to think about how they answered a question, made a decision, or solved a problem.
- What strategies were successful or unsuccessful? , What issues need to be remembered for next time? , What could or should be done differently in the future?

Follow the practices learned in Software Engineering course- Requirement Analysis, Designingand Modeling.

@The CO-PO Mapping Matrix

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

Savitribai Phule Pune University
Second Year of Computer Science and Design Engineering (2021 Course)
Code of Conduct

Teaching Scheme	Credit Scheme: 01	Examination Scheme and Marks
Practical: 01 Hours/Week		**Term work: 25 Marks**

Preamble:

Engineering is one of the important and cultured professions. With respect to any engineering profession, engineers are expected to exhibit the reasonable standards of integrity and honesty. Engineering is directly or indirectly responsible to create a vital impact on the quality of life for the society. Acceptably, the services provided by engineers require impartiality, honesty, equity and fairness and must give paramount importance to the protection of the public health, safety, and welfare. Engineers must perform under a standard of professional behavior that requires adherence to the principles of ethical conduct.

Prime aim is to recognize and evaluate ethical challenges that they will face in their professional careers through knowledge and exercises that deeply challenge their decision making processes and ethics.

Course Objectives:

- To promote ethics, honesty and professionalism.
- To set standards that are expected to follow and to be aware that If one acts unethically what are the consequences.
- To provide basic knowledge about engineering Ethics, Variety of moral issues and Moral dilemmas, Professional Ideals and Virtues
- To provide basic familiarity about Engineers as responsible Experimenters, Research Ethics, Codes of Ethics, Industrial Standards, Exposure to Safety and Risk, Risk Benefit Analysis
- To have an idea about the Collegiality and Loyalty, Collective Bargaining, Confidentiality, Occupational Crime, Professional, Employee, Intellectual Property Rights.

Course Outcomes:

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

CO1: Understand the basic perception of profession, professional ethics, various moral and social issues, industrial standards, code of ethics and role of professional ethics in engineering field.

CO2: Aware of professional rights and responsibilities of an engineer, responsibilities of an engineer for safety and risk benefit analysis.

CO3: Understand the impact of the professional Engineering solutions in societal and Environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

CO4: Acquire knowledge about various roles of engineers in variety of global issues and able to apply ethical principles to resolve situations that arise in their professional lives.

Course Contents

The following are the certain guidelines as far as ethics and code of conduct are concerned tobe clearly and elaborately explained to the students,

Fundamental norms Engineers, in the fulfillment of their professional duties, should include paying utmost attention to the safety, health, and welfare of the society. Along with that engineers should execute the services only in their areas of competence. Whenever there is a need to issue public statements then such statements should be expressed in objective and truthful manner. Engineer should extend high sense of integrity by acting for each employer or client as faithful agents or trustees. Whatever may be the working scope engineer should conduct themselves honorably, responsibly, ethically, and lawfully so as to enhance the honor, reputation, and usefulness of the profession.

As far as ethical practices are concerned engineers should not reveal facts, data, or information

without the prior consent of the client or employer except as authorized or required by law or Code. Engineers should not permit the use of their name or associate in business ventures with any person or firm that they believe is engaged in fraudulent or dishonest enterprise moreover he/she should not aid or abet the unlawful practice of engineering by a person or firm.

Engineers having knowledge of any alleged violation of the Code should report thereon to appropriate professional bodies and, when relevant, also to public authorities, and cooperatewith the proper authorities in furnishing such information or assistance as may be required. Engineers should disclose all known or potential conflicts of interest that could influence or appear to influence their judgment or the quality of their services. Engineers should not accept compensation, financial or otherwise, from more than one party for services on the same project, or for services pertaining to the same project, unless the circumstances are fully disclosed and agreed to by all interested parties. Engineers should not solicit or accept financial or other valuable consideration, directly or indirectly, from outside agents in connection with the work for which they are responsible.

Engineers should never falsify their qualifications or permit misrepresentation of their or their associates' qualifications. They shall not misrepresent or exaggerate their responsibility in orfor the subject matter of prior assignments. Brochures or other presentations incident to the solicitation of employment shall not misrepresent pertinent facts concerning employers, employees, associates, joint ventures, or past accomplishments.

Engineers should not offer, give, solicit, or receive, either directly or indirectly, any contribution to influence the award of a contract by public authority, or which may be reasonably construed by the public as having the effect or intent of influencing the awarding of a contract. They should not offer any gift or other valuable consideration in order to secure work. They should not pay a commission, percentage, or brokerage fee in order to secure work, except to a bona fide employee or bona fide established commercial or marketing agencies retained by them. There are certain obligations accompanied with engineering profession. Engineers should acknowledge their errors and should not distort or alter the facts. Candid advises in special cases are always welcome. Engineers should not accept outside employment to the detriment of their regular work or interest. Before accepting any outside engineering employment, they will notify their employers.

Engineers should not promote their own interest at the expense of the dignity and integrity of the profession furthermore they should treat all persons with dignity, respect, fairness, and without discrimination. Engineers should at all times strive to serve the public interest. Engineers are encouraged to participate in civic affairs; career guidance for youths; and work for the advancement of the safety, health, and well-being of their community. Engineers are encouraged to adhere to the principles of sustainable development in order to protect the environment for future generations. Engineers shall continue their professional development throughout their careers and should keep current in their specialty fields by engaging in professional practice, participating in continuing education courses, reading in the technical literature, and attending professional meetings and seminar.

Engineers should not, without consent, use equipment, supplies, laboratory, or office facilities of an employer to carry on outside private practice. They should not attempt to injure, maliciously or falsely, directly or indirectly, the professional reputation, prospects, practice, or employment of other engineers. Engineers who believe others are guilty of unethical or illegal practice shall present such information to the proper authority for action. "Sustainable development" is the challenge for the engineers meeting human needs for natural resources, industrial products, energy, food, transportation, shelter, and effective waste management while conserving and protecting environmental quality and the natural resource base essential for future development.

Following are contents to be covered in tutorial session-

1. **Introduction to Ethical Reasoning and Engineer Ethics:** Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas –Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy –Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories.
2. **Professional Practice in Engineering :** Global Issues -Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct
3. **Ethics as Design** - Doing Justice to Moral Problems : Engineer's Responsibility for Safety - Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk
4. **Workplace Responsibilities and Rights** - Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination
5. **Computers, Software, and Digital Information**
6. **Responsibility for the Environment**

#Exemplar/Case Studies :

General Motors ignition switch recalls (2014), Space Shuttle Columbia disaster (2003), Space Shuttle Challenger disaster (1986), Therac-25 accidents (1985 to 1987), Chernobyl disaster (1986),Bhopal disaster (1984), Kansas City Hyatt Regency walkway collapse (1981)

Guidelines for Conduction:

The course will exemplify the budding engineers the Code of Conduct and ethics pertaining to their area and scope of their work. The Instructor/Teacher shall explain the students the importance and impact of the ethics and code of conduct.

Confined to various courses and project/mini-project development the possible vulnerabilities and threats need to be elaborated and the students' participation need to be encouraged in designing such document explicitly mentioning Code of Conduct and Disclaimers.

Suggested set of Activities

1. **Purpose-**Introduce the concept of Professional Code of Conduct
   Method – Using Group Discussion as a platform, ask students to share one practice in their family / home that everyone has to follow. For ex. not wearing footwear in the house, taking a bath first thing in the morning, seeking blessings from elders, etc. Connect this Code of Conduct in their family to one that exists in the professional world
   Outcome – Awareness of profession-specific code of conduct and importance of adherence of that code specified. Ability to express opinions verbally and be empathetic to diverse backgrounds and values
2. **Purpose-**Impress upon the students, the significance of morality
   Method – Role play a professional situation where an engineer is not competent and is trying to copy the work of a colleague and claim credit for that work. Ask observing students to react to that situation. Alternatively, a short video that clearly shows unethical behavior can be played and ask viewers their opinion about the situation. Note to teachers – read about Kohlber's theory and Gilligan's theory to understand levels of moral behavior
   Outcome – Incite students to contemplate their own immoral behavior in public space or academic environment (like copying homework or assignment). Will coax students to introspect their own values and encourage them to choose the right path
3. **Purpose**-Highlight the importance of professional ideals like conflict management, ambition, ethical manners and accountability
   Method – Each student will have to write a 200 word essay on any of above mentioned virtues of being a good professional. On evaluation, the top 5 essays can be displayed on

the college wall magazine and rewarded if deemed appropriate

Outcome – Learn to express one's ideas and identify and relate to good virtues. Build writing skills, improve language and gain knowledge about how to write an impactful essay

4. **Purpose**-Make students aware of proper and globally accepted ethical way to handle work, colleagues and clients

   Method – Teacher can form groups of 6 – 7 students and assign them different cases (these can be accessed online from copyright free websites of B-school content)

   Outcome – Develop group communication skills. Learn to speak up one's opinion in a forum. Cultivate the habit of presenting solution-driven analytical arguments making them contributors in any team.

5. **Purpose** – Make students aware that technology can be harmful if not used wisely and ethically

   Method – Conduct a quiz on various ethical dilemmas that are relevant in today's world pertaining to privacy right, stalking, plagiarism, hacking, weaponizing technology, AI, electronic garbage creating environmental hazard etc

   Outcome – Make students aware of various adverse consequences of technology development and allow them to introspect on how to use technology responsibly.

6. **Purpose** – Expose students to professional situations where engineers must use their skills ethically and for the betterment of society and nation

   Method – Students in groups of 4 can be given an assignment in the earlier session to present in front of the class one specific case where they felt unethical treatment has been meted out to a person by an engineer – either as a witness, advisor, dishonesty, improper skills testimony etc. The group has to make a short presentation and also suggested plausible solutions to that situation. Q&A from other students must encouraged to allow healthy discussion

   Outcome – Become aware of unethical code of conduct in the professional world and how to follow a moral compass especially when one reaches positions of power.

7. **Purpose** – Provide an insight into rights and ethical behavior.

   Method – Movies like The Social Network can be played and students can be asked to discuss their opinion about collegiality, intellectual property, friendship and professional relationships

   Outcome – help them look at success stories from an ethical point of view. Develop critical thinking and evaluation of circumstances.

8. **Purpose** – Make students contemplate about ideal and safe professional environment and decide on making right decisions based on codes of conduct

   Method – Students can be asked to write down 5 most important codes of conduct that they feel that every computer engineer should follow. After evaluation by teacher / experts, the collection of codes can be converted into a handbook to be given to every student as amemoir to help them in their professional life.

   Outcome – Introspection and think about how to shape the professional environment. Also, when they carry back with them their own codes of conduct, they could feel bound to adhere to these ethics.

Term Work Assessment Guidelines

Students must submit the report of all conducted activities. The brief guidelines for report preparations are as follows:

1. One activity report must be of maximum 3 pages;
2. Combined Report of all activities with cover pages, table of contents and certificate (signed byinstructor) is to be submitted in soft copy (pdf) format only.
3. The report must contain:
    - General information about the activity;
    - Define the purpose of the activity;

- Detail out the activities carried out during the visit in chronological order;
- Summarize the operations / process (methods) during the activities;
- Describe what you learned (outcomes) during the activities as a student;
- Add photos of the activity;(optional)
- Add a title page to the beginning of your report;
- Write in clear and objective language; and
- Get well presented, timely and complete report submitted.

Recommended Assessment and Weightage Parameters:

(Attendance 30%, Assignments/Activities- Active participation and proactive learning 50% And report 20%)

Term Work Assessment Guidelines

Students must submit the report of all conducted activities conducted during Tutorial (Outside Classroom) of at least 04 activities (out of 07 activities) from group (of 02-03) students.

The brief guidelines for report preparations are as follows:

1.One activity report must be of maximum 3 pages;

2. Combined Report of all activities with cover pages, table of contents and certificate (signed by instructor) is to be submitted in soft copy (pdf) format only.

3.The report must contain:

- General information about the activity;
- Define the purpose of the activity;
- Detail out the activities carried out during the visit in chronological order;
- Summarize the operations / process (methods) during the activities;
- Describe what you learned (outcomes) during the activities as a student;
- Add photos of the activity;(optional)
- Add a title page to the beginning of your report;
- Write in clear and objective language; and
- Get well presented, timely and complete report submitted.

Recommended Assessment and Weightage Parameters:

(Attendance 30%, Active participation and proactive learning 50% and report 20%)

Web Links:

- https://www.ieee.org/about/compliance.html
- https://www.cs.cmu.edu/~bmclaren/ethics/caseframes/91-7.html
- https://www.nspe.org/
- http://www.ewh.ieee.org/soc/pes/switchgear/presentations/tp_files/2017-1_Thurs_Shiffbauer_Singer_Engineering_Ethics.pdf

MOOC/ Video lectures available at:

- https://swayam.gov.in/nd1_noc20_mg44/preview

@The CO-PO Mapping Matrix

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

Savitribai Phule Pune University
Second Year of Computer Science and Design (2021 Course)
Audit Course 4

In addition to credits, it is recommended that there should be audit course in preferably in each semester starting from second year in order to supplement student's knowledge and skills. Student will be awarded the bachelor's degree if he/she earns specified total credits [1] and clears all the audit courses specified in the syllabus. The student will be awarded grade as AP on successful completion of audit course. The student may opt for one of the audit courses per semester, starting in second year first semester. Though not mandatory, such a selection of the audit courses helps the learner to explore the subject of interest in greater detail resulting in achieving the very objective of audit course's inclusion. List of options offered is provided. Each student has to choose one audit course from the list per semester. Evaluation of audit course will be done at institute level itself. Method of conduction and method of assessment for audit courses are suggested.

Criteria:

The student registered for audit course shall be awarded the grade AP (Audit Course Pass) and shall be included such AP grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory performance and secured a passing grade in that audit course. No grade points are associated with this 'AP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA. Evaluation of audit course will be done at institute level itself. [1]

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

- Lectures/ Guest Lectures
- Visits (Social/Field) and reports
- Demonstrations
- Surveys
- Mini-Project
- Hands on experience on focused topic

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

- Written Test
- Demonstrations/ Practical Test
- Presentations, IPR/Publication and Report

Audit Course 4 Options

Audit Course Code	Audit Course Title
AC4-I	Water Management
AC4-II	Intellectual Property Rights and Patents
AC4-III	The Science of Happiness
AC4-IV	Stress Relief: Yoga and Meditation
AC4-V	Foreign Language (one of Japanese/Spanish/French/German) Course contents for **Japanese(Module 2)** are provided. For other languages institute may design suitably.

Note: It is permitted to opt one of the audit courses listed at SPPU website too, if not opted earlier.

[1]http://collegecirculars.unipune.ac.in/sites/documents/Syllabus%202017/Forms/AllItems.aspx

http://www.unipune.ac.in/university_files/syllabi.htm

AC4-I: Water Management

Home

Water is a vital resource for all life on the planet. Only three percent of the water resources on Earth are fresh and two-thirds of the freshwater is locked up in ice caps and glaciers. One fifth of the remaining one percent is in remote, inaccessible areas. As time advances, water is becoming scarcer and having access to clean, safe, drinking water is limited among countries. Pure water supply and disinfected water treatment are prerequisites for the well-being of communities all over the world. One of the biggest concerns for our water-based resources in the future is the sustainability of the current and even future water resource allocation. This course will provide students a unique opportunity to study water management activities like planning, developing, distributing and optimum use of water resources. This course covers the topics that management of water treatment of drinking water, industrial water, sewage or Wastewater, management of water resources, management of flood protection.

Course Objectives

- To develop understanding of water recourses.
- To study global water cycle and factors that affect this cycle.
- To analyze the process for water resources and management.
- To study the research and development areas necessary for efficient utilization and management of water recourses.

Course Outcomes

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

CO1: Understand the global water cycle and its various processes
CO2: Understand climate change and their effects on water systems
CO3: Understand Drinking treatment and quality of groundwater and surface water
CO4: Understand the Physical, chemical, and biological processes involved in water treatment and distribution.

Course Contents

1. Understanding 'water'-Climate change and the global water cycle, understanding global hydrology
2. Water resources planning and management-Water law and the search for sustainability: a comparative analysis, Risk and uncertainty in water resources planning and management
3. Agricultural water use -The role of research and development for agriculture water use
4. Urban water supply and management - The urban water challenge, Water sensitive urban design

References:

1. R. Quentin Graft, Karen Hussey, Quentin Graft, Karen Hussey, Publisher, "Water Resources Planning and Management", Cambridge University Press, ISBN: 9780511974304, 9780521762588.
2. P.C. Basil, "Water Management in India", ISBN: 8180690970, 2004.
3. C.A. Brebbia, "Water Resources Management", ISBN: 978-1-84564-960-9, 978-1-84564-961-6.

@The CO-PO Mapping Matrix

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

AC4-II: Intellectual Property Rights and Patents

Home

Intellectual property is the area of law that deals with protecting the rights of those who create original works. It covers everything from original plays and novels to inventions and company identification marks. The purpose of intellectual property laws is to encourage new technologies, artistic expressions and inventions while promoting economic growth.

Innovation and originality have great potential value. Whatever line of activity you are engaged in, future success depends on them. The last few years have seen intellectual property rights become an issue of general interest: the smart phone "patent wars", the introduction of Digital Rights management (DRM) and the rise of generic pharmaceuticals and open-source software are just some examples that have been in the public eye. Protecting your intellectual rights appropriately should be at a priority. Yet too many people embark on their chosen professions without even a basic awareness of intellectual property.

Course Objectives:

- To encourage research, scholarship, and a spirit of inquiry
- To encourage students at all levels to develop patentable technologies.
- To provide environment to the students of the Institute for creation, protection, and commercialization of intellectual property and to stimulate innovation.

Course Outcomes:

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

CO1: Understand the fundamental legal principles related to confidential information,copyright, patents, designs, trademarks and unfair competition

CO2: Identify, apply and **assess** principles of law relating to each of these areas ofintellectual property

CO3: Apply the appropriate ownership rules to intellectual property you have been involvedin creating

Course Contents

1. **IntroductiontoIntellectualPropertyLaw–**TheEvolutionaryPast-TheIPRToolKit-Para-Legal Tasks in Intellectual Property Law
2. **Introduction to Trade mark –** Trade mark Registration Process – Post registration Procedures -Trade mark maintenance - Transfer of Rights – Inter partes Proceeding – Infringement - Dilution Ownership of Trade mark
3. **Introduction to Copyrights –** 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
4. **IntroductiontoTradeSecret–**MaintainingTradeSecret–PhysicalSecurity–EmployeeLimitation - Employee confidentiality agreement

Reference:

1. Debirag E. Bouchoux, "Intellectual Property" Cengage learning, New Delhi, ISBN-10:1111648573
2. Ferrera, Reder, Bird, Darrow, "Cyber Law. Texts and Cases", South-Western's Special Topics Collections,ISBN:0-324-39972-3
3. Prabhuddha Ganguli, "Intellectual Property Rights", Tata Mc-Graw–Hill, New Delhi

@The CO-PO Mapping Matrix

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

AC4-III: The Science of Happiness

Everybody wants to be happy. One can explore innumerable ideas about what happiness is and how we can get some. But not many of those ideas are based on science. That's where this course comes in. The subject "Science of Happiness" aims to teach the pioneering science of positive psychology, which explores the ancestry of a happy and meaningful life. Clinical psychologists have been dealing with miserable feelings since their discipline was established. In the last 30 years, neuroscientists have made major headway in the understanding of the sources of anger, depression, and fear.

Today, whole industries profit from this knowledge—producing pills for every sort of pathological mood disturbance. But until recently, few neuroscientists focused on the subject of happiness. This course focuses on discovering how cutting-edge research can be applied to their lives. Students will learn about the Intra-disciplinary research supporting this view, spanning the fields of psychology, neuroscience, evolutionary biology, and beyond. The course offers students practical strategies for tapping into and nurturing their own happiness, including trying several research-backed activities that foster social and emotional well-being, and exploring how their own happiness changes along the way.

Course Objectives

- To understand the feeling of happiness
- To study the sources of positive feelings
- To analyze the anatomy of the happiness system
- To study the effect of thoughts and emotions on the happiness system

Course Outcomes

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

CO1: Understand what happiness is and why it matters to you
CO2: Learn how to increase your own happiness
CO3: Understand of the power of social connections and the science of empathy
CO4: Understand what is mindfulness and its real world applications

Course Contents

1. Happiness: what is it?
2. The secret of smiling
3. The autonomy of positive feelings
4. Positive feelings as a compass
5. The happiness system
6. Foundations: Emotions, Motivation and nature of Wellbeing
7. Subjective well being
8. Love and well being
9. Optimal well being
10. Religion, Spirituality and wellbeing

References:

1. Happier, Stefan Klein, "The Science of Happiness, How Our Brains Make Us Happy and what We Can Do to Get", Da Capo Press, ISBN 10: 156924328X, 13: 978-1569243282.
2. C. Compton, Edward Hoffman, "Positive Psychology: The Science of Happiness and Flourishing", William, Cengage Learning, 2012, ISBN10: 1111834121.

@The CO-PO Mapping Matrix

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

AC4-IV: Yoga and Meditation

The concepts and practices of Yoga originated in India about several thousand years ago. Its founders were great Saints and Sages. The great Yogis presented rational interpretation of their experiences of Yoga and brought about a practical and scientifically sound method within every one's reach. Yoga today, is no longer restricted to hermits, saints, and sages; it has entered into our everyday lives and has aroused a worldwide awakening and acceptance in the last few decades. The science of Yoga and its techniques have now been reoriented to suit modern sociological needs and lifestyles.

Yoga is one of the six systems of Vedic philosophy. The Yoga advocates certain restraints and observances, physical discipline, breathe regulations, restraining the sense organs, contemplation, meditation and Samadhi. The practice of Yoga prevents psychosomatic disorders and improves an individual's resistance and ability to endure stressful situations.

Course Objectives:

- To impart knowledge about the basic technique and practice of yoga, including instruction in breath control, meditation, and physical postures.
- To gain an intellectual and theoretical understanding of the principles embodied in the Yoga Sutras, the Bhagavad-Gita, and other important texts and doctrines.
- Relaxation and stress reduction, Personal insight and self-understanding. Personal empowerment, Gaining wisdom and spiritual discernment.
- Awakening the abilities or powers of the Super conscious mind.

Course Outcomes:

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

CO1: Understand philosophy and religion as well as daily life issues will be challenged and enhanced.

CO2: Enhances the immune system.

CO3: Intellectual and philosophical understanding of the theory of yoga and basic related Hindu scriptures will be developed.

CO4: Powers of concentration, focus, and awareness will be heightened.

Course Contents

1. Meaning and definition of yoga – Scope of Yoga - Aims and Objectives of Yoga –
   i. Misconception about yoga.
2. Ayurveda: an introduction to this system of health care derived from the Vedic tradition Anatomy and Physiology as they relate to Yoga
3. Yoga Philosophy and Psychology

References:

1. B.K.S. Iyengar, "BKS Iyengar Yoga The Path to Holistic Health" , DK publisher, ISBN-13: 978-1 1409343479
2. Osho, "The Essence of Yoga", Osho International Foundation, ISBN: 9780918963093

@The CO-PO Mapping Matrix

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

AC4-V: Foreign Language (Japanese) Module 2

W ith changing times, the competitiveness has gotten into the nerves and 'Being the Best' at all times is only the proof of it. Nonetheless, 'being the best' differs significantly from 'Communicating the best'! The best can merely be communicated whilst using the best… suited Language!!

Course Objectives:

- To meet the needs of ever growing industry with respect to language support.
- To get introduced to Japanese society and culture through language.

Course Outcomes:

On completion of the course learner will-

1. Have ability of basic communication.
2. Have the knowledge of Japanese script.
3. get introduced to reading , writing and listening skills
4. develop interest to pursue professional Japanese Language course

Course Contents

1. Katakana basic Script, Denoting things (nominal and pre nominal demonstratives), Purchasing at the Market / in a shop / mall (asking and stating price)
2. Katakana : Modified kana, double consonant, letters with ya, yu, yo, Long vowels, Describing time, describing starting and finishing time (kara ~ made), Point in time (denoting the time when any action or the movement occurs)
3. Means of transport (Vehicles), Places, Countries, Stating Birth date, Indicating movement to a certain place by a vehicle.

References:

1. Minna No Nihongo, "Japanese for Everyone", (Indian Edition), Goyal Publishers and Distributors Pvt. Ltd.
2. http://www.tcs.com (http://www.tcs.com/news_events/press_releases/Pages/TCS-Inaugurates- Japan-centric-Delivery-Center-Pune.aspx)

@The CO-PO Mapping Matrix

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

Acknowledgement

It is with great pleasure and honor that I share the curriculum for Second Year of Computer Engineering (2019 Course) on behalf of Board of Studies (BoS), Computer Engineering. We, members of BoS are giving our best to streamline the processes and curricula design at both UG and PG programs.

It is always the strenuous task to balance the curriculum with the blend of core courses, current developments and courses to understand social and human values. By considering all the aspects with adequate prudence the contents are designed satisfying most of the necessities as per AICTE guidelines and to make the graduate competent enough as far as employability is concerned. I sincerely thank all the minds and hands who work adroitly to materialize these tasks. I really appreciate everyone's contribution and suggestions in finalizing the contents.

Success is sweet. But it's sweeter when it's achieved thorough co-ordination, cooperation and collaboration. I am overwhelmed and I feel very fortunate to be working with such a fabulous team- the Members of Board of Studies, Computer Engineering!

Even in these anxious situation, during the time of this unfortunate pandemic, each and every person, including the course coordinators and their team members, have worked seamlessly to come up with this all inclusive curriculum for Second Year of Computer Engineering.

Thank you to all of you for delivering such great teamwork. I don't think it would have been possible to achieve the goal without each and every one of your efforts! I would like to express my deep gratitude to Dr. Rajesh Prasad (SITS), member BoS, Computer Engineering, for coordinating the complete activity and getting it to completion in a smooth manner.

I deeply appreciate and thank the managements of various colleges affiliated to SPPU for helping us in this work. These colleges have helped us by arranging sessions for preliminary discussion in the initial stage and at the same time in conducting Faculty Development Programs for various courses of the revised curriculum. All your support is warmly appreciated.

I sincerely appreciate, the hard work put in by the course coordinators and their team members, without your intellectual work and creative mind, and it would have not been possible to complete this draft. You have been a valuable member of our team!

Special thanks are due to Dr. Parikshit Mahalle, Dr. Swati Bhavsar and Dr. Jayashri Prasad for helping with the formatting and crisp presentation of this draft. I would like to thank you from the core of my heart. Thank you for always being your best selves and contributing to the work.

I am thankful to Dr. Nuzhat Shaikh, for the time she has spent in critically reading the draft and giving the final touches. I appreciate her initiative and thank her for her time, patience and hard work!

Thank you all, for not only your good work but also for all the support you have given each other throughout the drafting process, that's what makes the team stronger! You took the meaning of teamwork to a whole new level.

Thank you for all your efforts!

Professor (Mrs) Varsha H. Patil

Chairman, Board of Studies (BoS), Computer Engineering, Faculty of Science and Technology, Savitribai Phule Pune University.

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2. Team Leader- **Dr. Rajesh Prasad**

3. Teams, Course Design-

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