Savitribai Phule Pune University, Pune

Maharashtra, India

Faculty of Science and Technology

National Education Policy (NEP)-2020 Compliant Curriculum

SE - Second Year Engineering (2024 Pattern) in

Computer Engineering

&

Computer Science and Engineering

(With effect from Academic Year 2025-26)

Contents

Nomenclature

AEC Ability Enhancement Course

AICTE All India Council for Technical Education

CEP Community Engagement Project

EEM Entrepreneurship/Economics/Management Courses

MDM Multidisciplinary Minor

MOOC Massive Open Online Course

NEP National Education Policy

NPTEL National Programme on Technology Enhanced Learning

OE Open Elective

PCC Program Core Course

PEO Programme Educational Objectives

PSO Program Specific Outcomes

SWAYAM Study Webs of Active-learning for Young Aspiring Minds

UGC University Grants Commission

VEC Value Education Course

VSE Vocational and Skill Enhancement Course

WK Knowledge and Attitude Profile

Preface by Board of Studies

Dear Students and Teachers,

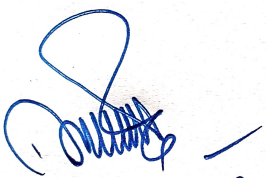
We, the members of Board of Studies Computer Engineering, are very happy to present Second Year Computer Engineering and Computer Science and Engineering syllabus effective from the AY Year 2025-26. Subsequently this will be carried forward for TE and BE in the AY 2026-27, 2027-28, respectively.

Computer Engineering is a dynamic discipline that provides the foundation for the design, development, and application of computer systems and other computing devices. This curriculum is designed to provide students with a comprehensive understanding of the fundamental principles, theories, and practices of computer engineering, while also preparing them for the ever-evolving technological landscape.

The revised syllabus falls in line with the objectives of NEP - 2020, Savitribai Phule Pune University, AICTE New Delhi, UGC, and various accreditation agencies by keeping an eye on the technological developments, innovations, and industry requirements. Wherever possible additional resource links of platforms such as NPTEL, Swayam are appropriately provided at the end of each course. Learners are now getting sufficient time for self learning either through online courses or additional projects for enhancing their knowledge and skill sets. This will definitely help learners to facilitate their enhanced learning based on their interest.

This curriculum is the result of extensive consultation with academic experts, industry professionals, and alumni to ensure relevance and excellence. It is designed not only to meet the current industry standards but also to prepare students for higher studies and research in the field of computer engineering.

We hope that this curriculum will inspire students to become competent professionals, responsible citizens, and contributors to the technological advancement of society. We would like to place on record our gratefulness to the faculty, students, industry experts and stakeholders for having helped us in the formulation of this syllabus.



Dr. Nilesh Uke
Chairman - Board of Studies (Computer Engineering)
Savitribai Phule Pune University

Members of Board of Studies - Computer Engineering	
Dr. Pramod Patil	Dr. Dipti Patil
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Curriculum for Second Year - "Computer Engineering" and "Computer Science and Engineering"- (2024 Pattern)

Program Specific Outcomes (PSO)

- **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.

Programme Educational Objectives (PEO)

Program Educational Objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve.

PEO	PEO Focus	PEO Statements
PEO1	Core competence	Attainment of key principles and practices of computation, mathematics and basic principles of engineering to ensure that graduates are able to apply their software development skills in design and implementation of practical systems consisting of software and/or hardware components.
PEO2	Problem solving skills and Ethics	Analyze real-life problems and impart science-based engineering education to develop professional skills that will prepare the students for immediate employment in the industry.
PEO3	Professionalism and Lifelong Learning	Imbibe lifelong learning, professional and ethical attitude for embracing global challenges and make positive impact on environment and society.

Knowledge and Attitude Profile (WK)

A Knowledge and Attitude Profile (KAP), often represented as WK (Knowledge and Attitude Profile) in some contexts, is a framework or assessment tool used to evaluate an individual's knowledge and attitudes related to a specific area, topic, or domain.

WK1	A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.
WK2	Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.
WK3	A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
WK4	Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.
WK5	Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.
WK6	Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
WK7	Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.
WK8	Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.
WK9	Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

Reference: Self-Assessment Report (SAR) Format Undergraduate Engineering Programs Graduate Attributes and Professional Competencies Version 4.0 (GAPC V4.0) - (August 2024) Page 55.

Programme Outcomes (PO)

Program Outcomes are statements that describe what students are expected to know and be able to do upon graduating from the program. These relate to the skills, knowledge, attitude and behaviour that students acquire through the program. On successful completion of B.E. in Computer Engineering, graduating students/graduates will be able to:

PO1	Engineering knowledge	Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO2	Problem analysis	Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO3	Design / Development of Solutions	Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO4	Conduct Investigations of Complex Problems	Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
PO5	Engineering Tool Usage	Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
PO6	The Engineer and The World	Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
PO7	Ethics	Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
PO8	Individual and Collaborative Team work	Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
PO9	Communication	Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10	Project Management and Finance	Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO11	Life-Long Learning	Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Reference: Self-Assessment Report (SAR) Format Undergraduate Engineering Programs Graduate Attributes and Professional Competencies Version 4.0 (GAPC V4.0) - (August 2024) Page 56.

General Rules and Guidelines

- **Course Outcomes (CO):** Course Outcomes are narrower statements that describe what students are expected to know, and are able to do at the end of each course. These relate to the skills, knowledge and behaviour that students acquire in their progress through the course.
- **Assessment:** Assessment is one or more processes, carried out by the institution, that identify, collect, and prepare data to evaluate the achievement of Program Educational Objectives and Program Outcomes.
- **Evaluation:** Evaluation is one or more processes, done by the Evaluation Team, for interpreting the data and evidence accumulated through assessment practices. Evaluation determines the extent to which Program Educational Objectives or Program Outcomes are being achieved, and results in decisions and actions to improve the program

Guidelines for Examination Scheme

Theory Examination: The theory examination shall be conducted in two different parts Comprehensive Continuous Evaluation (CCE) and End-Semester Examination (ESE).

Comprehensive Continuous Evaluation (CCE) :

1. CCE of 30 marks based on all the Units of course syllabus to be scheduled and conducted at institute level.
2. Case studies included under each unit are intended to support applied learning and are part of Comprehensive Continuous Evaluation
3. These case studies will be assessed through internal assessment components such as presentations, assignments, or group discussions. They shall not be included in the End-Semester Theory Examination.
4. To design a Comprehensive Continuous Evaluation scheme for a theory subject of 30 marks with the specified parameters, the allocation of marks and the structure can be detailed as follows:

Sr.	Parameters	Marks	Coverage of Units
1	Unit Test	12 Marks	Units 1 & Unit 2 (6 Marks/Unit)
2	Assignments / Case Study	12 Marks	Units 3 & Unit 4 (6 Marks/Unit)
3	Seminar Presentation / Open Book Test/ Quiz	06 Marks	Unit 5

5. CCE of 15 marks based on all the Units of course syllabus to be scheduled and conducted at institute level. To design a CCE scheme for a theory subject of 15 marks with the specified parameters, the allocation of marks and the structure can be detailed as follows:

Sr.	Parameters	Marks	Coverage of Units
1	Unit Test	10 Marks	Units 1 & Unit 2 (5 Marks/Unit)
2	Seminar Presentation / Open Book Test/ Assignments/Case Studies	05 Marks	Units 3 & Unit 4

- **Unit Test**
  - **Format :** Questions designed as per Bloom's Taxonomy guidelines to assess various cognitive levels (Remember, Understand, Apply, Analyze, Evaluate, Create).
  - **Implementation**: Schedule the test after completing Units 1 and 2. Ensure the question paper is balanced and covers key concepts and applications.
- **Sample Question Distribution**
  - Remembering (2 Marks): Define key terms related to [Topic from Units 1 and 2].
  - Understanding (2 Marks): Explain the principle of [Concept] in [Context].
  - Applying (2 Marks): Demonstrate how [Concept] can be used in [Scenario].
  - Analyzing (3 Marks): Compare & contrast [Two related concepts] from Units 1 and 2.
  - Evaluating (3 Marks): Evaluate the effectiveness of [Theory/Model] in [Situation].
- **Assignments / Case Study** : Students should submit one assignment or one Case Study Report based on Unit 3 and one assignment or one Case Study Report based on Unit 4.
  - **Format:** Problem-solving tasks, theoretical questions, practical exercises, or case studies that require in-depth analysis and application of concepts.
  - **Implementation:** Distribute the assignments or case study after covering Units 3 and 4. Provide clear guidelines and a rubric for evaluation.
- **Seminar Presentation:**
  - **Format:** Oral presentation on a topic from Unit 5, followed by a Q&A session.
  - **Deliverables:** Presentation slides, a summary report in 2 to 3 pages, and performance during the presentation.
  - **Implementation:** Schedule the seminar presentations towards the end of the course. Provide students with ample time to prepare and offer guidance on presentation skills.
- **Open Book Test:**
  - **Format:** Analytical and application-based questions to assess depth of understanding.
  - **Implementation:** Schedule the open book test towards the end of the course, ensuring it covers critical aspects of Unit 5.
- **Quiz :**
  - **Format:** Quizzes can help your students practice existing knowledge while stimulating interest in learning about new topic in that course. You can set your quizzes to be completed individually or in small groups.
  - **Implementation:** Online tools and software can be used create quiz. Each quiz is made up of a variety of question types including multiple choice, missing words, true or false etc
- **Example Timeline for conducting CCE:**
  - Weeks 1-4 : Cover Units 1 and 2
  - Week 5 : Conduct Unit Test (12 marks)
  - Weeks 6-8 : Cover Units 3 and 4

- Week 9 : Distribute and collect Assignments / Case Study (12 marks)
- Weeks 10-12 : Cover Unit 5
- Week 13 : Conduct Seminar Presentations or Open Book Test or Quiz (6 marks)

- **Evaluation and Feedback:**
  - **Unit Test:** Evaluate promptly and provide constructive feedback on strengths and areas for improvement.
  - **Assignments / Case Study:** Assess the quality of submissions based on the provided rubric. Offer feedback to help students understand their performance.
  - **Seminar Presentation:** Evaluate based on content, delivery, and engagement during the Q&A session. Provide feedback on presentation skills and comprehension of the topic.
  - **Open Book Test**: Evaluate based on the depth of analysis and application of concepts. Provide feedback on critical thinking and problem-solving skills.

End-Semester Examination (ESE)

End-Semester Examination (ESE) of 70 marks written theory examination based on all the unit of course syllabus scheduled by university. Question papers will be sent by the University through QPD (Question Paper Delivery). University will schedule and conduct ESE at the end of the semester.

- **Format and Implementation :**
  - **Question Paper Design** : Below structure is to be followed to design an End-Semester Examination (ESE) for a theory subject of 70 marks on all 5 units of the syllabus with questions set as per Bloom's Taxonomy guidelines and 14 marks allocated per unit.
  - **Balanced Coverage**: Ensure balanced coverage of all units with questions that assess different cognitive levels of Bloom's Taxonomy: Remember, Understand, Apply, Analyze, Evaluate, and Create. The questions should be structured to cover:
    * Remembering: Basic recall of facts and concepts.
    * Understanding: Explanation of ideas or concepts.
    * Applying: Use of information in new situations.
    * Analyzing: Drawing connections among ideas.
    * Evaluating: Justifying a decision or course of action.
    * Creating: Producing new or original work (if applicable).
  - **Detailed Scheme for 70 Marks :** Unit-Wise Allocation (14 Marks per Unit): Each unit will have a combination of questions designed to assess different cognitive levels. By following this scheme, you can ensure a comprehensive and fair assessment of students' understanding and application of the course material, adhering to Bloom's Taxonomy guidelines for cognitive skills evaluation.
  - **Detailed Scheme for 35 Marks :** Unit-Wise Allocation (08 Marks for Unit 1 , 09 Marks for Unit 2, Unit 3 and Unit 4) : Each unit will have a combination of questions designed to assess different cognitive levels. By following this scheme, you can ensure a comprehensive and fair assessment of students' understanding and application of the course material, adhering to Bloom's Taxonomy guidelines for cognitive skills evaluation.

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Curriculum Structure - Semester III

Second Year Engineering (2024 Pattern) – "Computer Engineering" and "Computer Science and Engineering"

Level 5.0

Course Code	Course Type	Course Name	Teaching Scheme			Examination Scheme						Credits			
			Theory	Tutorial	Practical	CCE	EndSem	TermWork	Practical	Oral	Total	Theory	Tutorial	Practical	Total
PCC-201-COM	Program Core Course	Data Structures	3	-	-	30	70	-	-	-	100	3	-	-	3
PCC-202-COM	Program Core Course	Object Oriented programming and Computer Graphics	3	-	-	30	70	-	-	-	100	3	-	-	3
PCC-203-COM	Program Core Course	Operating Systems	3	-	-	30	70	-	-	-	100	3	-	-	3
PCC-204-COM	Program Core Course	Data Structures Laboratory	-	-	4	-	-	50	25	-	75	-	-	2	2
PCC-205-COM	Program Core Courses	Object Oriented Programming and Computer Graphics Laboratory	-	-	2	-	-	25	-	25	50	-	-	1	1
	Open Elective	*Open Elective - I	2	-	-	15	35	-	-	-	50	2	-	-	2
MDM-221-COM	Multi disciplinary Minor	Digital Electronics and Logic Design	2	-	-	30	70	-	-	-	100	2	-	-	2
EEM-231-COM	Entrepreneurship/ Management	Entrepreneurship Development	-	1	2	-	-	25	-	-	25	-	1	1	2
VEC-232-COM	Value Education Course	Universal Human Values and Professional Ethics	2	-	-	15	35	-	-	-	50	2	-	-	2
CEP-241-COM	Community Engagement Project	Community Engagement Project	-	-	4	-	-	25	-	25	50	-	-	2	2
Total			**15**	**1**	**12**	**150**	**350**	**125**	**25**	**50**	**700**	**15**	**1**	**6**	**22**

***Note:** Students can opt for Open Electives offered by different faculty like Arts, Science, Commerce ,Management, Humanities or Inter-Disciplinary studies.

- Example – Open Elective I - Financial Accounting, Digital Finance, Digital Marketing can be opted from Commerce and Management faculty.
- Elective II - Project Management, Business Analytic, Financial Management can be opted from Inter-Disciplinary studies, Commerce and Management faculty respectively.

Second Year Engineering (2024 Pattern) – "Computer Engineering" and "Computer Science and Engineering"

Level 5.0

Course Code	Course Type	Course Name	Teaching Scheme			Examination Scheme						Credits			
			Theory	Tutorial	Practical	CCE	EndSem	Term Work	Practical	Oral	Total	Theory	Tutorial	Practical	Total
PCC-251-COM	Program Core Course	Database Management systems	3	-	-	30	70	-	-	-	100	3	-	-	3
PCC-252-COM	Program Core Course	Discrete Mathematics	3	-	-	30	70	-	-	-	100	3	-	-	3
PCC-253-COM	Program Core Course	Computer Organization & Microprocessor	2	-	-	30	70	-	-	-	100	2	-	-	2
PCC-254-COM	Program Core Course	Database Management Laboratory	-	-	2	-	-	25	25	-	50	-	-	1	1
PCC-255-COM	Program Core Course	Microprocessor Laboratory	-	-	2	-	-	-	-	25	25	-	-	1	1
	Open Elective	*Open Elective - II	2	-	-	15	35	-	-	-	50	2	-	-	2
MDM-271-COM	Multi Disciplinary Minor	Internet of Things	2	-	-	30	70	-	-	-	100	2	-	-	2
VSE-281-COM	Vocational and Skill Enhancement	Web Development	-	-	4	-	-	25	25	-	50	-	-	2	2
AEC-282-COM	Ability Enhancement	Modern Indian Language (Marathi)	-	1	2	-	-	50	-	-	50	-	1	1	2
EEM-283-COM	Entrepreneurship / Management	Engineering Product Design	-	1	2	-	-	25	-		25		1	1	2
VEC-284-COM	Value Education Course	Environmental Studies	2	-	-	15	35	-	-	-	50	2	-	-	2
Total			**14**	**2**	**12**	**150**	**350**	**125**	**50**	**25**	**700**	**14**	**2**	**6**	**22**

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Savitribai Phule Pune University, Pune

Maharashtra, India

SE - Computer Engineering
&
SE - Computer Science and Engineering

Semester - III

Savitribai Phule Pune University Second Year of Computer Engineering & Computer Science and Engineering (2024 Course)		
PCC-201-COM : Data Structures		
Teaching Scheme	**Credits**	**Examination Scheme**
Theory : 03 Hours/Week	03	CCE : 30 Marks End-Semester: 70 Marks

Prerequisite Courses:

1. Programming and Problem Solving
2. Fundamentals of Programming Languages

Companion Course : Data Structures Lab

Course Objectives: The course aims to:

1. To understand importance of data structures in context of writing efficient programs
2. To be able to implement linear and non-linear data structures

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1: **Understand** and **Analyze** various types of data structures and algorithms
- CO2: **Apply** various sorting and searching algorithms for given problem
- CO3: Make **Use** of Stacks and Queues to **solve** the given problem
- CO4: **Analyze** different hashing techniques and collision resolution strategies.
- CO5: **Demonstrate** basic operations on trees and graphs

Course Contents

Unit I - Introduction to Data Structures and Algorithms (09 Hours)

Introduction: Introduction to Data Structures: Abstract Data Types (ADT), Linear and Non-linear, Static and Dynamic, Persistent and Ephemeral data structures

Algorithms: 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

Case Study:E-commerce Product Sorting using Divide and Conquer strategy Google Calendar application using Greedy strategy

Unit II - Linear Data Structures, searching and sorting (09 Hours)

Overview of Array, Array as an Abstract Data Type, Operations on Array, Storage Representation, Multidimensional Arrays[2D, nD], Sparse matrix representation using 2D Searching: Sequential Search/Linear Search, Binary Search, Fibonacci Search, and Indexed Sequential Search.

Sorting: Concepts- Stability, Efficiency, and Number of Passes, Internal and External Sorting, Bubble sort, Insertion Sort, Selection Sort , Quick Sort, Merge sort

Case Study : Social Network Adjacency Matrix Representing friendship connections among millions of users.

Unit III - Stacks, Queues and Linked Lists (09 Hours)

Stacks: Stack operations, Multiple Stacks, Applications of Stack for Expression Conversion [infix, prefix and postfix], Postfix expression evaluation

Queues: Queue Operations, Circular Queue, Priority Queue and its advantages and applications

Linked list: Introduction of Linked Lists, Primitive Operations on Linked List- Create, Traverse, Search, Insert, Delete, Sort, and Concatenate. Types of Linked List: Singly linked, linear and Circular Linked Lists, Doubly Linked List,

Case study: Implementation of Stack and Queue operations using Linked lists

Unit IV - Hashing (09 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, properties of good hash function, Collision resolution strategies- open addressing and chaining, Hash table overflow- open addressing and chaining, extendible hashing, closed addressing and separate chaining

Case study : Dictionary Application using Hash Tables, Description: Implement a dictionary where words and meanings are stored and retrieved using hashing with collision resolution

Unit V - Graphs and Trees (09 Hours)

Graphs: Basic Concepts, Storage representation, Adjacency matrix, adjacency list, Traversals-depth first and breadth first, Minimum spanning Tree, Greedy algorithms for computing minimum spanning tree- Prims and Kruskal Algorithms

Trees: General tree and its representation: sequential and linked organization, Binary tree- properties, converting tree to binary tree, binary tree traversals (recursive and non-recursive) - inorder, preorder, post order, Operations on binary tree. Binary Search Tree (BST) and its operation

Case study: GPS/Navigation system that models a city map as a weighted graph and applies core graph algorithms ZIP/GZIP file compression using frequency-based encoding. using Huffman tree

Learning Resources

Text Books:

1. Data structures and algorithms in python by Michael T. Goodrich, ISBN-13: 978- 1118290279, ISBN-10: 1118290275, Publisher: Wiley; 1st edition (March 18, 2013).
2. Problem Solving with Algorithms and Data Structures Using Python by Bradley N Miller and David L. Ranum. ISBN-13: 978-1590282571, ISBN-10: 1590282574, Publisher: Franklin, Beedle & Associates; 2nd edition (August 22, 2011).

Reference Books:

1. Hands-On Data Structures and Algorithms with Python: Write complex and powerful code using the latest features of Python 3.7, 2nd Edition by Dr. Basant Agarwal, Benjamin Baka. ISBN: 9781788991933, 2018.
2. Core Python Programming -R. Nageswara Rao, ISBN-10: 9789351199427, ISBN-13: 978-9351199427, Willy; 1st edition (January 1, 2016).

MOOC / NPTEL/YouTube Links: -

1. Programming, Data Structures and Algorithms using Python By Prof. Madhavan Mukund, Chennai Mathematical Institute, https://archive.nptel.ac.in/courses/106/106/106106145/

YouTube/Video Links:

1. https://nptel.ac.in/courses/106102064
2. https://onlinecourses.swayam2.ac.in/cec19_cs04/preview

Savitribai Phule Pune University Second Year of Computer Engineering & Computer Science and Engineering (2024 Course)		
PCC-202-COM : Object Oriented programming and Computer Graphics		
Teaching Scheme	**Credits**	**Examination Scheme**
Theory : 03 Hours/Week	03	**CCE** : 30 Marks **End-Semester :** 70 Marks

Prerequisite Courses :

1. Programming and Problem Solving concepts

Course Objectives: The course aims to:

1. To explore & understand the principles of Object Oriented Programming (OOP)
2. To apply the object-oriented paradigm in program design
3. To provide object-oriented programming insight using Java
4. To lay a foundation for computer graphics concepts and implementation

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1: **Apply** fundamental programming constructs, object oriented constructs in Java for Implementing an application.
- CO2: **Apply** fundamental object oriented constructs like class, objects, array of objects in Java for Implementing an application..
- CO3: **Apply** object-oriented features like Inheritance, Polymorphism, Dynamic binding, Exception handling, multi-threading in Java for implementing an application
- CO4: **Understand** basic concepts in computer graphics and **implement** them by applying object oriented features
- CO5: **Understand** mathematical foundation in 2D, 3D Transformation, Projections and **implement** them by applying object oriented features

Course Contents

Unit I - Introduction to OOP Concepts and Control Structure (09 Hours)

Programming paradigms - Introduction to programming paradigms, Introduction to four main Programming paradigms- procedural, object oriented, functional, and logic & rule based. 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, Java as object oriented programming language.

Overview of Java Language: simple Java program structure: documentation section, package statement, import statements, class definition, main method class. Implementing Java Program, JVM, Data types, Primitive Types vs. Reference type, floating point numbers, operators and expressions, Java Class Libraries, Typical Java Development Environment, and Memory Concepts.

Control Statements: Selection Statements: if, if-else, nested if-else, Iteration Statements: do, while, for, for-each statement, break, and continue statements

Case Study: Analyze the object -oriented features in Java with other object oriented programming languages.

Unit II - Introduction to Classes and Objects and Arrays (09 Hours)

Introduction to Classes and Objects: Defining a Class, Field declaration, method declaration and definition, instantiating an object of a Class, Accessing class members, declaring methods with multiple parameters, argument passing, object as a parameter, returning objects, assigning object reference variables, set methods and get methods, constructors, this keyword, Constructors, static methods, scope of declaration, method overloading and Java API packages.

Arrays: declaring and creating arrays in Java, examples using arrays, passing arrays to methods, multidimensional arrays, variable-length argument lists, using command-line arguments.

Managing I/O: Streams Byte Streams and Character Streams, Predefined Streams, Reading console Input, Writing Console Output, Print Writer class.

Case Studies: Demonstrate an interactive Banking/Library management system using class, objects, array of objects

Unit III - Inheritance and Polymorphism Exception Handling and Multithreading (09 Hours)

Inheritance: Super classes and Subclasses, protected members, relationship between super classes and subclasses, types of Inheritance, constructors in subclasses, object class.

Polymorphism: Abstract classes and methods, final methods and classes, dynamic binding, polymorphism examples and Interfaces.

Exception handling: fundamentals, Exception Types, Using try-catch, Multiple try-catch clauses, Nested try statements, throw, throws, finally, Built-in Exceptions

MultiThreading: Java Thread Model, Main Thread, Creating a Thread , Creating Multiple Threads.

Case Study ; Demonstrate online Banking/Library system using Inheritance, Exception handling and Multi-Threading concepts

Unit IV- Graphics Primitives, Scan Conversion, Windowing and Clipping (09 Hours)

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

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

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.

Case Studies - 1) Real-Time Map Rendering in GPS Navigation Systems using Line and Circle Drawing Algorithms 2) 3D pipeline / polygonal modelling and applications

Unit V- 2D, 3D Transformations and Projections (09 Hours)

2-D Transformations: 2-D transformations - Translation, Scaling, Rotation and Shear, Rotation about an arbitrary point. 3-D Transformations: 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)

Case Studies - 1) Affine Transformations Vlab (Vlab link: https://cse19- iiith.vlabs.ac.in/exp/affine-transformation/theory.html) 2) Image augmentation in Deep learning

Learning Resources

Text Books:

1. E Balaguruswamy, (2023). Programming with Java: A Primer. 7th edition. India: McGraw Hill Education
2. Herbert Schildt, (2021). Java: The complete reference, 13th edition. McGraw-Hill Education.
3. S. Harrington, “Computer Graphics”, 2ndEdition, McGraw-Hill Publications, 1987, ISBN 0 – 07–100472 – 6.
4. Donald D. Hearn and Baker, “Computer Graphics with OpenGL”, 4thEdition, ISBN-13: 9780136053583

Reference Books:

1. Paul Deitel and Harvey Detail, Java: How to Program, Pearson’s Publication, 9thEdition
2. Horstmann, C. S. (2023). Core Java - Vol. I – Fundamentals (Vol. 12). Pearson Education
3. Dr. Samit Bhattacharya, Computer Graphics, Oxford University Press, ISBN-13: 978-0-19-809619-1; ISBN-10: 0-19-809619-4.
4. D. Rogers, “Procedural Elements for Computer Graphics”, 2ndEdition, Tata McGraw-Hill Publication, 2001, ISBN 0 – 07 – 047371 – 4.

MOOC / NPTEL/YouTube Links: -

1. https://archive.nptel.ac.in/courses/106/103/106103224/
2. https://archive.nptel.ac.in/courses/106/102/106102065/
3. https://nptel.ac.in/courses/106106090

E-Books :

1. https://www.iitg.ac.in/samit/Computer%20Graphics.pdf
2. https://open.umn.edu/opentextbooks/textbooks/introduction-to-computer-graphics
3. http://www2.cs.uidaho.edu/∼jeffery/courses/324/lecture.html

Savitribai Phule Pune University Second Year of Computer Engineering & Computer Science and Engineering (2024 Course)		
PCC-203-COM : Operating Systems		
Teaching Scheme	**Credits**	**Examination Scheme**
Theory : 03 Hours/Week	03	**CCE** : 30 Marks **End-Semester:** 70 Marks

Prerequisite Courses : Data Structure, Digital Electronics

Companion Course : Computer Organization and Microprocessors

Course Objectives: The course aims to:

1. To understand the fundamental concepts, types, and structures of Operating Systems.
2. To understand and analyze process management concepts.
3. To identify and solve concurrency and deadlock in the operating system.
4. Explore the various techniques of memory management.
5. Understand I/O management, disk scheduling, and file systems.

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1: **Analyze** the fundamentals of Operating Systems, including types, structures, system calls, and basic Linux commands.
- CO2: **Apply** process scheduling and synchronization to optimize CPU utilization in modern operating systems.
- CO3: **Identify** the mechanism for dealing with deadlocks and concurrency concerns.
- CO4: **Apply** techniques of memory management to solve memory management problems
- CO5: **Illustrate** I/O and file management policies.

Course Contents

Unit I - Introduction to Operating System (09 Hours)

Basics of Operating Systems: Objectives & Functions, Evolution of OS, Types of Operating Systems, OS Service, System Calls: Introduction, Types of System Calls

OS structure: Layered Approach, Monolithic, Microkernel Operating Systems

Introduction to Linux OS: Components of Linux system, Basic Shell commands

Case studies: 1) Automating User and File Management in Linux using Shell Script 2) Demonstrating Different OS Structures (Monolithic, Layered, Microkernel OS)

Unit II - Process and Thread Management (09 Hours)

Process management: Definition, types of process. Process States and Transitions diagram, Process Control Block (PCB), context switching and its impact on performance, Process Scheduling.

Types of Schedulers: long term, short term, middle term, Threads: Concept of thread, Multithreading, User-level vs Kernel-level Threads.

Scheduling Algorithms: Preemptive Scheduling vs Non-preemptive Scheduling, FCFS, SJF, RR, Priority Process Scheduling in UNIX and Windows

Cast Studies - 1) Prepare case study on challenges for Real-time Scheduling 2)Performance Comparison of Scheduling Algorithms (FCFS vs SJF, RR vs Priority Scheduling) under different workload conditions

Unit III - Interprocess Communication and Deadlock (09 Hours)

Concurrency: Critical section problem, Synchronization primitives (Semaphores, Mutexes, Monitors) Synchronization Problems: Producer-Consumer, Reader Writer, Dining Philosophers

Inter-Process Communication (IPC): Message passing, Shared memory Deadlocks: Conditions, Prevention, Avoidance (Banker's Algorithm), Detection, Recovery

Case Studies - 1) Interprocess Communication (IPC) in a Banking System 2) Deadlock in Railway Scheduling Systems

Unit IV - Memory Management (09 Hours)

Introduction, Contiguous and non-contiguous, Fragmentation:Internal and External fragmentation

Memory allocation strategies: First Fit, Best Fit, Worst Fit, Memory Partitioning:Fixed and Dynamic partitions

Paging: Structure of page table, Segmentation.Virtual Memory: Background, Demand Paging

Page Replacement: FIFO, LRU, Optimal Thrashing.

Case study : Intel Premium

Unit V - File and Disk Management (09 Hours)

File Management: File operation, Directory structure, File System structure, File Organization and Access, File Directories, File Allocation Methods,Secondary Storage Management, File Systems in Operating System (FAT, NTFS, EXT, and HFS).

Disk Management: Secondary-Storage Structure - Disk structure, Disk scheduling algorithm (FIFO, SSTF, SCAN, C-SCAN, LOOK, C-LOOK), Disk reliability, Disk formatting, Boot-block, Bad blocks.

Case Studies - 1) Study of Linux File System. 2) Study of Android File System.

Learning Resources

Text Books:

1. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, ISBN-10: 0-13-380591-3, ISBN-13: 978-0-13-380591-8, 8th Edition
2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, WILEY, ISBN 978-1-118-06333-0, 9th Edition
3. Arnold Robbins, Nelson H. F. Beebe, Classic Shell Scripting, O'Reilly Media, Inc., 2005, ISBN 9780596005955.

Reference Books:

1. Tom Adelstein and Bill Lubanovic, Linux System Administration, O'Reilly Media, ISBN-10: 0596009526, ISBN-13: 978-0596009526.

2. Harvey M. Deitel, Operating Systems, Prentice Hall, ISBN-10: 0131828274, ISBN-13: 978-0131828278.

3. Thomas W. Doeppner, Operating System in depth: Design and Programming, WILEY, ISBN: 978- 0-471-68723-8.

4. Mendel Cooper, Advanced Shell Scripting, Linux Documentation Project. 5. Andrew S. Tanenbaum & Herbert Bos, Modern Operating System, Pearson, ISBN-13: 9780133592221, 4th Edition.

E-Book

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

MOOC/NPTEL/SWAYAM Course Links:

1. https://onlinecourses.nptel.ac.in/noc24_cs108/preview

Savitribai Phule Pune University Second Year of Computer Engineering & Computer Science and Engineering (2024 Course)		
PCC-204-COM : Data Structures Laboratory		
Teaching Scheme	**Credits**	**Examination Scheme**
Practical : 04 Hours/Week	02	**Term Work** : 50 Marks **Practical :** 25 Marks

Prerequisite Courses : Basics of python programming and Principles of Problem Solving
Companion Course : Data Structures
Course Objectives: The course aims to:

1. Provide hands-on experience with basic and advanced data structures.
2. Understand various data searching and sorting methods with pros and cons.
3. Apply Data Structures for real-world problem solving.

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1: **Analyze** basic searching and sorting algorithms to solve problems and evaluate their efficiency in different scenarios.
- CO2: Make **use** of stacks and queue concepts to solve the given problem
- CO3: **Demonstrate** various types of linked lists.
- CO4: **Demonstrate** basic operations on trees and graphs and **determine** minimum spanning.
- CO5: **Apply** a suitable data structure for solving application-based problems.

Course Contents

Guidelines for Instructor's Manual

The instructor's manual/Lab 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, 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. Students programs maintained on cloud or college server by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory for accreditation purpose.

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 Laboratory Conduction

The instructor is expected to conduct **TWO assignments from each group (A,B,C,D,E).** The instructor may set multiple sets of assignments and distribute them among batches of students.

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, instructors may assign one real life application in the form of a mini-project based on the concepts learned.

Suggested Language: Python/C++/C or any open source

Guidelines for Practical Examination

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

Guidelines for Oral Examination

Oral examination gauge students' knowledge and skills based on the spoken word, typically guided by questions or small tasks. A pair of examiners must design appropriate questions for each learning outcome. They should focus on depth rather than breadth. They should include potential follow-up questions and prompts based on different types of answers. Examiners should standardize the number of questions, difficulty of questions, and the time allotted. Questions should be based on the practical assignments performed in the term work and not on the entire syllabus.

Suggested List of Laboratory Experiments/Assignments

Sr.	Group A: Arrays and Searching Sorting Algorithms
1	Write a Python program to manage the borrowing records of books in a library. Implement the following functionalities: • Compute the average number of books borrowed by all library members. • Find the book with the highest and lowest number of borrowings in the library. • Count the number of members who have not borrowed any books (denoted by a borrow count of 0). • Display the most frequently borrowed book (i.e., the mode of borrow counts). After performing, determine the time and Space complexity of each operation
2	In an e-commerce system, customer account IDs are stored in a list, and you are tasked with writing a program that implements the following: • Linear Search: Check if a particular customer account ID exists in the list. • Binary Search: Implement Binary search to find if a customer account ID exists, improving the search efficiency over the basic linear

3	In a company, employee salaries are stored in a list as floating-point numbers. Write a Python program that sorts the employee salaries in ascending order using the following two algorithms: • Selection Sort: Sort the salaries using the selection sort algorithm. • Bubble Sort: Sort the salaries using the bubble sort algorithm. After sorting the salaries, the program should display top five highest salaries in the company
Group B Stacks Queues and Linked List	
1	Implementing a real-time undo/redo system for a text editing application using a Stack data structure. The system should support the following operations: • Make a Change: A new change to the document is made. • Undo Action: Revert the most recent change and store it for potential redo. • Redo Action: Reapply the most recently undone action. • Display Document State: Show the current state of the document after undoing or redoing an action
2	Implement a real-time event processing system using a Queue data structure. The system should support the following features: • Add an Event: When a new event occurs, it should be added to the event queue. • Process the Next Event: The system should process and remove the event that has been in the queue the longest. • Display Pending Events: Show all the events currently waiting to be processed. • Cancel an Event: An event can be canceled if it has not been processed.
3	A call center receives incoming calls, and each call is assigned a unique customer ID. The calls are answered in the order they are received. Your task is to simulate the call queue of a call center using a queue data structure. • addCall(customerID, callTime): Add a call to the queue with the customer ID and the call time (in minutes). • answerCall(): Answer and remove the first call from the queue. • viewQueue(): View all calls currently in the queue without removing them. • isQueueEmpty(): Check if the queue is empty.
4	Create a Student Record Management System using linked list • Use a singly/doubly linked list to store student data (Roll No, Name, Marks). • Perform operations: Add, Delete, Update, Search, and Sort. • Display records in ascending/descending order based on marks or roll number.
Group C - Hashing	

1	Implement a hash table of size 10 and use the division method as a hash function. In case of a collision, use chaining. Implement the following operations: • Insert(key): Insert key-value pairs into the hash table. • Search(key): Search for the value associated with a given key. • Delete(key): Delete a key-value pair from the hash table
2	Design and implement a hash table of fixed size. Use the division method for the hash function and resolve collisions using linear probing. Allow the user to perform the following operations: • Insert a key • Search for a key • Delete a key • Display the table
3	Implement a hash table with extendible hashing. The hash table should dynamically expand when the number of keys in a bucket exceeds a certain threshold. Perform the following operations: • Insert(key): Insert key-value pairs into the hash table • Search(key): Search for the value associated with a given key • Delete(key): Delete a key-value pair from the hash table
Group D: Graphs and Trees	
1	Consider a particular area in your city. Note the popular locations A, B, C . . . in that area. Assume these locations represent nodes of a graph. If there is a route between two locations, it is represented as connections between nodes. Find out the sequence in which you will visit these locations, starting from (say A) using (i) BFS and (ii) DFS. Represent a given graph using an adjacency matrix to perform DFS and an adjacency list to perform BFS.
2	A pizza shop receives multiple orders from several locations. Assume that one pizza boy is tasked with delivering pizzas in nearby locations, which is represented using a graph. The time required to reach from one location to another represents node connections. Solve the problem of delivering a pizza to all customers in the minimum time. Use appropriate data structures.
3	Implement various operations on a Binary Search Tree, such as insertion, deletion, display, and search.
4	Construct an expression tree from the given prefix expression, e.g., +--a*bc/def, traverse it using post-order traversal (non-recursive), and then delete the entire tree.
5	A list stores city names and their populations. Use a Binary Search Tree for implementation. Provide a facility for adding new cities, deleting a city, and updating population values. Provide a facility to display all the city names in ascending/descending order. Also, find how many maximum comparisons are required to search for a particular city.
6	Read 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?
Group E : Mini project	

Implement any application based mini project. Sample mini projects can be selected from the list given here [not limited to]

- Implementation of Snake and Ladder [BFS]
- Implementation of Maze generation [DFS]
- Implementation of Flight Reservation System [Searching and Sorting]
- Implementation of Student Database Management system [Hashing]
- Implementation of Job Scheduling [Graphs]
- Implementation of Palindrome checker [Stacks and Queues]
- Implementation of Queue using Two Stacks
- Implementation of Keyword Frequency Counter [Hash Table]
- Implementation of a basic version of a web browser's back button functionality [Stack]

Learning Resources

Text Books

1. Data structures and algorithms in python by Michael T. Goodrich, ISBN-13: 978- 1118290279, ISBN-10: 1118290275, Publisher: Wiley; 1st edition (March 18, 2013).
2. Problem Solving with Algorithms and Data Structures Using Python by Bradley N Miller and David L. Ranum. ISBN-13: 978-1590282571, ISBN-10: 1590282574, Publisher: Franklin, Beedle & Associates; 2nd edition (August 22, 2011).

Reference Books

1. Hands-On Data Structures and Algorithms with Python: Write complex and powerful code using the latest features of Python 3.7, 2nd Edition by Dr. Basant Agarwal, Benjamin Baka. ISBN: 9781788991933, 2018.
2. Core Python Programming -R. Nageswara Rao, ISBN-10: 9789351199427, ISBN-13: 978-9351199427, Willy; 1st edition (January 1, 2016).

MOOC/NPTEL/SWAYAM Course Links:

1. NPTEL :- Programming, Data Structures and Algorithms using Python By Prof. Madhavan Mukund, Chennai Mathematical Institute, https://archive.nptel.ac.in/courses/106/106/106106145/

YouTube/Video Links:

1. https://www.youtube.com/playlist?list=PLeo1K3hjS3uu_n_a__MI_KktGTLYopZ12

Savitribai Phule Pune University Second Year of Computer Engineering & Computer Science and Engineering (2024 Course)		
PCC-205-COM : Object Oriented programming and Computer Graphics Laboratory		
Teaching Scheme	**Credits**	**Examination Scheme**
Practical : 02 Hours/Week	01	**Term Work** : 25 Marks **Oral :** 25 Marks

Prerequisite Courses :

1. Understanding of Programming and Problem Solving concepts

Course Objectives: The course aims to:

1. To explore & understand the principles of Object-Oriented Programming (OOP).
2. To apply the object-oriented paradigm in program design.
3. To provide object-oriented programming insight using Java
4. To lay a foundation for computer graphics concepts and algorithms

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1: To **apply** fundamental programming constructs in Java for implementing an application.
- CO2: To **apply** fundamental object oriented constructs in Java for implementing an application.
- CO3: To **apply** object-oriented features like Inheritance, Polymorphism, Dynamic binding, exception handling, multi-threading in Java for implementing an application.
- CO4: To **implement** basic concepts in computer graphics by applying object oriented features
- CO5: To **implement** 2D, 3D Transformation, Projections by applying object oriented features

Course Contents

Guidelines for Instructor's Manual

The instructor's manual/Lab 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, 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. Students programs maintained on cloud or college server by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory for accreditation purpose.

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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 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 needs 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 them 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, instructors may assign one real life application in the form of a mini-project based on the concepts learned. Instructors may also set one assignment or mini-project that is suitable to respective branch beyond the scope of the syllabus.

Operating System recommended:- 64-bit Open source Linux or its derivative
Programming tools recommended: - Open Source Java Open JDK,
Programming IDE like: BlueJ, Eclipse, NetBeans, JDeveloper.
Part-A: 5 Assignments , Part- B: 5 Assignments, Part-C (Mini Project): Mandatory Assignment

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.

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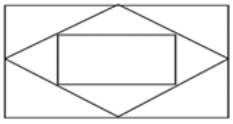
Oral examination gauge students' knowledge and skills based on the spoken word, typically guided by questions or small tasks. A pair of examiners must design appropriate questions for each learning outcome. They should focus on depth rather than breadth. They should include potential follow-up questions and prompts based on different types of answers. Examiners should standardize the number of questions, difficulty of questions, and the time allotted. Questions should be based on the practical assignments performed in the term work and not on the entire syllabus.

Suggested List of Assignment	
Sr	**Group A - Any THREE (from 1 to 5)**
1	Implement a robust Java calculator program that captures user input dynamically, processes mathematical operations using conditional logic and looping constructs, and ensures efficient error handling.
2	Develop a Java program for an E-commerce order processing where some products are initialized through multiple constructors, overloaded constructors, where users can input some product details manually, the system computes total order cost dynamically, applies discount policies based on conditions, and presents a detailed invoice summarizing the purchase.
3	Develop a Java program that implements a simple hotel room booking system using two-dimensional arrays. The system allows users to: View available and booked rooms, Book a room by selecting a floor and room number and exit the system when finished
4	Create a Java program demonstrating single inheritance where a subclass extends a superclass and calls its methods.
5	Implement Multiple Inheritance using interface in Java to demonstrate polymorphism.
6	Develop a Java program for simulation of any real time application with required functionalities. For eg. ATM machine with functionalities like checking account balance, withdrawing, and depositing money. Use try, catch, and finally blocks to handle potential exceptions such as insufficient funds (throwing ArithmeticException) and invalid input (throwing IllegalArgumentException). Ensure that the application continues to run smoothly after handling exceptions.
7	Create a multi-threaded Java application that simulates any real time application with required functionalities. For eg. Basic chat system in which each user (thread) sends and receives messages. Use isAlive() to check the status of threads and join() to ensure proper synchronization. Implement thread priorities to handle high-priority messages and demonstrate thread suspension, resumption, and stopping.

Sr.	**Group B - (Any SIX)**
1	Write a C/C++/Java program to draw the following pattern using (a) the DDA line drawing algorithm for both rectangles with Dotted, Thick line style and (b) Bresenham‘s line drawing algorithm for a diamond shape with Dashed, Solid line style. 
2	Write a menu driven program in C/C++/Java to draw circle using DDA, Bresenham’s , Midpoint circle drawing algorithm with different styles as solid, dotted and dashed circles.
3	Write a menu driven program in C/C++/Java to draw a concave polygon a d fill it with the desired color using the scan fill algorithm; flood fill and seed fill algorithms.
4	Write a program to implement the Sutherland-Hodgeman algorithm for clipping any polygon. Provide the vertices of the polygon to be clipped and the pattern of clipping interactively.
5	Write a C/C++/Java program to implement the Cohen-Sutherland line clip ing algorithm.
6	Write a C/C++/Java program to implement translation, rotation, shear and scaling transformations on a 2D object about X axis, Y axis.
7	Write C/C++/Java program to implement translation, sheer, rotation and scaling transformations on equilateral triangle and rhombus.
8	Write a C/C++/Java program to implement rotation of a 2D object about X axis and an arbitrary point.

Sr.	**Group C - Mini Project**
Mini-Project using maximum features of Object-Oriented programming to develop solutions for any one a	
1	Banking system having the following operations: a. Create an account b. Deposit money c. Withdraw money d. Honor daily withdrawal limit e. Check the balance f. Display Account i formation. g. Passbook Print (from to)
2	Inventory management system having the following operations: a. List of all products b. Display individual product information c. Purchase d. Shipping e. Balance stock f. Loss and Profit calculation. g. Purchase Report (from to)
Note– Subject Incharge can consider any other application having similar features and complexity.	

Learning Resources

Text Books:

1. E Balaguruswamy, (2023). Programming with JAVA: A Primer. 7th edition. India: McGraw Hill Education
2. Herbert Schildt, (2021). Java: The complete reference, 13th edition. McGraw-Hill Education.

Reference Books:

1. Paul Deitel and Harvey Detail, Java: How to Program, Pearson's Publication, 9thEdition
2. Horstmann, C. S. (2023). Core Java - Vol. I – Fundamentals (Vol. 12). Pearson Education
3. Dr. Samit Bhattacharya, Computer Graphics, Oxford University Press, ISBN-13: 978-0-19-809619-1; ISBN-10: 0-19-809619-4.
4. D. Rogers, "Procedural Elements for Computer Graphics", 2ndEdition, Tata McGraw-Hill Publication, 2001, ISBN 0 – 07 – 047371 – 4.

MOOC / NPTEL/YouTube Links: -

1. Programming In Java: https://onlinecourses.nptel.ac.in/noc25_cs57/preview
2. https://archive.nptel.ac.in/courses/106/102/106102065/
3. https://nptel.ac.in/courses/106106090

E-Books :

1. https://www.iitg.ac.in/samit/Computer%20Graphics.pdf
2. https://open.umn.edu/opentextbooks/textbooks/introduction-to-computer-graphics
3. http://www2.cs.uidaho.edu/~jeffery/courses/324/lecture.html

Savitribai Phule Pune University Second Year of Computer Engineering & Computer Science and Engineering (2024 Course)		
MDM-221-COM : Digital Electronics and Logic Design		
Teaching Scheme	**Credits**	**Examination Scheme**
Theory : 02 Hours/Week	02	**CCE** : 30 Marks **End-Semester**: 70 Marks

Prerequisite Courses, if any :

1. Basic Electronics Engineering (ESE-101-ETC)

Course Objectives: The course aims to introduce engineering students to the fundamentals of Digital electronics technology, enhance problem-solving abilities, and provide a strong foundation for careers in computing, automation, and embedded systems.

1. Learn the basics of Boolean algebra and how to simplify digital circuits using Boolean functions.
2. Understand how signed binary numbers (like 1's complement and 2's complement) are used in digital systems.
3. Study how adders, subtractors, and code converters work in digital circuits.
4. Learn how flip-flops, registers, and counters function in memory and control systems.
5. Explore how to design digital systems using Algorithmic State Machines (ASMs) and understand the role of different logic families and programmable devices.

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1: **Understand** and **apply** key concepts of Boolean algebra, binary number systems and simplification techniques for Boolean functions.
- CO2: **Study** the **design** and operation of combinational circuits in digital systems.
- CO3: **Understand** and **apply** the design and operation of various sequential circuits in digital systems.
- CO4: **Understand** the **design** and implementation of FSMs and ASMs for sequential circuits, and study logic families.
- CO5: **Explore** the fundamentals and applications of programmable logic devices (PLDs) in digital circuit design

Course Contents

Unit I - Boolean Algebra and Simplification Techniques (06 Hours)

Boolean Algebra: Basic theorems and properties of Boolean algebra, DeMorgan's rules.
Signed Binary number representation: Signed Magnitude, 1's complement and 2's complement representation.
Simplification Techniques: Sum of product and Product of sum form, Minimization of SOP and POS using K-map. Minimization of Boolean function using K-map (up to 4 variables).

Case Study: Design and Optimization of a Digital Temperature Control System

Unit II - Combinational Logic Design (06 Hours)

Adders/Subtractors: Half Adder, Full Adder, Half Subtractor, Full Subtractor, Binary Adder (IC 7483), BCD adder, Look ahead carry generator.

Code Converters: BCD, Excess-3, Gray code, Binary Code. Multiplexers and Demultiplexers, Comparators (2 bit).

Case Study :Design of a Binary Calculator for BCD Input and 2's Complement Operations

Unit III - Sequential Circuits (06 Hours)

Flip-Flops: SR, JK, D, T; Preset &Clear, Master Slave JK Flip Flops, Truth Tables and Excitation tables, Conversion from one type to another type of Flop Flop.
Registers: Registers: SISO, SIPO, PISO, PIPO, Shift Registers
Counters: Ring Counter, BCD Counter, Johnson Counter.

Case study: Design of a Digital Stopwatch Using Flip-Flops, Registers, and Counters

Unit IV - Algorithmic State Machines and Logic Families (06 Hours)

Algorithmic State Machines: Finite State Machines (FSM) and ASM, ASM charts, notations, construction of ASM chart and realization for sequential circuits.
Logic Families: Classification of logic families: Unipolar and Bipolar Logic Families, Characteristics of Digital ICs: Fan-in, Fan-out, Current and voltage parameters, Noise immunity, Propagation Delay, Power Dissipation, Figure of Merits, Operating Temperature Range, power supply requirements. Introduction to TTL & CMOS, Comparison between TTL and CMOS

Case study : Vending Machine Controller using Algorithmic State Machines

Unit V - Programmable Logic Devices (06 Hours)

PLDS: PLD, ROM as PLD, Programmable Logic Array (PLA): Implementation procedure, Construction and working, Advantages over read only memory and applications, Programmable Array Logic (PAL): Architecture, Programming PAL's, construction and working, Designing combinational circuits using PLDs.

Case study: Traffic Light Control System Using PLD

Learning Resources

Text Books:

1. Modern Digital Electronics by R.P.Jain, 4th Edition, ISBN 978-0-07-06691-16 Tata McGraw Hill
2. Digital Logic and Computer Design by Moris Mano, Pearson , ISBN 978-93-325-4252-5

Reference Books:

1. John F. Wakerly, "Digital Design: Principles and Practices," Pearson.
2. Mark Bach, "Complete Digital Design", Tata MCGraw Hill, 2005.
3. Charles H. Roth Jr., "Fundamentals of Logic Design," Cengage Learning.

e-Books:

1. https://link.springer.com/book/10.1007/978-3-030-36196-9
2. https://www.mheducation.co.uk/ebook-fundamentals-of-digital-logic-9780077144227-emea

MOOC / NPTEL/YouTube Links: -

1. Digital Circuits by Prof.SantanuChattopadhyay , IIT Kharagpur https://swayam.gov.in/nd1_noc19_ee5
2. Digital Circuits and Systems by Prof. S. Srinivasan , IIT Madras https://nptel.ac.in/courses/117/106/11

3. Microprocessors and Interfacing by Prof Shaikh Rafi Ahamed, IIT Guwahati.https://onlinecourses.nptel
4. VLSI Technology by Dr. Nandita Dasgupta, IIT Madras https://nptel.ac.in/courses/117106093

YouTube/Video Links:

1. https://www.youtube.com/watch?v=CL3ups78jrs
2. https://www.youtube.com/watch?v=ibQBb5yEDlQ

Savitribai Phule Pune University Second Year of Computer Engineering & Computer Science and Engineering (2024 Course)		
EEM-231-COM : Entrepreneurship Development		
Teaching Scheme	**Credits**	**Examination Scheme**
Practical : 2 Hours/Week **Tutorials** : 1 Hour/Week	01 01	**Term Work** : 25 Marks

Course Objectives: The course aims to:

1. Introduce the fundamental principles of entrepreneurship, forms of business organizations, and the startup ecosystem.
2. Enable students to identify, evaluate, and select viable business opportunities using structured techniques.
3. Familiarize students with business models, financial planning, and market validation strategies.
4. Expose students to key marketing strategies, customer acquisition techniques, and branding essentials for startups
5. Develop students' entrepreneurial mindset and their ability to communicate and pitch business ideas effectively using structured storytelling techniques

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1: **Describe** the role of entrepreneurship in economic growth and the startup ecosystem.
- CO2: **Apply** creative techniques to viable business ideas based on customer needs.
- CO3: **Develop** a basic business model using tools like the Business Model Canvas through market research.
- CO4: **Implement** basic marketing strategies for startups.
- CO5: **Deliver** a concise business pitch using storytelling and effective communication techniques.

Course Contents

Unit I - Introduction to Entrepreneurship (03 Hours)

Entrepreneurship: Definition and evolution, Role of entrepreneurship in economic development , Role in job creation, GDP, and innovation.
Characteristics of an Entrepreneur: Key traits: Risk-taking, innovation, pro-activeness, Leadership, perseverance, and resilience
Types of Entrepreneurships: Startup entrepreneurship, Social entrepreneurship, Intrapreneurship (corporate entrepreneurship), Lifestyle and small business entrepreneurship, Forms of Business Organization – Sole proprietorship, partnership, private limited, public limited.
Entrepreneurial Mindset: Growth mindset and adaptability, Creativity and problem-solving, Opportunity recognition and initiative-taking
Overview of the Startup Ecosystem: Key stakeholders: Incubators, accelerators, angel investors, VCs, Government support schemes (Startup India, Atal Innovation Mission, etc.), Global vs. Indian startup ecosystems
Case Study:

1. Ritesh Agarwal – Founder of OYO Rooms (India)
2. Falguni Nayar – Founder of Nykaa (India)

3. Nandan Nilekani – Co-founder of Infosys & Architect of Aadhaar (India) etc.

Unit II -Idea Generation & Opportunity Recognition (03 Hours)

Creativity Techniques for Idea Generation: Definition and importance of creativity in entrepreneurship. Brainstorming: Rules of effective brainstorming. Individual vs. group brainstorming. Mind Mapping: Visual idea structuring using central themes and branches. Tools (manual and digital) for mind mapping.

Understanding Customer Needs and Pain Points: Customer pain points and their identification, Problem-solution fit: Linking pain points to possible solutions. Observational techniques, user interviews, and empathy mapping.

Evaluating Opportunities: Difference between an "idea" and an "opportunity." Basic filters: Desirability, feasibility, and viability. Tools: SWOT Analysis, Opportunity Matrix, Industry trends, market gaps.

Case Study : Analyzing how "Dunzo" or "BigBasket" identified urban pain points and How "Zerodha" scaled in India with a digital-first approach

Unit III - Business Model Development (03 Hours)

Introduction to Business Model Canvas: Definition and purpose of a business model, Overview of the Business Model Canvas by Osterwalder, Benefits of using BMC for startups.

Key Components of BMC: Value Proposition: Defining what unique value the product/service offers. Addressing customer pain points. Customer Segments: Identifying target customers. Creating customer personas Revenue Models: Direct sales, subscriptions, freemium, licensing, etc.

Basic Market Research for Validation: Importance of market research in early-stage business development. Designing effective surveys and customer feedback forms. Conducting basic interviews and analyzing responses. Introduction to MVP (Minimum Viable Product) and feedback loops.

Case study: Map the BMC for a well-known startup (e.g., Uber or Zomato).

Unit IV - Marketing Strategies & Customer Acquisition (03 Hours)

Basics of Branding and Positioning: Introduction to Brand – Elements of brand identity: name, logo, voice, tone, and values. Positioning – How to create a unique space in the customer's mind. Positioning maps, Value-based positioning vs. competitor-based positioning Startup Branding Challenges – Limited budget, building trust, clarity in messaging.

Costing & Pricing Strategies – Fixed vs. variable costs, break-even analysis.

Introduction to Digital Marketing: Distribution Channels: Traditional vs. digital distribution. Social Media Marketing: Platforms overview (Instagram, LinkedIn, Facebook, X/Twitter) Creating a content strategy and calendar Organic vs. paid reach

Search Engine Optimization (SEO): Basics of how search engines work, Keyword research and content optimization, On-page vs. off-page SEO Importance of Digital Presence – Website essentials, blogs, and analytics tools.

Customer Acquisition Strategies: Understanding the Customer Journey – Awareness, interest, decision, action. Early-Stage Customer Acquisition Tactics: Word-of-mouth & referrals, Influencer marketing (micro-influencers), Email marketing basics, building a landing page and collecting leads

Case Studies :

1. Zomato – Branding & Positioning in a Competitive Market
2. Mamaearth – Digital-First Customer Acquisition
3. Nykaa – Customer Segmentation and Channel Strategy

Unit V - Pitching & Business Communication (03 Hours)

Crafting an Elevator Pitch: Definition and purpose, Key elements: Problem, solution, value proposition, target audience, Delivery tips: Clarity, brevity, confidence

Storytelling & Communication: Importance of Storytelling in Business, Structure of a Business Story: Setup, Conflict, Resolution. Communication Skills: Verbal and Non-verbal

Overview of Funding Sources: Public & private capital sources, venture capital, debt financing. Bootstrapping: Meaning, benefits, and risks, Angel investors: Role, expectations, approach, Brief on incubators, government schemes, crowdfunding.

Case study:

1. Shark Tank India – Pitch Analysis (Any Season)
2. Airbnb – The Original Pitch Deck
3. Dropbox – Storytelling Through Demonstration
4. Dunzo – Investor Pitch Evolution

Learning Resources

Text Books:

1. Bygrave, W.D., Zacharakis, A., & Corbett, A.C. Entrepreneurship, 6th Edition, Wiley, 2025. ISBN: 9781394262809.
2. Drucker, Peter F. Innovation and Entrepreneurship: Practice and Principles, Reprint Edition, Harper Business, 2006. ISBN: 9780060851132.
3. Osterwalder, Alexander & Pigneur, Yves. Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers, 1st Edition, Wiley, 2010. ISBN: 9780470876411.

Reference Books:

1. Ries, Eric. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, 1st Edition, Crown Business, 2011. ISBN: 9780307887894.
2. Kawasaki, Guy. The Art of the Start 2.0: The Time-Tested, Battle-Hardened Guide for Anyone Starting Anything, Portfolio (Penguin Random House), 2015. ISBN: 9781591847847.

MOOC / NPTEL/YouTube Links: -

1. Entrepreneurship Essentials By Prof. Manoj Kumar Mondal IIT Kharagpur https://onlinecourses.nptel.ac.in/noc20_ge08/preview
2. Entrepreneurship By Prof. C Bhaktavatsala Rao IIT Madras https://onlinecourses.nptel.ac.in/noc21_mg70/preview
3. https://onlinecourses.nptel.ac.in/noc20_mg35
4. https://www.coursera.org/learn/entrepreneur-guide-beginners
5. https://wadhwanifoundation.org/

YouTube/Video Links

1. https://www.youtube.com/@wadhwani-foundation/videos

List of Assignments

No	Title	Objective	Description
1	Entrepreneurial Mindset Reflection	To encourage students to explore their personal views on entrepreneurship and recognize the key characteristics of an entrepreneurial mindset by studying the journey of a real-world entrepreneur.	**Write a reflective essay** (500–600 words) based on the following: • Explain what entrepreneurship means to you personally. • Identify an entrepreneur (Indian or global) whom you admire and explain the reasons for your admiration. • Highlight specific mindset traits (e.g., risk-taking, resilience, innovation, adaptability) that contributed to this entrepreneur's success. • Reflect on how these traits align with your own strengths or indicate areas you wish to develop.
2	Idea Generation Challenge	To foster creativity, structured brainstorming, and the ability to identify potential business opportunities based on real-world problems.	**Generate 10 Business Ideas** Use any structured brainstorming technique Ideas can be tech-based, social impact, service-based, or product-based 2. Select One Idea- Choose the most promising idea from your list 3. Write a 1-page Concept Summary, include the following: • Problem Identified: Describe the specific problem or pain point your idea addresses. • Solution Overview: Briefly describe your business idea. • Target Audience: Identify the group of people or organizations that would benefit. • Market Potential: Discuss the viability and scalability of the idea.
3	Business Model & Customer Validation	To help students develop a clear, structured business model and test its assumptions through customer conversations. The goal is to learn how to validate ideas through real-world feedback and refine the business concept accordingly.	**Part A: Business Model Canvas** 1. Choose a business idea (from Assignment 2 or a new one). 2. Create a Business Model Canvas with all 9 key blocks: o Customer Segments o Value Propositions o Channels o Customer Relationships o Revenue Streams o Key Resources o Key Activities o Key Partnerships o Cost Structure 3. Present the BMC in visual or tabular format.

			Part B: Customer Interviews & Insights 1. Identify 2–3 potential customers from your target segment. 2. Conduct brief interviews (5–10 minutes each) to gather insights on: o Their pain points o Their reaction to your proposed solution o Willingness to pay or use your product/service 3. Summarize findings in a 1–1.5 page report that includes: o Key customer quotes or paraphrased insights o A revised Value Proposition or Customer Segment block (if needed) o A short reflection: key learnings and potential changes to your idea
4	Business Launch Plan – Marketing & Financial Snapshot	To develop a practical understanding of how marketing stratey and financial planning go hand-in-hand in launching a startup. Students will define a basic marketing campaign and align it with estimated costs, pricing, and projected revenue.	You are preparing to launch your business idea. Prepare a combined Marketing and Financial Snapshot including the following **Part A: Marketing Campaign Plan** • Define your target market by identifying primary customers. • Design a mini-campaign using one or more of the following channels: Social media (e.g., Instagram, LinkedIn) Print/digital flyers Email marketing • Describe the campaign content, including the message or offer to be promoted. • Optionally, create 1–2 sample marketing materials. • Write a 300-word explanation outlining your marketing strategy and expected impact.
			Part B: Financial Snapshot 1. Startup Costs – Estimate your initial costs (fixed + variable) 2. Pricing Strategy – State your pricing model and justification 3. Break-even Analysis – Basic cost vs. sales estimate 4. 6-Month Revenue Projection – Expected sales and income 5. Format: Use a simple table or spreadsheet (optional)

5	Elevator Pitch Video	To help students develop confidence and clarity in presenting their business idea in a short, compelling format. The exercise simulates real-world investor or networking scenarios where entrepreneurs must grab attention quickly.	**Prepare a 90-second elevator pitch for your business idea** (the same or refined idea used in earlier assignments). Your pitch should cover the following elements: o The Problem – Problem Identification o The Solution – Description of your product/service. o Value Proposition – The unique value proposition. o Target Audience – Audience for your idea. o Call to Action – E.g. request for support, funding, feedback, etc. **Deliver Your Pitch:** o Record a video and submit it with written version of your pitch. o Ensure clear speech, confident body language (for video), and persuasive tone. **Reflection (Short Write-up):** o Share what you learned about communicating your idea o Describe challenges or rewards you experienced in the process

Savitribai Phule Pune University Second Year of Computer Engineering & Computer Science and Engineering (2024 Course)		
VEC-232-COM : Universal Human Values and Professional Ethics		
Teaching Scheme	**Credits**	**Examination Scheme**
Theory : 02 Hours/Week	02	**CCE:** 15 Marks **End-Semester Exam**: 35 Marks

Prerequisite Courses, if any :

1. Student Induction Program (SIP)

Course Objectives: The course aims to:

1. To help the students develop a holistic, humane world-vision, and appreciate the essential complementarity between values and skills to ensure mutual happiness and prosperity
2. To elaborate on 'Self-exploration' as the process for Value Education.
3. To facilitate the understanding of harmony at various levels starting from self and going towards family and society.
4. To elaborate on the salient aspects of harmony in nature and the entire existence.
5. To explain how the Right understanding forms the basis of Universal human values and definitiveness of Ethical human conduct.
6. To provide the vision for a holistic way of living and facilitate transition from chaotic life to an orderly life.

Course Outcomes: Upon successful completion of this course, students will be able to:

1. **Recognize** the concept of self-exploration as the process of value education and see they have the potential to explore on their own right.
2. **Explore** the human being as the coexistence of self and body to see their real needs / basic aspirations clearly.
3. **Explain** relationship between one self and the other self as the essential part of relationship and harmony in the family.
4. **Interpret** the interconnectedness, harmony and mutual fulfilment inherent in the nature and the entire existence and **draw** ethical conclusions in the light of Right understanding

Course Contents

Unit I - Introduction to Value Education (07 Hours)

1. Understanding Value Education
2. Self-exploration as the Process for Value Education
3. Continuous Happiness and Prosperity - the Basic Human Aspirations and their Fulfilment
4. Right Understanding, Relationship and Physical Facility
5. Happiness and Prosperity - Current Scenario
6. Method to Fulfil the Basic Human Aspirations

Unit II - Harmony in the Human Being (07 Hours)

1. Understanding Human being as the Co-existence of the Self and the Body
2. Distinguishing between the Needs of the Self and the Body
3. The Body as an Instrument of the Self
4. Understanding Harmony in the Self
5. Harmony of the Self with the Body
6. Programme to Ensure self-regulation and Health

Unit III -Harmony in the Family and Society (08 Hours)

1. Harmony in the Family - the Basic Unit of Human Interaction "Trust' - the Foundational Value in Relationship
2. 'Respect' - as the Right Evaluation
3. Values in Human-to-Human Relationship
4. Understanding Harmony in the Society
5. Vision for the Universal Human Order

Unit IV -Harmony in the Nature (Existence) (08 Hours)

1. Understanding Harmony in the Nature
2. Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature
3. Realizing Existence as Co-existence at All Levels
4. The Holistic Perception of Harmony in Existence
5. Professional Ethics in the light of Right Understanding
6. Strategies for Transition towards Value-based Life and Profession

Learning Resources

Text Books:

1. A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, GP Bagaria, 3rd revised edition, UHV Publications, 2023, ISBN: 978-81-957703-7-3 (Printed Copy), 978-81-957703-6-6 (e-book)
2. Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, GP Bagaria, 3rd revised edition, UHV Publications, 2023, ISBN: 978-81-957703-5-9 (Printed Copy), 978-81-957703-0-4 (e-Book)

Reference Books:

1. P. L. Dhar, R. R. Gaur, 1990, Science and Humanism, Commonwealth Publishers.

2. A. Nagaraj, 1999, Jeevan Vidya: Ek Parichaya, Jeevan Vidya Prakashan, Amarkantak

3. B. P. Banerjee, 2005, Foundations of Ethics and Management, Excel Books.

4. A. N. Tripathy, 2003, Human Values, New Age International Publishers.

5. E. G. Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press

6. B. L. Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

7. M. Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics and Human Values, Eastern Economy Edition, Prentice Hall of India Ltd.

8. M. K. Gandhi, "The Story of my Experiments with Truth", Discovery Publisher

MOOC / NPTEL/YouTube Links: -

1. Swayam Course on "Understanding Human Being Nature and Existence Comprehensively" by Dr. Kumar Sambhav https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

2. NPTEL Course on "Exploring Human Values: Visions of Happiness and Perfect Society" by Prof. A. K. Sharma IIT Kanpur https://nptel.ac.in/courses/109104068

E-Resources: -

1. https://fdp-si.aicte-india.org/download.php#1/

2. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw

Savitribai Phule Pune University Second Year of Computer Engineering & Computer Science and Engineering (2024 Course)		
CEP-241- COM : Community Engagement Project		
Teaching Scheme	**Credits**	**Examination Scheme**
Practical : 04 Hours/Week	02	**Term Work :** 25 Marks **Oral /Presentation :** 25 Marks

Prerequisite : Students should have prior knowledge of

1. Basic understanding of social and ethical responsibilities
2. Teamwork and communication skills acquired in prior coursework or group activities
3. Familiarity with problem-solving methodologies and project planning
4. Conversation in local language

Companion Course :

- CEP is an experiential learning approach that combines education, learning, community development, and meaningful community service.
- Project involves students in community development and service activities and applies the experience to personal and academic development.
- The targeted contribution of college students to the village/local development will benefit the community.
- The college has an opportunity to help students become more socially conscious and responsible while simultaneously becoming a socially conscious organization.

Course Objectives: The course aims to:

1. Establish a mutually beneficial relationship between the college and the community
2. Opportunities to engage with their local community, fostering empathy, teamwork, and problem-solving skills while contributing positively to their surroundings.
3. An understanding of the challenges faced by the local community and the role of engineering in addressing those challenges.
4. The ability to apply technical knowledge and skills to design solutions or interventions that create a positive impact on the community.
5. The skills to evaluate and critically analyze the outcomes of their engagement activities, deriving actionable insights for sustainable impact

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1 - **Identify** and **Analyze** local community needs and challenges by engaging with stakeholders and evaluating real-world problems.
- CO2 - **Design** and **Implement** practical, creative, and context-specific solutions using engineering principles to address community issues.
- CO3 - **Reflect** and **Evaluate** the effectiveness of their interventions and articulate lessons learned through reports and presentations.

Implementation

- A group of 3 to 4 students could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay/college premise.
- Each group /practical batch is allotted to a faculty member of the department as a mentor.
- A division of 60 students can have 3 batches of minimum 20 students. Practical load of 4 hours to be allocated to each batch.
- The group of students will be associated with a government official / village authorities /NGOs etc. concerned, allotted by the district administration, during the duration of the project.
- The Community Engagement Project should be different from the regular programmes of NSS/NCC /Green Club/Hobby Clubs, Special Interests Groups etc
- An activity book has to be maintained by each of the students to record the activities undertaken/involved and will be countersigned by the concerned mentor/HoD.
- Project report shall be submitted by each student/group of students.
- An internal evaluation shall also be conducted by a committee constituted by the HoD. Evaluation to be done based on the active participation of the student and marks could be awarded by the mentor/HoD.
- Students groups can conduct an awareness programme on Health and Hygiene or in Organic Farming or in Fisheries or in advocating prohibition of liquor or about renewable energy, e-waste management or any other activity in an area of their studies and as per his/her aptitude.
- Oral Examination shall consist of presentation and demonstration of the project work carried out by the project groups.

Suggestive list of topics under Community Engagement Project

The below lists are not exhaustive and open for HoD's or mentors to add, delete or modify. It is expected that the focus should be on specific local issues in their nearby areas. The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a student/group of students shall

- Use/ miss-use of cell phones
- Career orientation of youth
- Water facilities and drinking water availability
- Health and hygiene of the school going students, home makers and old personals
- Health intervention and awareness programmes
- Horticulture
- Herbal and Nutrition
- Traditional and Modern health care methods
- Food habits

- Air /Sound /Water pollution
- Plantation and Soil protection
- Renewable energy and Solar Systems
- Yoga awareness and practice
- Health care awareness programmes and their impact
- Organic farming
- Food adulteration
- Incidence of Diabetes and other chronic diseases
- Blood groups and blood levels
- Chemicals in daily life
- Music and dance
- Women education and empowerment

Project Scope

- Conduct workshops or awareness drives on topics like digital literacy, environmental sustainability, mental health, or career planning for local stakeholders.
- Develop a simple prototype or solution that addresses a real-world problem (e.g., a water-saving device, simple mobile apps, or tools for community use).
- Organize clean-up drives, tree plantations, recycling campaigns, or energy conservation initiatives.
- Promote health through awareness programs on hygiene, nutrition, and exercise.
- Teach basic computer or technical skills to students, staff, or the community

Proposal Submission

CEP Group should Submit a two-page project proposal, preferably prior to the term commencement outlining the following:-

- Title of the project
- Aim, Objective and expected outcome
- Plan of execution (timeline and activities).
- Place of the CEP and involvement of any local authority, NGP
- Required resources (if any).
- Get approval from the designated faculty mentor.

Learning Resources

Text Books:

1. Waterman, A. Service-Learning: A Guide to Planning, Implementing, and Assessing Student Projects. Routledge, 1997.

2. Beckman, M., and Long, J. F. Community-Based Research: Teaching for Community Impact. Stylus Publishing, 2016.

3. Design Thinking for Social Innovation. IDEO Press, 2015.

4. Dostilio, L. D., et al. The Community Engagement Professional's Guidebook: A Companion to The Community Engagement Professional in Higher Education. Stylus Publishing, 2017

MOOC / NPTEL/YouTube Links:

1. NPTEL course: Ecology and Society, https://onlinecourses.nptel.ac.in/noc20_hs77/preview

Web Links: -

1. UNESCO: Education for Sustainable Development https://www.unesco.org

2. EPICS (Engineering Projects in Community Service) https://engineering.purdue.edu/EPICS

3. Ashoka: Innovators for the Public https://www.ashoka.org

4. Design for Change https://www.dfcworld.com

Savitribai Phule Pune University, Pune

Maharashtra, India

SE - Computer Engineering

&

SE - Computer Science and Engineering

Semester IV

Savitribai Phule Pune University Second Year of Computer Engineering & Computer Science and Engineering (2024 Course)		
PCC-251- COM : Database Management Systems		
Teaching Scheme	**Credits**	**Examination Scheme**
Theory : 03 Hours/Week	03	**CCE** : 30 Marks **End-Semester:** 70 Marks

Prerequisite Courses :

1. Discrete Mathematics, Data Structures and Algorithms

Course Objectives: The course aims to:

1. To understand database concepts, design principles, and ER/EER modeling.
2. To develop SQL and PL/SQL skills for efficient database operations and procedural programming.
3. To apply normalization techniques for designing well-structured relational databases.
4. To explore database transactions, concurrency control methods, and recovery mechanisms.
5. To analyse NoSQL database models and their role in managing unstructured data.

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1: **Explain** the fundamentals of database management systems, including data models, ER modeling, and database design.
- CO2: **Develop** and **execute** SQL and PL/SQL programs to manage and manipulate relational data.
- CO3: **Apply** normalization techniques to improve database design and ensure data integrity.
- CO4: **Analyze** transaction management concepts and concurrency control techniques for reliable database systems
- CO5: **Evaluate** NoSQL database types and **explain** their suitability for handling unstructured data.

Course Contents

Unit I - Introduction to Database Management System (09 Hours)

Introduction to Database Management Systems, Purpose of Database Systems, Database-System Applications, View of Data, Database Languages, Database System Structure, Enterprise Constraints Data Models, Database Design and ER Model: Entity, Attributes, Relationships, Constraints, Keys, Design Process, Entity Relationship Model, ER Diagram, Design Issues, Extended E-R Features, Converting E-R & EER diagram into tables.

Case Study: Study of Architecture of any DBMS like Oracle or MySQL. Design a database schema for any problem given in previous Question Papers.

Unit II - SQL and PL/SQL (09 Hours)

SQL: DDL, DML, Select Queries, String, Date and Numerical Functions, Aggregate Functions ,View, Indexes, Group by and Having Clause, Join Queries, Set, Set operation, Set membership, Nested queries, DCL, TCL

PL/SQL: Control Statement, Cursor, Stored Procedure and Function, Trigger

Case Study : Design and implement a Student Course Management System using SQL and PL/SQL to manage students, courses, and faculty members efficiently. The system should store and retrieve relevant data, ensuring integrity, security, and performance optimization.

Unit III - Relational Database Design (09 Hours)

Relational Model: Basic concepts, Attributes and Domains, CODD's Rules, Relational Integrity, Referential Integrities, Database Design: Features of Good Relational Designs, Normalization, Atomic Domains and First Normal Form, Decomposition using Functional Dependencies, 2NF, 3NF, BCNF.

Case study: Design and Optimization of a Relational Database for a University Management System

Unit IV - Database Transactions (09 Hours)

Basic concept of a Transaction, Transaction Management, Properties of Transactions, ACID, Concept of Schedule, Serial Schedule, Serializability: Conflict and View, Cascaded Aborts, Recoverable and Non-recoverable Schedules, Concurrency Control: Need, Locking Methods.

Case study : Design Online Shopping Cart Transaction Management In an e-commerce platform, multiple users simultaneously add, update, and purchase products. To ensure data consistency and reliability, the system must handle concurrent transactions effectively.

Unit V - NoSQL Database (09 Hours)

Introduction to NoSQL Database, NoSQL data models, CAP theorem and BASE Properties, Comparative study of SQL and NoSQL, MongoDB: CRUD Operations, Indexing and Aggregation.

Case study: Study NoSQL Database Selection for a Social Media Platform.

Learning Resources

Text Books:

1. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, ISBN 0-07-120413-X, 6th edition
2. Connally T., Begg C., "Database Systems", 4th Edition, Pearson Education, 2002, ISBN 8178088614
3. D T Editorial Services "BIG DATA Black Book", Dreamtech Press ISBN 13 : 9789351199311

Reference Books:

1. C J Date, "An Introduction to Database Systems", Addison-Wesley, ISBN: 0201144719
2. S.K.Singh, "Database Systems: Concepts, Design and Application", Pearson Education, ISBN 978-81-317-6092-5
3. Kristina Chodorow, Michael Dierolf, "MongoDB: The Definitive Guide", O Reilly Publications, ISBN: 978-1-449-34468-9
4. Adam Fowler, "NoSQL For Dummies", John Wiley & Sons, ISBN-1118905628
5. Kevin Roebuck, "Storing and Managing Big Data - NoSQL, HADOOP and More", Emereopty Limited, ISBN: 1743045743, 9781743045749
6. Joy A. Kreibich, "Using SQLite", O'REILLY, ISBN: 13:978-93-5110-934-1
7. Ivan Bayross, "SQL, PL/SQL the Programming Language of Oracle", BPB Publications ISBN: 9788176569644, 9788176569644

MOOC / NPTEL/YouTube Links: -

1. https://nptel.ac.in/courses/106106220
2. https://nptel.ac.in/courses/106105175
3. https://www.mongodb.com/resources/basics/databases/nosql-explained
4. https://learn.microsoft.com/en-us/azure/cosmos-db/nosql/modeling-data

Savitribai Phule Pune University Second Year of Computer Engineering & Computer Science and Engineering (2024 Course)		
PCC-252-COM : Discrete Mathematics		
Teaching Scheme	**Credits**	**Examination Scheme**
Theory : 03 Hours/Week	03	**CCE** : 30 Marks **End-Semester**: 70 Marks

Prerequisite Courses : Students should have prior knowledge of Basic Mathematics

Course Objectives: The course aims to introduce several Discrete Mathematical Structures found to be serving as tools even today in the development of theoretical computer science.

1. To introduce students to understand, explain, and apply the foundational mathematical concepts at the core of computer science.
2. To understand use of set, function and relation models to understand practical examples, and interpret the associated operations and terminologies in context.
3. To acquire knowledge of logic and proof techniques to expand mathematical maturity.
4. To learn the fundamental counting principle, permutations, and combinations.
5. To study how to model problems using graphs and trees.
6. To learn algebraic structures

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1: **Apply** and **Analyze** Set Theory and Propositional Logic
- CO2: **Evaluate** and **Construct** Models using Relations and Functions
- CO3: **Design** and **Implement** Tree Structures and Network Flow Algorithms
- CO4: **Analyze** and **Develop** Solutions using Graph Theory
- CO5: **Apply** and **Solve** Problems using Counting Principles, **Understand** Algebraic structures

Course Contents

Unit I - Set and Propositions (09 Hours)

Introduction and significance of Discrete Mathematics, Propositional Logic- logic, Propositional Equivalences, Application of Propositional Logic- Translating English Sentences, Proof by Mathematical Induction and Strong Mathematical Induction. 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.

Case study: Know about the great philosophers- Georg Cantor, Richard Dedekind and Aristotle. Design a recommendation system using logical propositions and predicates to filter movies based on user preferences.

Unit II - Relations and Functions (09 Hours)

Introduction to Relations and their Properties Representation of Relations using Matrices and Digraphs Equivalence relations, Partial orderings, Partitions, Hasse diagram, Lattices, Chains and Anti-Chains, Transitive closure and Warshall‘s algorithm.

Functions: Types of Functions (Injective, Surjective, Bijective) , Composition and Inverse of Functions , Recursive Functions and Applications in Algorithms, Counting Functions and Growth of Functions

Cast Study - Know about the great philosophers-Dirichlet

Unit III - Introduction to Trees (09 Hours)

Introduction to Trees and Properties decision tree, prefix codes and Huffman coding, Applications of Trees in File Systems, cut sets, The Max flow- Min Cut Theorem in Transport network, Minimum Spanning Tree Algorithms Prims and Kruskal algorithm

Case Studies - Algebraic Expression Tree, Tic-Tac-Toe Game Tree, implement a file directory system using a tree structure, allowing hierarchical organization of files and folders

Unit IV - Introduction to Graph Theory (09 Hours)

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

Case study : Model a social media platform using directed graphs to represent relationships such as "follower" or "friend." Three utility problem, Web Graph, Google map

Unit V - Counting Principles and Algebraic Structures - (09 Hours)

Basic Counting Techniques: Addition and Multiplication Principles, Permutations and Combinations, Binomial Coefficients and Pascal's Triangle, Pigeonhole Principle and its Applications, Inclusion-Exclusion Principle, Generating Functions for Counting Problems.

The structure of algebra - Algebraic Systems, Semi Groups, Monoids, Groups, Homomorphism and Normal Subgroups and Congruence relations, Rings, Integral Domains and Fields.

Case Studies - Study Sudoku solving algorithms and algorithm for generation of new SUDOKU. Study Hank-shake Puzzle and algorithm to solve it Calculate the number of possible password combinations given specific constraints on length, character types, and repetition

Learning Resources

Text Books:

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Tata McGraw-Hill, ISBN 978-0-07-288008-3
2. Bernard Kolman, Robert C. Busby and Sharon Ross, "Discrete Mathematical Structures", Prentice-Hall of India /Pearson, ISBN: 0132078457, 9780132078450.
3. Narsingh Deo, "Graph with application to Engineering and Computer Science", Prentice Hall of India, 1990, 0 – 87692 – 145 – 4.
4. Eric Gossett, "Discrete Mathematical Structures with Proofs", Wiley India Ltd, ISBN:978-81-265-2758-8.
5. Sriram P.and Steven S., "Computational Discrete Mathematics", Cambridge University Press, ISBN 13: 978-0-521-73311-3.
6. Herstein, I. N. Topics in Algebra. 2nd ed., Indian Adaptation, Wiley India Pvt. Ltd., 2006. ISBN: 9788126510184.

E-Book

1. https://www.ebookphp.com/discrete-mathematical-structures-6th-edition-epub-pdf/
2. http://discrete.openmathbooks.org/pdfs/dmoi-tablet.pdf
3. http://home.iitk.ac.in/∼arlal/book/mth202.pdf
4. https://web.stanford.edu/class/cs103x/cs103x-notes.pdf

5. http://home.iitk.ac.in/∼arlal/book/mth202.pdf

MOOC/NPTEL/SWAYAM Course Links:

1. https://onlinecourses.nptel.ac.in/noc20_cs82/preview
2. https://nptel.ac.in/courses/106108227
3. https://nptel.ac.in/courses/106106094

Savitribai Phule Pune University Second Year of Computer Engineering & Computer Science and Engineering (2024 Course)		
PCC-253-COM : Computer Organization and Microprocessor		
Teaching Scheme	**Credits**	**Examination Scheme**
Theory : 02 Hours/Week	02	**CCE** : 30 Marks **End-Semester:** 70 Marks

Prerequisite Courses : Digital Electronics and Logic Design

Course Objectives: To provide students with a foundational understanding of computer evolution, memory management, the 8086 microprocessor, memory organization, interrupts, and parallel organization in computer systems.

1. Learn about the history and development of computers and how their performance has improved over time.
2. Understand how memory is managed in a computer and the techniques used to store and access data efficiently.
3. Get familiar with the 8086 microprocessor, its basic functions, and its role in computer systems.
4. Learn how memory is organized in a computer and how interrupts help manage tasks.
5. Understand the basics of parallel organization and how it improves the speed and performance of computer systems.

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1: Understand and analyze computer system design and historical development of computers and foundational architectures like Von Neumann and Harvard.
- CO2: To design and optimize internal, and external memory systems for high-performance computing.
- CO3: To understand fundamental knowledge of the 8086-microprocessor architecture, programming model, addressing modes, and instruction set.
- CO4: To understand memory management, I/O operations and interrupt handling, including address translation, memory banks and interrupt controllers.
- CO5: To explore the multiprocessor systems, Flynn's Taxonomy and RISC design principles, including memory architectures

Course Contents

Unit I - Computer Evolution and Performance (06 Hours)

A Brief History of Computers, Von Neumann Architecture, Harvard Architecture, Designing for Performance, Evolution of Intel processor architecture- 4 bit to 64 bit, performance assessment. A top level view of Computer function and interconnection Computer Components, Interconnection structure, bus interconnection,

Computer Arithmetic- The Arithmetic and Logic Unit, addition and subtraction of signed numbers, design of adder and fast adder, carry look ahead addition, multiplication of positive numbers, signed operand multiplication, Booths algorithm for multiplying binary integers.

Case Study: Evolution (Brief History) of Microprocessors

Unit II - Memory Management (06 Hours)

Characteristics of Memory System, The memory hierarchy.

Cache Memory- Cache memory principles, Elements of cache design cache address, size, and mapping functions. Replacement algorithms, write policy, line size, number of cache, one level and two level cache. Performance characteristics of two level cache- locality & operations.
Internal Memory- semiconductor main memory, advanced DRAM organization. External Memory- Hard Disk organization. RAID- level 1 to level 6.

Case Study : Memory Management in ATMs

Unit III - Introduction to 8086 Microprocessor (06 Hours)

8086 Architecture: Introduction to 16 bit microprocessor, Architecture and Pin diagram of 8086, Programmers model of 8086 (Registers).
Addressing modes of 8086: Immediate Addressing, Register Addressing, Direct Addressing, Indirect Addressing, Indexed Addressing, Based Addressing, Based Indexed Addressing
Instruction set of 8086: Data Movement Instructions, Arithmetic Instructions, Logic Instructions, Control Transfer Instructions, String Instructions, Input / Output Instructions, Flag Control Instructions, Process Control Instructions, Other Instructions.

Case study: Design of Basic Calculator Using 8086

Unit IV - Memory Organization and Interrupts (06 Hours)

Memory Organization: Segmentation, logical to physical address translation, even and odd memory banks, Read write cycle timing diagrams, Address mapping and decoding, I/O: memory mapped I/O & I/O Mapped I/O.
Interrupts: Interrupt Control & status registers, Interrupt Vector Table (IVT), ISR, Hardware and software Interrupts, 8259 (Programmable Interrupt Controller): Features, Block Diagram, Control & Status registers.

Case study : Memory and Interrupt Management in an Automated Railway Reservation System

Unit V - Parallel Organization (06 Hours)

Multiprocessors, Clusters, Flynn's Taxonomy for Multiple Processor Organizations, Closely and Loosely Coupled Multiprocessors Systems, Symmetric Multiprocessor (SMP) Organization, UMA, NUMA.
RISC: Instruction execution characteristics, use of large register file, compiler-based register optimization, RISC architecture and pipelining. RISC Vs CISC.

Case study:Multi-core System

Learning Resources

Text Books:

1. W. Stallings, Computer Organization and Architecture: Designing for performance, Pearson Education/ Prentice Hall of India, 2003, ISBN 978-93-325-1870-4, 7 th Edition.
2. Zaky S, Hamacher, —Computer Organization, 5th Edition, McGraw-Hill Publications, 2001, ISBN- 978-1-25-900537-5, 5th Edition.
3. Douglas Hall, "Microprocessors & Interfacing", McGraw Hill, Revised 2 Edition,
4. A. Ray, K. Bhurchandi, "Advanced Microprocessors and peripherals: Arch, Programming & Interfacing" Tata McGraw Hill,2004 ISBN 0-07-463841.

Reference Books:

1. John P Hays, —Computer Architecture and Organization, McGraw-Hill Publication, 1998, ISBN:978-1-25-902856-4, 3rd Edition.
2. Miles Murdocca and Vincent Heuring, —Computer Architecture and Organization- an integrated approach, Wiley India Pvt. Ltd, ISBN:978-81-265-1198-3, 2nd Edition

3. A. Tanenbaum, —Structured Computer Organization||, Prentice Hall of India, 1991 ISBN: 81 – 203 – 1553 – 7, 4th Edition.

4. Patterson and Hennessy, —Computer Organization and Design, Morgan Kaufmann Publishers In, ISBN 978-0-12-374750-1, 4th Edition.

5. Liu, Gibson, "Microcomputer Systems: The 8086/88 Family", 2 nd Edition, PHI,2005.

6. Kenneth Ayala, "The 8086 Microprocessor: Programming & Interfacing the PC"

MOOC / NPTEL/YouTube Links: -

1. NPTEL course on "Computer architecture and organization" By Prof. Indranil Sengupta, Prof. Kamalika Datta, IIT Kharagpur https://swayam.gov.in/nd1_noc21_cs61/preview

2. NPTEL course on "Microprocessor & Interfacing" By Prof. Shaik Rafi Ahamed, IIT Guwahati https://archive.nptel.ac.in/courses/108/103/108103157/

3. Complete COA Computer Organization & Architecture in one shot, Semester Exam, Hindi, https://www.youtube.com/watch?v=DsK35f8wyUw

4. 8086 Microprocessor Architecture - Bharat Acharya, Hindi, https://www.youtube.com/watch?v=Dmw

5. Microprocessor 8086 - YouTube Playlist https://www.youtube.com/playlist?list=PLgwJf8NK-2e4oAeDid0hwuiol_RJdscrp

Savitribai Phule Pune University Second Year of Computer Engineering & Computer Science and Engineering (2024 Course)		
PCC-254-COM : Database Management Laboratory		
Teaching Scheme	**Credits**	**Examination Scheme**
Practical : 02 Hours/Week	01	**Term Work :** 25 Marks **Practical :** 25 Marks

Companion Course : Database Management Systems

Course Objectives: The course aims to:

1. To understand and apply the concepts of database design by formulating case studies, creating E-R diagrams, and mapping them to the relational model.
2. To develop and execute SQL queries for creating, modifying, and managing database structures using DDL, DML, DCL, and TCL commands.
3. To implement advanced SQL operations, including aggregate functions, joins, subqueries, views, stored procedures, and triggers, for efficient database management.
4. To explore NoSQL databases by designing and implementing CRUD operations in MongoDB, understanding document-based storage and retrieval.

Course Outcomes: Upon successful completion of this course, students will be able to:

1. **Apply** the concepts of database design by creating E-R diagrams and converting them into relational models.
2. **Develop** and **execute** SQL queries for data manipulation, transaction control, and access management using DML, DCL, and TCL commands.
3. **Analyze** and **implement** SQL operations, including joins, views, subqueries, stored procedures, and triggers, to optimize data retrieval and integrity.
4. **Design** and **Implement** CRUD operations in MongoDB, demonstrating an understanding of NoSQL database concepts and their practical applications.

Course Contents

Guidelines for Instructor's Manual

The instructor's manual/Lab 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, 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. Students programs maintained on cloud or college server by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory for accreditation purpose.

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 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 needs 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 them 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, instructors may assign one real life application in the form of a mini-project based on the concepts learned. Instructors may also set one assignment or mini-project that is suitable to respective branch beyond the scope of the syllabus.

Operating System recommended :- 64-bit Open source Linux or its derivative
Programming tools recommended: - MYSQL/Oracle, MongoDB, ERD plus, ER Win

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.

Suggested List of Laboratory Experiments/Assignments

Sr.	Name of Assignment

1	**Case Study and ER Diagram** Develop a case study and design its Entity-Relationship (ER) Diagram. Convert the ER model into a relational model.
2	**Write and execute SQL Data Definition Language** (DDL) commands such as CREATE, ALTER, DROP, RENAME, and TRUNCATE to define and modify tables. Insert data into the tables and apply appropriate integrity constraints such as NOT NULL, UNIQUE, PRIMARY KEY, FOREIGN KEY, and CHECK. (The application may vary as per the subject teacher's requirement.)
3	**SQL Queries for Data Manipulation, Access Control, and Transactions** Design and run SQL queries to demonstrate the following: a) Data Manipulation (DML): Use SQL statements to INSERT, UPDATE, and DELETE records. Apply arithmetic, logical, set operators, pattern matching, and string functions. b) Access Control (DCL): Use GRANT, REVOKE, and ROLE commands to manage user access. c) Transaction Control (TCL): Apply START TRANSACTION, COMMIT, ROLLBACK, and SAVEPOINT commands to manage transactions.
4	**Aggregate Functions and Grouping** Use aggregate functions along with GROUP BY and HAVING clauses to retrieve summarized data from the database.
5	**JOIN Operations and Views** Perform various types of JOIN operations to extract meaningful relationships between tables. Create and manage different database views.
6	**Subqueries** Write and execute subqueries to retrieve data from one table based on results from another.
7	**Stored Procedures or Function with Cursors** Create and execute stored procedures / function using cursors.
8	**Database Triggers** Implement and test triggers to maintain data integrity in database.
9	**CRUD Operations using MongoDB** Design and implement basic Create, Read, Update, and Delete (CRUD) operations using MongoDB. Use the save method and logical operators where necessary.
10	**Aggregation and Indexing in MongoDB** Design and execute MongoDB queries using aggregation and indexing techniques with suitable examples.

11	Using the database concepts covered in above assignments, develop an application with following details: 1. Follow the Software Development Life cycle and other concepts learnt in Software Engineering Course throughout the implementation. 2. Develop application considering: • Front End: Java/Perl/PHP/Python/Ruby/.net/any other language • Backend : MongoDB/ MySQL/Oracle 3. Test and validate application using Manual/Automation testing. 4. Student should develop application in group of 2-3 students and submit the Project Report which will consist of documentation related to different phases of Software Development Life Cycle: • Title of the Project, Abstract, Introduction • Software Requirement Specification • Conceptual Design using ER features, Relational Model in appropriate Normalize form • Graphical User Interface, Source Code • Testing document • Conclusion

Note

- Instructor should maintain progress report of mini project throughout the semester from project group.
- The practical exam will be based on Assignments 1 through 10 provided above.
- Mini Project in this course should facilitate the Project Based Learning among students

Savitribai Phule Pune University Second Year of Computer Engineering & Computer Science and Engineering (2024 Course)		
PCC-255-COM : Microprocessor Lab		
Teaching Scheme	**Credits**	**Examination Scheme**
Practical : 02 Hours/Week	01	**Oral :** 25 Marks

Prerequisite Courses : Microprocessor

Course Objectives: The course aims to:

1. To understand assembly language programming instruction set
2. To understand different assembler directives with example
3. To apply instruction set for implementing X86/64 bit assembly language programs

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1 - **Understand** and **apply** various addressing modes and instruction set to implement assembly language programs
- CO2 - **Apply** logic to implement code conversion
- CO3 - **Analyze** and apply logic to demonstrate processor mode of operation

Course Contents

Guidelines for Instructor's Manual

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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. Students programs maintained on cloud or college server by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory for accreditation purpose.

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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 needs 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 them 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, instructors may assign one real life application in the form of a mini-project based on the concepts learned. Instructors may also set one assignment or mini-project that is suitable to respective branch beyond the scope of the syllabus.

Operating System: Latest 64-bit Version and update of Microsoft Windows 7/ Windows 8 Operating System onwards or 64-bit Open source Linux or its derivative.
Programming Tools: Preferably using Linux equivalent or MASM 64x or equivalent, Microsoft Visual Studio x64 Intrinsic

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.

	Suggested List of Assignment (Any NINE)
1	Write an X86/64 ALP to accept five 64 bit Hexadecimal numbers from user and store them in an array and display the accepted numbers.
2	Write an X86/64 ALP to accept a string and to display its length.
3	Write an X86/64 ALP to count number of positive and negative numbers from the array.
4	Write X86/64 ALP to perform non-overlapped block transfer without string specific instructions. Block containing data can be defined in the data segment.
5	Write X86/64 ALP to perform overlapped block transfer with string specific instructions Block containing data can be defined in the data segment
6	Write X86/64 ALP to perform multiplication of two 8-bit hexadecimal numbers. Use successive addition method only.
7	Write an X86/64 ALP to find the largest of given Byte/Word/Dword/64-bit numbers.
8	Write a switch case driven X86/64 ALP to perform 64-bit hexadecimal arithmetic operations (+,-,*, /) using suitable macros. Define procedure for each operation
9	Write X86/64 ALP to convert 4-digit Hex number into its equivalent BCD number
10	Write X86/64 ALP to convert 5- digit BCD number into its equivalent HEX number.

Suggested List of Assignment (Any NINE)	
11	Study of Motherboard. Motherboards are complex. Break them down, component by component, and Understand how they work. Choosing a motherboard is a hugely important part of building a PC. Study- Block diagram, Processor Socket, Expansion Slots, SATA, RAM, Form Factor, BIOS, Internal Connectors, External Ports, Peripherals and Data Transfer, Display, Audio, Networking, Overclocking, and Cooling.

Learning Resources

Text Books:

1. Douglas Hall, “Microprocessors & Interfacing”, McGraw Hill, Revised 2 Edition,
2. A. Ray, K.Bhurchandi, ”Advanced Microprocessors and peripherals: Arch, Programming & Interfacing”Tata McGraw Hill,2004 ISBN 0-07-463841

Savitribai Phule Pune University Second Year of Computer Engineering & Computer Science and Engineering (2024 Course)		
MDM-271-COM : Internet of Things		
Teaching Scheme	**Credits**	**Examination Scheme**
Theory : 02 Hours/Week	02	**CCE** : 30 Marks **End-Semester:** 70 Marks

Prerequisite Courses, if any :

1. Digital Electronics and Logic Design

Course Objectives: The course aims to:

1. To study the fundamentals about IoT
2. To acquire knowledge of sensor, actuators
3. To understand about IoT Access technologies and understand application protocols for IoT
4. To comprehend cloud and services in the field of IoT
5. To develop various application in IoT

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1: **Understand** fundamental and ecosystem of IoT.
- CO2: Interface different sensors and actuators with IoT development boards.
- CO3: **Illustrate** different layers of IoT protocols.
- CO4: **Use** of cloud and its services.
- CO5:**Apply** and **develop** domain specific IoT applications.

Course Contents

Unit I - Introduction to IoT (06 Hours)

What is Internet of Things: Definition & Characteristics of IoT, Evolution of IoT, Convergence of IoT, IoT Challenges, M2M Communication, Things in IoT, IoT Protocols, Functional blocks of IoT Ecosystem, Communication Models, Communication APIs, IoT enabled Technologies: Wireless Sensor Network, Cloud Computing, Big Data Analytics, Embedded Systems, IoT enabled Applications.

Case Study: Home Automation

Unit II - Introduction to Sensors, Actuator (06 Hours)

Sensors/Transducers – Definition, Principles, Classifications, Types, Characteristics and Specifications,

Actuators -– Definition, Principles, Classifications, Types, Characteristics and Specifications

IoT Development Boards: Arduino IDE and Board Types, Raspberry Pi, NodeMCU, ESP 32, Beaglebone

Case Study : Interfacing Sensors

Unit III - Protocols for IoT (06 Hours)

IoT Access Technologies: Physical and MAC layers, IEEE 802.15.4, 802.11ah and Lora WAN, Network Layer- IP versions 4 & 6 ,6LoWPAN, IoT Application Layer Protocols – CoAP and MQTT, Transport Protocols - Zigbee, Bluetooth, BLE, ZWave

Case study: MQTT

Unit IV -Cloud for IoT (06 Hours)

Fundamentals of Cloud Computing, Types of Cloud services- AWS, Azure, Adafruit, IoT with Cloud, Challenges faced in cloud services, selection of cloud for IoT applications

Case study : How to use Adafruit cloud

Unit V -IoT Applications (06 Hours)

Smart Cities – Smart Parking, Smart Lighting, Smart Roads, Structural Health Monitoring, Surveillance

Energy – Smart Grids, Renewable Energy Systems, Prognostics

Environment – Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection, River Floods Detection

Agriculture – Smart Irrigation, GreenHouse Control

Industry – Machine Diagnostics & Prognosis, Indoor Air Quality Monitoring

Health & Lifestyle – Health & Fitness Monitoring, Wearable Electronics

Case study: IoT Analytics: Thingspeak

Learning Resources

Text Books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, “IoT Fundamentals – Networking Technologies, Protocols, and Use Cases for the Internet of Things”, 1st Edition, Published by Pearson Education, Inc, publishing as Cisco Press, 2017.
2. Hakima Chaouchi, “The Internet of Things - Connecting Objects to the Web”, 1st Edition, Wiley, 2010.
3. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – Hands-On Approach”, 2nd Edition, Universities Press, 2016.
4. Perry Lea, “Internet of things For Architects”, 1st Edition, Packt Publication, 2018
5. Simone Cirani, Gianluigi Ferrari, Marco Picone, Luca Veltri, “Internet of Things:Architectures, Protocols and Standards”, Wiley

Reference Books:

1. Raj Kamal, Internet of Things: Architecture and Design Principles, McGraw Hill Education, 1st Edition, 2017

2. Adrian McEwen & Hakim Cassimally, “Designing the Internet of Things”, 1st Edition, Wiley, 2014.

3. David Hanes, Gonzalo Salgueiro, IoT Fundamentals Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 1st Edition, 2017.

4. Donald Norris, “Raspberry Pi – Projects for the Evil Genius”, 2nd Edition, McGraw Hill, 2014.

MOOC / NPTEL/YouTube Links:

1. https://onlinecourses.nptel.ac.in/noc22_cs53/preview

E-Books :

1. https://pg.its.edu.in/sites/default/files/KCA043%20Internet%20of%20things%20IoT%20by%20Raj%
2. https://aitskadapa.ac.in/e-books/CSE/IOT/Internet%20of%20Things_%20Architectures,%20Protocol
3. https://jcer.in/jcer-docs/E-Learning/Digital%20Library%20/E-Books/Internet-of-things-a-hands-on-approach-%20Arshadeep.pdf

Savitribai Phule Pune University Second Year of Computer Engineering & Computer Science and Engineering (2024 Course)		
VSE-281-COM : Web Development		
Teaching Scheme	**Credits**	**Examination Scheme**
Practical : 04 Hours/Week	02	**Term Work** : 25 Marks **Practical :** 25 Marks

Course Objectives: The course aims to:

1. Understand Internet basics, including protocols, client-server architecture, and network security essentials.
2. Develop structured web pages using HTML, CSS, and Bootstrap for responsive front-end design.
3. Implement interactivity with JavaScript and DOM manipulation techniques.
4. Build dynamic web applications using PHP for back-end logic and server-side processing.

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1: **Explain** the fundamentals of Internet architecture, protocols, and client-server interactions.
- CO2: **Design** responsive web pages using HTML, CSS, and Bootstrap frameworks
- CO3: **Apply** JavaScript and DOM to **create** dynamic and interactive web content
- CO4: **Develop** server-side functionality using PHP for dynamic content generation and form handling

Course Contents

Unit I - Introduction to Internet and Web Development (05 Hours)

Introduction to Internet Basics: Protocols, Servers and Clients, Functions of server and client, web Development

Case Study: Users (students) act as clients accessing the system through HTTP.

Unit II - Hyper Text Markup Language (05 Hours)

Static & dynamic web Application, HTML: Fundamentals/ Basic HTML, Text formatting on Web Pages, Incorporate images, Creating hyperlinks, complex image maps, tables and nested tables, Inserting web page, Setting & modifying field properties.

Case Study : Create a feedback form using HTML <form>, <input>, <textarea>, <select>, and <button>.

Unit III - Cascading Style Sheet (CSS) (05Hours)

CSS: Introduction, types of CSS: Internal, External & inline, Designing with Style Sheets, Style Sheet Syntax, ID, types of Selectors. Bootstrap: Overview, Bootstrap Works, Component.

Case study: Style the feedback form using internal or external CSS.

Unit IV - JavaScript- (05 Hours)

Javascript & DoM: Introduction to JavaScript, Variables and Objects, Decision Making Statement, Loops, Arrays, Functions & Prototypes, Core JavaScript Objects, DOM Introduction, DOM Structure.

Case study : Show a popup (alert) for confirmation using JavaScript.

Unit V - Back End Technologies - (05 Hours)

PHP: Introduction, PHP Document, Language Fundamentals, Decision Making Statement, Loops, Statements, Operators, PHP functions, Arrays & Functions, String Functions.

Case study: Print submitted data back as confirmation or save to a .txt or database (optional).

Practical Assignments

Week	Topics to be covered
1	Create a simple HTML page displaying personal details using text formatting tags.
2	Design a web page that includes an image, hyperlink, and a nested table.
3	Create a form with fields: name, email, gender, date of birth, and submit button.
4	Apply internal, external, and inline CSS to style a web page with headings and tables.
5	Develop a responsive web page using Bootstrap Grid and Components.
6	Write a JavaScript program to validate form inputs (e.g., email, empty fields).
7	Create a web page that uses JavaScript to display dynamic content using DOM.
8	Write a JavaScript program for a simple calculator using functions and switch-case.
9	Design a PHP script to display "Welcome" message and current date & time.
10	Write a PHP program to accept form input and display it using the POST method.
11	Implement a PHP program for string manipulation (e.g., reverse, length, substring).
12	Create a PHP script to store and display values in an array.

Savitribai Phule Pune University Second Year of Computer Engineering & Computer Science and Engineering (2024 Course)		
AEC-282- COM: Modern Indian Language (Marathi)		
Teaching Scheme	**Credits**	**Examination Scheme**
Tutorial : 01 Hour/Week **Practical** : 02 Hours/Week	01 01	**Term Work** : 50 Marks

Course Objectives: The course aims to:

अभ्यासक्रमाची उद्दिष्टे :

१. प्रगत भाषिक कौशल्यांची क्षमता विकसित करणे.
२. प्रसारमाध्यमांतील संज्ञापनातील स्वरूप आणि स्थान स्पष्ट करणे.
३. व्यक्तिमत्त्व विकास आणि भाषा यांच्यातील सहसंबंध स्पष्ट करणे.
४. लोकशाहीतील जीवनव्यवहार आणि प्रसारमाध्यमे यांचे परस्पर संबंध स्पष्ट करणे.
५. प्रसारमाध्यमांसाठी लेखनक्षमता विकसित करणे.

Course Contents

Unit I & II (07 Hours & 08 Hours)

घटक	तपशील
१	१. भाषा आणि व्यक्तिमत्त्व विकास : सहसंबंध २. लोकशाहीतील जीवनव्यवहार आणि प्रसारमाध्यमे
२	प्रसारमाध्यमांसाठी लेखन १ वृत्तपत्रासाठी बातमीलेखन आणि मुद्रितशोधन २ नभोवाणीसाठी भाषणाची संहितालेखन ३ दूरचित्रवाणीसाठी माहितीपटासाठी संहितालेखन

Case Study:

Unit III & IV (07 Hours & 08 Hours)

१	१. भाषा, जीवन व्यवहार आणि नवमाध्यमे, समाजमाध्यमे २. नवमाध्यमे आणि समाजमाध्यमांचे प्रकार : ब्लॉग, फेसबुक, ट्विटर. ३. नवमाध्यमे आणि समाजमाध्यमांविषयक साक्षरता, दक्षता, वापर आणि परिणाम
२	१. वेबसाईट आणि ब्लॉग, ट्विटरसाठी लेखन २. व्यावसायिक पत्रव्यवहार

Learning Resources

Text Books:

संदर्भ ग्रंथ :

१ सायबर संस्कृती, डॉ. रमेश वरखेडे
२ उपयोजित मराठी, संपादक डॉ. केतकी मोडक, संतोष शेणई, सुजाता शेणई
३ ओळख माहिती तंत्रज्ञानाची, टिमोथी जे. ओ लिअरी
४ संगणक, अच्युत गोडबोले, मौज प्रकाशन, मुंबई.
५ इंटरनेट, डॉ. प्रबोध चोबे, मनोरमा प्रकाशन, मुंबई.
६ व्यावहारिक मराठी, डॉ. ल. रा. नसिराबादकर, फडके प्रकाशन, कोल्हापूर.
७ आधुनिक माहिती तंत्रज्ञानाच्या विश्वात, शिक्रापूरकर दीपक, मराठे उज्ज्वल, उत्कर्ष प्रकाशन, पुणे.

Guidelines Term Work conduction and Evaluation

Implementation Guidelines

1. Subject teacher should frame minimum 08 assignments-based covering on all four units.
2. Scaffolding: Start with simpler tasks and gradually increase complexity. Provide necessary vocabulary and grammatical structures beforehand.
3. Differentiation: Offer varied levels of support for students with different proficiency.
4. Pair Work & Group Work: Encourage collaborative learning and peer correction.
5. Feedback: Provide constructive feedback on all assignments, focusing on both accuracy and fluency.
6. Authentic Materials: Use real-world Marathi materials (simple songs, short videos, advertisements) as much as possible.
7. Cultural Context: Integrate cultural aspects into the assignments (e.g., describing a Marathi festival, a famous personality).
8. Fun & Engaging: Make the activities enjoyable to keep students motivated. Use games and competitive elements where appropriate.
9. Technology Integration: Use online dictionaries, translation tools (with caution), and Marathi typing tools.
10. These assignments can be adapted based on the students' proficiency level and the specific learning objectives of the Marathi course.

Suggested List of Assignments

1. "Samvad Sadara Kara" (Present a Dialogue): Role-Playing Everyday Scenarios: Objective is to practice conversational Marathi, understanding social cues. In pairs or small groups, students create and perform a short dialogue based on a given scenario.
2. Vartamanpatra Vachan" (Newspaper Reading): (Columns like Sports, political, finance, editorial, education, international news etc) in the daily Marathi newspapers, summarize and present in the practical. A summary should be added as part of the journal.
3. Creative writing: Write blogs and posts on social media up to 200 words on recent development in their field of study
4. "Mala He Sangayche Aahe" (I Want to Say This): Students are expected to show the objects and describe it to the class in Marathi. They should mention its color, size, use, why it's important to them, etc.
5. Professional letter / report writing
   (a) Write a letter to the principal/director for organizing NSS camp in nearby village. Preparation of the budget, permission letters and report submission in the University
   (b) Write a letter for internship sponsorship to any organization.
6. Book Review – Students are expected to read any novel, fiction or literature book of their choice and write a review on post it on social media of their choice.

7. Participation in Competitions (in college/out side the college) debate, declamation, elocution – A Report should be submitted

8. Group Activity: Road show, skit play, one-act play

9. Participation in One-Act-Play - Participation in Purushottam karandam, Firodia karandak, Dajikaka Gadgil Karandak and Shreetej Karandak.

10. Marathi Film Review – Watch the Marathi movie widely available on an OTT (Over-The-Top) platform , broadcaster in Television or availle on YouTube and write a review.

Savitribai Phule Pune University Second Year of Computer Engineering and Computer Science and Engineering (2024 Course)		
EEM-283-COM : Engineering Product Design		
Teaching Scheme	**Credits**	**Examination Scheme**
Tutorial : 01 Hour/Week **Practical** : 02 Hours/Week	01 01	**Term Work :** 25 Marks

Course Objectives: The course aims to:

1. Apply and learn about the product design life cycle, giving particular attention to market demand and user needs.
2. Promote innovative thinking and ideation to address practical issues with a product-focused strategy.
3. Use both digital and physical tools to create low- to high-fidelity prototypes.
4. Incorporate multidisciplinary knowledge into product design, such as accessibility, ethics, cost-effectiveness, and sustainability.
5. Collaborate in groups to jointly create and showcase product concepts with functional models and supporting documentation.

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1: **Use** the design thinking technique to identify and characterize user-centric problems and generate innovative product concepts.
- CO2: **Create** and **present** working prototypes while taking accessibility, sustainability, and usability into account.
- CO3: **Collaborate** in groups to properly study, **evaluate**, and communicate the entire product design process in order to document and present it.

Course Contents

Guidelines for Instructor's Manual

The instructor's manual/Lab 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, 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. Students programs maintained on cloud or college server by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory for accreditation purpose.

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.

	Suggested List of Assignment (Any SIX)
1	Ideation and Problem Identification: Identify a real-world problem in the domains of healthcare, agriculture, education, or urban living that can be addressed through a technological product. Tools: Mira, Figma, or Canva
2	User-Centred Design and Wireframing: Develop wireframes for a mobile or web application focusing on user experience and interface design. Tools: Figma, Adobe XD
3	Rapid Prototyping with IoT Integration: Create a functional prototype of a smart device (e.g., smart irrigation system, health monitoring wearable) integrating sensors and microcontrollers. Tools: Arduino, Raspberry Pi, Tinkercad
4	Design for Sustainability: Redesign an existing electronic product to enhance its sustainability by focusing on energy efficiency, recyclability, and minimal environmental impact. Tools: AutoCAD, SolidWorks, or Fusion 360
5	Human-Computer Interaction (HCI) Evaluation: Conduct usability testing on a software application to assess its user-friendliness and accessibility. Tools: UsabilityHub, Google Forms, or Hotjar
6	Value Engineering and Cost Analysis: Analyze the cost components of a tech product and propose design modifications to reduce costs without compromising quality. Tools: Excel, Costimator, or custom spreadsheets
7	Inclusive Design Challenge: Design a product interface that is accessible to users with disabilities, ensuring compliance with accessibility standards. Tools: WAVE, Axe, or Lighthouse
8	Ethical and Legal Aspects in Product Design: Understand and evaluate the ethical, legal, and societal implications of a tech-based product. Tools: Word processors, Canva for presentations

Learning Resources

Text Books:

1. Dr. M. A. Bulsara, Dr. H. R. Thakkar, Charotar Publishing House Pvt. Ltd., 2nd Edition 2015 (Revised & Enlarged) ISBN : 9789385039140
2. Product Design for Engineers by Devdas Shetty, Cengage Publishing, ISBN: 9788131533031
3. Product Design and Development, Karl T. Ulrich, Steven D. Eppinger, McGraw-Hill Education, ISBN:9-78-1259060380
4. The Design of Everyday Things, Don Norman, Basic Books, ISBN:9780465050659
5. Design Thinking for Strategic Innovation, Idris Mootee, Wiley, ISBN: 9781118620120

Reference Books:

1. Change by Design, Tim Brown (IDEO), HarperBusiness, ISBN: 9780061766084
2. Engineering Design: A Project-Based Introduction, Clive Dym, Patrick Little, Wiley, ISBN: 97811183245
3. Creative Confidence: Unleashing the Creative Potential Within Us All, Tom Kelley, David Kelley, Crown Business, ISBN:9780385349369

NPTEL Online Courses:

1. Product Design and Manufacturing, [NPTEL Link](https://onlinecourses.nptel.ac.in/noc21_me66/prev
   Prof. J. Ramkumar, Prof. Amandeep Singh, IIT Kanpur

2. Design Thinking - A Primer, [NPTEL Link](https://onlinecourses.nptel.ac.in/noc22_mg32/preview),
   Prof. Ashwin Mahalingam, Prof. Bala Ramadurai, IIT Madras

3. Human-Computer Interaction, [NPTEL Link](https://onlinecourses.nptel.ac.in/noc25_cs38/preview),
   Prof. Rajiv Ratn Shah, IIIT Delhi

4. Product Design & Innovation, [NPTEL Link](https://onlinecourses.nptel.ac.in/noc21_de01/preview),
   Prof. Supradip Das, Prof. Swati Pal, Prof. Debayan Dhar, IIT Guwahati

Online Resources:

1. [IDEO.org Design Kit](https://www.designkit.org/), Design Thinking tutorials, Empathy, Ideation, Prototyping

2. [Interaction Design Foundation](https://www.interaction-design.org/), HCI & UX Design Learning, Assignments on usability and evaluation

3. [TinkerCAD](https://www.tinkercad.com/), Online prototyping and circuit simulation, Prototyping with Arduino, IoT,

4. [Figma](https://www.figma.com/), Wireframing & UI Design, Assignments on user-centered design

5. [MIT D-Lab](https://d-lab.mit.edu/), Sustainable design & inclusive innovation, Assignments on design for sustainability and inclusion

6. [Canva](https://www.canva.com/), Design mockups and visuals, Sketches and presentation of product ideas

Savitribai Phule Pune University Second Year of Computer Engineering & Computer Science and Engineering (2024 Course)		
VEC-284- COM - Environmental Studies		
Teaching Scheme	**Credits**	**Examination Scheme**
Theory : 02 Hours/Week	02	**CCE :** 15 Marks **End-Sem Examination :** 35 Marks

Course Objectives: The course aims to:

1. To introduce the multidisciplinary nature and scope of environmental studies.
2. To understand ecosystem structures, biodiversity, and ecological balance through hands-on observation and documentation.
3. To examine the use and impact of natural resources on environmental sustainability.
4. To explore biodiversity conservation practices and develop eco-sensitive thinking through field-based inquiry.

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1. **Illustrate** the interdependence of ecosystems through activity-based exploration
- CO2. **Analyze** the role of natural resources in sustainable development using real-world data.
- CO3. **Investigate** biodiversity threats and conservation strategies through surveys and projects
- CO4. **Create** awareness tools or **reports** promoting sustainability based on their findings.

Course Contents

Unit I - Environment and its issues (07 Hours)

a) Environment Meaning of Environment, Types of Environment, Components of Environment,
b) Man- Environment relationship, importance of environment,
c) Need for Public Awareness
d) Ecosystem-Meaning, Major Components of Ecosystem
e) Case studies of Forest Ecosystem, Grassland Ecosystem, Desert Ecosystem, Aquatic Ecosystem
f) Stability of Ecosystem in Sustainable Environment

Unit III - Environment Pollution (07 Hours)

a) Definition of Pollution, Types of Pollution
b) Air Pollution-Meaning, Sources, effects of air pollution, Air Pollution Act
c) Water Pollution Meaning, Sources, Effects of Water pollution, Water Pollution Act
d) Noise Pollution Meaning, Sources, Effect of Noise Pollution
e) Solid Waste Pollution Meaning, sources, Effect of Waste Pollution

Unit III - E-Waste Managements and Acts (08 Hours)

E- waste; composition and generation. Global context in e- waste; E-waste pollutants, E waste hazardous properties, Effects of pollutant (E- waste) on human health and surrounding environment, domestic e-waste disposal, Basic principles of E waste management, Technologies for recovery of resources from electronic waste, resource recovery potential of e-waste, steps in recycling and recovery of materials-mechanical processing, technologies for recovery of materials, occupational and environmental health perspectives of recycling e-waste in India.

Unit IV - E-waste Control and measures

Need for stringent health safeguards and environmental protection laws in India, Extended Producers Responsibility (EPR), Import of e-waste permissions, Producer-Public-Government cooperation, Administrative Controls & Engineering controls, monitoring of compliance of Rules, Effective regulatory mechanism strengthened by manpower and technical expertise, Reduction of waste at source

Practical Assignments

Week	Topic to be covered
1	Introduction : Group discussion and poster making on "Why Environmental Studies Matter for Technologists"
2	Eco Mapping: Identify and document elements of an ecosystem within the college campus
3	Model the Food Web: Create food chains and food webs using flowcharts (digital tools like Canva / Lucid chart)
4	Case Study Review: Present real-world examples of forest, grassland, and aquatic ecosystems
5	Soil and Water Testing Activity: Test soil pH, water quality (use school-level kits), and interpret results
6	Field Visit / Virtual Tour: Document deforestation or mining impact in a chosen region; students prepare a comparative report
7	Water Audit Exercise: Estimate water usage at home/hostel and identify areas of overuse; propose conservation measures
8	Renewable Energy Models: Create a simple model or PPT on any renewable energy source (e.g., solar cooker, wind energy demo)
9	Biodiversity Documentation: Survey nearby areas for plant/animal species; identify any endemic/endangered species
10	Conservation Proposal Pitch: In groups, students prepare a mini proposal for biodiversity conservation at local level
11	Group Project Work: Work on mini project report/documentation on any ecosystem/natural resource/e-waste management topics
12	Presentation & Viva: Final presentation and oral examination based on project work and learning portfolio

Learning Resources

Text Books:

1. Odum, Eugene P. “Fundamentals of Ecology”
2. R. Rajagopalan, “Environmental Studies – From Crisis to Cure”, Oxford
3. Johri R., E-waste: implications, regulations, and management in India and current global best practices, TERI Press, New Delhi

Reference Books:

1. Erach Bharucha, “Textbook of Environmental Studies”, UGC
2. Anubha Kaushik and C.P. Kaushik, “Environmental Studies”, New Age International

E-Books Links: -

1. https://www.environment.gov.in
2. https://www.unep.org
3. https://news.mit.edu/2013/ewaste-mit

Savitribai Phule Pune University, Pune

Maharashtra, India

Task Force for Curriculum Design and Development

Programme Coordinator

Dr. Dipak Patil - Member, Board of Studies - Computer Engineering

Team Members for Course Design

Data Structures	
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Dr. Dipalee D Rane	D.Y. Patil College Of Engineering Akurdi Pune
Dr. Vaishali Tidake	MVPS's K. B. T. College of Engineering, Nashik
Dr. Chandrakant Kokane	Nutan Maharashtra Institute of Engineering and Technology, Pune
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Dr. Dinesh Hanchate	Datta kala group of Institutions, Bhigwan, Pune

Object Oriented Programming and Computer Graphics	
Dr. Prashant M Yawalkar	MET's Institute of Engineering, Nashik
Dr. Amit Kadam	Anantrao Pawar College of Engineering and Research, Pune
Dr. Vaishali Tidake	NDMVP's KBT College of Engineering, Nashik
Prof Kanchan Pekhale	MET's Institute of Engineering, Nashik
Dr. G. D. Puri	Amrutvahini College of Engineering, Sangamner
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Dr. Archana Panhalkar	Amrutvahini College of Engineering, Sangamner
Prof Shubhangi Said	Jaihind College of Engineering, Kuran

Operating Systems	
Dr. Shweta Koparde	DIP Pimpri Pune
Dr. Poonam Railkar	SKN COE , Pune
Dr. Meghana Lokhande	PCCOE Pune
Mr. Prakash Kshirsagar	I2IT Pune
Mr. Sharad Adsure	IP Pimpri Pune
Mrs. Rupali Shewale	KBTCOE,Nashik

Discrete Mathematics	
Dr. Archana Suhas Vaidya	GES's R H Sapat COEMSR, Nashik
Dr. Pranali More	APCOER, Parvati , Pune
Mr. Amol J Shakadwipi	SNJB's K.B. Jain College of Engineering, Chandwad
Ms. Sheetal Wagh	Matoshree COE, Nashik
Mr. Swapnil V. Ghorpade	Weoto Technologies Private Limited

Database Management Systems	
Dr. Sharmila Kishor Wagh	MES Wadia College of Engineering, Pune
Dr. Sharayu Lokhande	Army Institute of Technology, Pune
Prof. Ratnakar Jagale	R H Sapat College of Engineering, Management Studies and Research
Prof. Sagar Shinde	MES Wadia College of Engineering, Pune
Prof. Manoj Kharde	Pravara Rural Engineering College, Loni
Mr. Bhushan Pawar	Nagarro Enterprise Private Limited, Pune

Financial Accounting and Financial Management	
Prof. Rahul Paikrao	Amrutvahini College of Engineering, Sangamner
Dr. D. V. Patil	GES's R H Sapat COEMSR, Nashik
Dr. Vinodkumar Pathade	Amrutvahini College of Engineering, Sangamner

Computer Organization & Microprocessor and Digital Electronics & Logic Design	
Dr. D.V. Patil	R.H. Sapat College of Engineering, Management Studies & Research
Dr. Swati Bhawsar	Matoshri College of Engineering, Nashik
Prof. S.A. Shinde	R.H. Sapat College of Engineering, Management Studies & Research
Dr. Uday Patkar	Bharati Vidyapeeth College of Engineering Lavale, Pune
Prof. R.B. Mandlik	MET Institute of Engineering, Nashik
Dr. Shanti Kumaraguru	DY Patil COE, Akurdi

Microprocessor Laboratory	
Dr. Chhaya Gosavi	MKSSS Cummins College of Engineering for Women
Prof. Geeta M Kodabagi	Ajeenkya DY Patil school of engineering Lohegaon Pune
Prof. Jitendra Garud	Dr. D.Y. Patil Institute of Engineering, Management and Research
Ms. Shreeya Palkar	PES Moze Coellege of Engineering
Prof. Prasad B. Jare	S B Patil College of Engineering, Indapur
Dr. Javed Shaikh	Captal Numbers Infotech Pvt Ltd

Digital Finance	
Dr. Girish Potdar	Pune Institute of Computer Technology, Pune
Prof. Prasad A Lahare	College of Engineering & SS Dhamankar Institute of Management
Dr.Minakshi P Atre	PVG'S College Of Engineering and Technology Pune
Prof.Vikram K Abhang	Amrutvahini College of Engineering, Sangamner
Prof. Satyajit S Nimbalkar	SVPM's College of Engineering in Malegaon, Baramati
Dr. Deepankar Roy	National Institute of Bank Management, Pune

Digital Marketing	
Dr D B Kshirsagar	Sanjivani College of Engineering, Kopargaon
Dr. Shyam Ghodake	Sanjivani MBA
Dr. Amol Admuthe	RIT, Sakharale
Dr. R. S. Tambe,	DVVPCOE, Ahmednagar

Entrepreneurship Development	
Dr. Kalpana Metre	ITMBU, Vadodara, Gujrat
Prof. Nilesh Bhojane	Sinhgad College of Engineering ,Pune
Prof. Ravindra P Aher	Karmaveer Adv. BG Thakare College of Engineering, Nasik
Prof. Shubham D Shelke	Samarth College of Engineering and Management, Belhe
Prof. Pankaj B Devre	MIT Academy of Engineering ,Alandi, Pune
Prof. Sachin Bhanwase	ShivMani InfoTech Pvt.Ltd.,Pune

Web Development	
Dr. Mininath Bendre	Pravara Rural Engineering College Loni
Mr. Swapnil V. Ghorpade	Weoto Technologies Pvt. Ltd Nasik
Mrs. Megha A. Patil	R.H. Sapat College of Engineering, Management Studies & Research
Mrs. Shweta Borase	R.H. Sapat College of Engineering, Management Studies & Research

Engineering Product Design	
Mr. Nilesh V. Alone	GES's R H Sapat COEMSR, Nashik
Dr. D. V. Patil	GES's R H Sapat COEMSR, Nashik
Mr. Swapnil Ghorpade	Weoto Technologies Pvt. Ltd., Nashik
Mr. Gaurav B. Bhamare	Weoto Technologies Pvt. Ltd., Nashik
Dr. Shyam B. Deshmukh	Pune Institute of Computer Technology, Pune

Chairman

Dr. Nilesh Uke - Board of Studies Computer Engineering

Savitribai Phule Pune University, Pune

Dean

Dr. Pramod Patil - Dean – Science and Technology
Savitribai Phule Pune University, Pune

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Savitribai Phule Pune University, Pune

Maharashtra, India

National Education Policy (NEP)-2020 Compliant Curriculum

Second Year Engineering

Open Electives for Semester III and Semester IV

(With effect from Academic Year 2025-26)

Contents

Preface by Dean (Science and Technology)

Dear Students and Teachers,

Open elective courses, as per the National Education Policy (NEP), are courses chosen by students from disciplines outside their core program, promoting interdisciplinary learning and broadening their knowledge base. These electives allow students to explore diverse subjects and gain a more holistic education. The National Education Policy (NEP) 2020 in India places a strong emphasis on multidisciplinary education, and Open Electives (OEs) are a key component in achieving this goal.

NEP 2020 empowers students with greater flexibility to choose their learning trajectories. OEs allow students to select courses based on their interests, talents, and career goals, even if they are from a different faculty or department. A science student might take an OE in humanities or commerce, a commerce student in science or arts, and so on. This exposure broadens their perspective and understanding.

This documents lists the Open Electives offered to various programmes under the science and technology faculty, by other faculty including Science, Commerce ,Management, Humanities or Inter-Disciplinary studies. The overall NEP 2020 curriculum framework aims for a holistic education, integrating arts, crafts, humanities, games, sports, fitness, languages, literature, culture, and values alongside science and mathematics. OEs contribute significantly to this integrated approach.

We hope that this curriculum will inspire students to become competent professionals, responsible citizens, and contributors to the technological advancement of society.

Dr. Pramod Patil
Dean
Science and Technology
Savitribai Phule Pune University

Savitribai Phule Pune University, Pune

Maharashtra, India

Semester - III

Open Elective - I		
Course Code	**Offering Faculty**	**Course Name**
OEL-220A	Commerce	Financial Accounting
OEL-220B	Finance	Digital Finance
OEL-220C	Management	Digital Marketing
OEL-220D	Management	Digital Business
OEL-220E	Management	Digital Business Technology
OEL-220F	Management	Personal Financial Management
OEL-220G	Science	Wine Technology
OEL-220H	Science	Dairy Technology
OLE-220I	Management	Supply Chain Management
OLE-220J	Commerce	Digital Manufacturing

With effect from Academic Year 2025-26

Savitribai Phule Pune University		
OEL-220A : Financial Accounting		
Teaching /scheme	**Credits**	**Examination Scheme**
Theory : 02 Hours/Week	02	**CCE** : 15 Marks **End-Semester:** 35 Marks

Course Objectives: The course aims to:

1. To build upon the foundational knowledge of financial accounting acquired in the first year.
2. To develop a deeper understanding of the theoretical underpinnings of financial reporting.
3. To equip students with the ability to apply accounting standards to complex business transactions.
4. To enable students to analyze and interpret financial statements for decision-making purposes.
5. To introduce students to specialized accounting topics relevant to various industries.

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1: **Apply** accounting Principles and Standards to Account for Assets management,
- CO2: **Analyze** and apply accounting Principles and standards to Liabilities, and Equity.
- CO3: **Prepare** and Analyze Financial Statements for Various Business Entities, including Specialized Transactions.
- CO4: **Evaluate** the Impact of Different Accounting Methods on Financial Statements & Business Performance for Informed Decision-Making.

Course Contents

Unit I - Accounting for Assets (07 Hours)

Property, Plant, and Equipment (PP&E): Acquisition, cost determination, and capitalization, Depreciation methods (straight-line, reducing balance, units of production), Impairment of assets (concepts and accounting treatment), Accounting for disposals and exchanges. Relevant Accounting Standards (AS 10, IAS 16).

Inventory: Inventory costing methods (FIFO, LIFO, weighted average), Lower of cost or net realizable value (LCNRV), Inventory systems (periodic and perpetual), Relevant Accounting Standards (AS 2, IAS 2).

Intangible Assets: Recognition, measurement, and amortization of intangible assets (patents, trademarks, goodwill,etc), Impairment of intangible assets, Accounting for research and development costs (AS 26, IAS 38, etc).

Unit II - Accounting for Liabilities and Equity (07 Hours)

Liabilities: Accounting for current liabilities (accounts payable, short-term debt), Accounting for long-term liabilities (bonds payable, loans), Concepts of provisions, contingent liabilities, and contingent assets (e.g., AS 29, IAS 37).

Equity: Share capital: Types of shares, issue, forfeiture, and reissue of shares, Accounting for share issue, buyback, and bonus shares, Dividends: Types, declaration, and payment.

Unit III - Corporate Accounting - (08 Hours)

Accounting for share capital and debentures, Preparation of company final accounts Introduction to cash flow statements (basic concepts and preparation as per AS 3 or IAS 7), Understanding and accounting for share buyback, Accounting for bonus shares and rights issue, Introduction to interim and final dividends.

Branch Accounting: Accounting for dependent branches, Accounting for independent branches and reconciliation.

Lease Accounting: Types of leases (operating and finance leases), Accounting treatment for operating and finance leases.

Unit IV Special Accounting Topics (08 Hours)

Objectives of financial statement analysis, **Tools and techniques of financial statement analysis:** Horizontal analysis (trend analysis), Vertical analysis (common-size statements),

Ratio analysis: Liquidity, solvency, profitability, and efficiency ratios. Interpretation of financial statements,

Limitations of financial statement analysis: Historical cost concept, Use of estimates, Impact of different accounting policies, Limited information about non-financial factors, Potential for manipulation.

Learning Resources

Text Books:

1. S.N. Maheshwari and S.K. Maheshwari, "Advanced Accountancy "12th Edition, S. Chand and Company.
2. R.L. Gupta and M. Radhaswamy, "Corporate Accounting", 15th Edition, S. Chand and Company.

Reference Books:

1. Subramanyam and Wild, "Financial Statement Analysis handbook", Zebralearn publication.
2. Benjamin Graham and Charles McGolrick," Interpretation of Financial Statements", Harper Business.
3. Relevant Accounting Standards issued by ICAI/ IASB.

MOOC / NPTEL/YouTube Links: -

1. Institute of Chartered Accountants of India (ICAI): https://www.icai.org/
2. International Accounting Standards Board (IASB): https://www.ifrs.org/
3. Securities and Exchange Board of India (SEBI): https://www.sebi.gov.in/
4. Financial Accounting Standards Board (FASB): https://www.fasb.org/
5. Accounting Tools: https://www.accountingtools.com/

Savitribai Phule Pune University		
OEL- 220B : Digital Finance		
Teaching /scheme	**Credits**	**Examination Scheme**
Theory : 02 Hours/Week	02	CCE : 15 Marks End-Semester: 35 Marks

Prerequisite Courses, if any :

1. Basic Finance and Economics
2. Cyber Security & Digital Payments

Course Objectives: The course aims to:

1. The evolution of digital finance and the influence of big data on financial systems.
2. Digital payment ecosystems and ongoing transformations in digital banking.
3. Core concepts of blockchain, cryptocurrencies, and decentralized finance.
4. Applications of AI, machine learning, and analytics in financial services.
5. Cybersecurity concerns, financial risk factors, and regulatory developments in digital finance.

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1 - Explain the basics of digital finance, big data, and regulatory frameworks
- CO2 - Analyze digital payments, FinTech trends, and neo-banking models.
- CO3- Illustrate blockchain, cryptocurrencies, and DeFi systems.
- CO 4- Discuss the role of AI/ML for financial analytics.
- CO5 - Apply cybersecurity and compliance strategies for digital finance.

Course Contents

Unit I - Digital Finance Fundamentals & Big Data (07 Hours)

Evolution & Fundamentals of Digital Finance: Evolution of digital finance and the shift from traditional to digital systems. Introduction to FinTech and technological transformations in financial services. Overview of regulatory frameworks and compliance in the digital era.

The Rise of Big Data in Finance: Role of big data in shaping financial decision-making and risk management. Leveraging data science for personalization and modern financial services

Case Study: DBS Bank's Digital Transformation

Unit II - Digital Payment Systems & Digital Banking Transformation (07 Hours)

Digital Payment Ecosystems: Historical evolution and digitalization of payment systems (ECS, RTGS, NEFT, IMPS, UPI, mobile wallets, contactless payments), Attributes of a well-functioning payment system and the role of banks.

Fintech Innovations & Disruption: FinTech startups, challenger banks, and peer-to-peer lending models, FinTech applications across banking, NBFCs, insurance, lending, audit, and compliance, Regulatory guidelines (e.g., RBI guidelines) and risks associated with new payment models. The Future of Digital Banking: How traditional banks are adapting and the rise of neo-banks, Digital banking trends and evolving customer expectations

Case Study : Unified Payments Interface (UPI) in India

Unit III - Blockchain, Cryptocurrencies & Decentralized Finance (08 Hours)

Blockchain Technology: Fundamentals of blockchain and underlying cryptographic techniques, Smart contracts and decentralized finance (DeFi) applications. **Cryptocurrencies & Digital Assets:** Overview and evolution of cryptocurrencies (Bitcoin, Ethereum, etc.), Central Bank Digital Currencies (CBDCs) and other emerging digital assets. Advanced Applications & Case Studies: Impact of blockchain on payments, lending, and financial settlements, Real-world case studies and disruptive potential in global finance

Case study: The Sand Dollar (Bahamas' CBDC)

Unit IV - Artificial Intelligence, Machine Learning & Financial Analytics (08 Hours)

AI & Machine Learning in Finance: Predictive analytics in stock markets, trading, and algorithmic/high-frequency trading, Credit risk analysis and automated decision-making using AI.

Data Analytics & Financial Applications: Data sourcing, cleaning, processing, and visualization for financial data, Sentiment analysis and AI-driven portfolio management.

Practical Projects & Case Studies: Hands-on projects: building stock price prediction models, fraud detection systems, and credit score prediction models, Real-world applications in digital lending and wealth management

Case study : Thread programming Using Pthreads, POSIX

Learning Resources

Text Books

1. C. Skinner, Digital Finance: Big Data, Startups, and the Future of Financial Services, 1st ed. Hoboken, NJ, USA: Wiley, 2016.
2. J. H. M. T. Jeffry, Introduction to FinTech, 1st ed. Noida, India: Pearson Publications, 2018
3. D. Tapscott and A. Tapscott, The Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies is Changing the World, 1st ed. New York, NY, USA: Penguin Random House, 2016.
4. M. López de Prado, Machine Learning for Asset Managers, 1st ed. Cambridge, UK: Cambridge University Press, 2020.
5. "FinTech: The Impact and Role of Financial Technology" by Parag K. Patel, Wiley publications, 1st edition

Reference Books:

1. R. Ghose, Future Money: Fintech, AI and Web3. London, UK: Kogan Page, 2024.
2. Y. Hilpisch, Artificial Intelligence in Finance: A Python-Based Guide, 1st ed. Sebastopol, CA, USA: O'Reilly Media, 2020.
3. M. López de Prado, Advances in Financial Machine Learning, 1st ed. Hoboken, NJ, USA: Wiley, 2018.
4. S. Chishti and J. Barberis, The FINTECH Book: The Financial Technology Handbook for Investors, Entrepreneurs, and Visionaries, 1st ed. Hoboken, NJ, USA: Wiley, 2016.
5. D. Drescher, Blockchain Basics: A Non-Technical Introduction in 25 Steps, 1st ed. Berkeley, CA, USA: Apress, 2017.
6. B. Hines, Digital Finance: Security Tokens and Unlocking the Real Potential of Blockchain, 1st ed. Hoboken, NJ, USA: Wiley, 2020.

E-Books

1. P. H. Beaumont, Digital Finance: Big Data, Start-ups, and the Future of Financial Services, 1st ed. London, U.K.: Routledge, 2019. Link: https://download.e-bookshelf.de/download/0015/1963/23G-0015196323-0047264745.pdf
2. N. Urbach and M. Röglinger, Big Data and Artificial Intelligence in Digital Finance, 1st ed. Cham, Switzerland: Springer, 2022 Link: https://library.oapen.org/bitstream/id/fefe46c7-4495-49ba-bcab-9cf1851e81e6/978-3-030-94590-9.pdf
3. L. Perlman, An Introduction to Digital Financial Services, 1st ed., 2018. Link: https://www.academia.ed

MOOC / NPTEL/YouTube Links:

1. https://www.my-mooc.com/en/mooc/introduction-to-fintech/
2. https://mooc.besideproject.eu/courses/blockchain-use-cases-in-digital-finance/
3. https://www.coursera.org/specializations/digital-transformation-financial-services

Savitribai Phule Pune University		
OEL-220C : Digital Marketing		
Teaching Scheme	**Credits**	**Examination Scheme**
Theory : 02 Hours/Week	02	**CCE** : 15 Marks **End-Semester**: 35 Marks

Companion Course : Information and Cyber Security Laboratory
Course Objectives: The course aims to:

1. To understand the basic Concepts of Digital marketing and the road map for successful Digital marketing strategies.
2. To know the importance of Social Media Platforms importance in Digital Marketing
3. To understand the technological importance of Search Engine Optimization (SEO)

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1: **Understand** the basic Concepts of Digital marketing
- CO2: **Apply** digital marketing tools for suitable applications
- CO3: **Examine** the various social media and design Advertising campaigns
- CO4: **Learn** search engine optimization (SEO) techniques and **apply** it for suitable application to increase page views.
- CO5 : **Analyse** social media advertising platforms

Course Contents

Unit I - Introduction to Digital Marketing (07 Hours)

Fundamentals of Digital marketing & Its Significance, Traditional marketing Vs Digital Marketing, Evolution of Digital Marketing, Digital Marketing Landscape, Key Drivers, The Digital users in India, Digital marketing Strategy- Consumer Decision journey Digital advertising Market in India, Skills in Digital Marketing, Digital marketing Plan.

Unit II - Digital Marketing Terminology (07 Hours)

Terminology used in Digital Marketing, PPC and online marketing through social media, Social Media Marketing, Google web-master and analytics overview, Email Marketing, Mobile Marketing
Display adverting, Buying Models, different type of ad tools, Display advertising terminology, types of display ads, different ad formats

Unit III - Social Media Marketing (08 Hours)

Fundamentals of Social Media Marketing& its significance, Necessity of Social media Marketing
Facebook Marketing: Facebook for Business, Facebook Insight, Different types of Ad formats, setting up Facebook Advertising Account, Facebook audience & types, Designing Facebook Advertising campaigns, Facebook Avatar, Apps, Live, Hashtags

Unit IV - Search Engine Optimization (SEO) (08 Hours)

Introduction to SEO, How Search engine works, SEO Phases, History Of SEO, How SEO Works, Googlebot (Google Crawler), Types of SEO technique, Keyword Planner tools
Social media Reach- Video Creation & Submission, Maintenance- SEO tactics, Google search Engine

Learning Resources

Text Books:

1. V. Ahuja, Digital Marketing, Oxford University Press
2. D. Ryan, C. Jones, “Understanding Digital Marketing Strategies for Engaging the Digital Generation”,Koganpage Publication, (2nd Edition)
3. Chinmay Kamat, Nitin Kamat, “Digital Marketing”, Himalaya Publishing House, (2nd Edition)

Reference Books:

1. H. Annmarie , A. Joanna, ”Quick win Digital Marketing”, Paperback edition, Oak Tree Press
2. Seema Gupta, “Digital Marketting”, Mc Graw Hill (3d Edition)

Savitribai Phule Pune University		
OEL- 220D : Digital Business		
Teaching /scheme	**Credits**	**Examination Scheme**
Theory : 02 Hours/Week	02	CCE : 15 Marks End-Semester: 35 Marks

Course Objectives: The course aims to

1. To analyse digital technologies' impact on business models
2. To evaluate emerging platforms like AI and blockchain, create innovative digital solutions
3. To apply data analytics for strategic decisions, and assess ethical and sustainability challenges in digital business.

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1 - **Understand** the digital economy's societal impact
- CO2 - **Apply** digital strategies practically
- CO3 - **Use** analytics tolls for digital business
- CO4 - **Develop** critical thinking to solve digital business challenges, and address ethical, legal, and sustainability issues responsibly, ensuring readiness for diverse roles in the digital business landscape.

Course Contents

Unit I - Foundations of Digital Business (07 Hours)

Overview of the Digital Economy and Society, Digital Transformation and its Impact, The Digital Enterprise - Strategies and Characteristics, Online and Virtual Communities, Defining Digital Business - Scope and Evolution, Emerging Platforms - AI-Driven Marketplaces, Blockchain-Based Systems, Metaverse Commerce. E-Business Models - B2B, B2C, C2C, D2C, Hybrid Models, Integration of Physical and Digital Marketspaces, Web 3.0 and Decentralized Platforms. Drivers - Scalability, Data Analytics, Automation, AI, Benefits - Global Reach, Personalization, Efficiency, Limitations - Cybersecurity Risks, Digital Divide, Impact on Businesses, Customers, Governments, Society.

Case Study :

1. Amazon's Digital Ecosystem: How Amazon integrates AI-driven recommendations, cloud computing (AWS), and marketplace strategies to dominate e-commerce.
2. Nike's Digital Transformation: Leveraging data analytics and direct-to-consumer (D2C) models to enhance customer engagement via the Nike+ app.

Unit II - Mobile, Social, and IoT-Driven Commerce (07 Hours)

Mobile Commerce - Evolution, Applications, 5G Impact, Mobile Marketing - Location-Based Advertising, In-App Purchases, Mobile Wallets. Social Commerce - Social Media Marketplaces, Influencer Economy, Live-Streaming Commerce, Social Business Networks - Enterprise Collaboration Tools, Social Media Analytics. Benefits - Customer Engagement, Brand Loyalty, Limitations - Privacy Concerns, Platform Dependency. Internet of Things (IoT) - Retail, Supply Chain, Smart Cities, Healthcare, IoT Applications - Connected Devices, Predictive Maintenance, Edge Computing, Wearables.

Case Study :

1. Starbucks Mobile App: Use of mobile payments and loyalty programs to drive customer retention and sales through personalized offers.

2. Xiaomi's IoT Strategy: Integration of IoT in smart home devices and wearables to create a connected ecosystem for consumers.

Unit III - Digital Business Ecosystem (08 Hours)

Digital Commerce Mechanisms - Online Purchasing, E-Marketplaces, Digital Twins, Types - B2B, B2C, C2C, Multi-Sided Platforms, Disintermediation, Reintermediation, Platform Economy. Customer Mechanisms - Webstores, Malls, Portals, Mobile Apps, Voice Commerce, Intermediaries - Aggregators, Curators, Merchant Solutions - Electronic Catalogs, Search Engines, Recommendation Systems, Shopping Carts. Auctions - E-Auctions, Algorithmic Pricing, Supply Chains - Blockchain, 3D Printing, Just-in-Time Delivery. Digital Payments - Mobile Payments, Digital Wallets, Cryptocurrencies, CBDCs, Security, Privacy, Ethical Issues

Case study:

1. Alibaba's E-Marketplace: How Alibaba uses its platform to connect buyers and sellers globally, leveraging blockchain for supply chain transparency.

2. eBay's Dynamic Pricing: Implementation of e-auctions and algorithmic pricing to optimize seller outcomes and buyer satisfaction.

Unit IV - Digital Business Applications : (08 Hours)

Electronic Retailing - B2C, Omnichannel Retailing, AI-Driven Personalization, Social Shopping - User-Generated Content, Social Proof, Benefits, Drivers. Fintech - E-Banking, Mobile Banking, Neobanks, Insurtech, Open Banking, Regtech. Digital Government - Smart Cities, E-Governance, Data-Driven Policy Making, Digital Public Services. E-Learning and EdTech - Online Platforms, Corporate Training, Gamification, VR/AR in Education, Digital Content - Streaming Services, Podcasts, Content Monetization.

Case study :

1. Revolut's Fintech Disruption: How Revolut uses mobile banking and open banking to challenge traditional financial institutions.

2. Coursera's EdTech Growth: Leveraging online platforms and gamification to deliver scalable education globally.

Learning Resources

Text Books

1. "Digital Business and E-Commerce Management" by Dave Chaffey, Tanya Hemphill, and David Edmundson-Bird, 7th Edition, Pearson, 2019.

2. "E-Commerce 2023: Business, Technology, and Society" by Kenneth C. Laudon and Carol Guercio Traver, 18th Edition, Pearson, 2023.

3. "Platform Revolution: How Networked Markets Are Transforming the Economy" by Geoffrey G. Parker, Marshall W. Van Alstyne, and Sangeet Paul Choudary, W.W. Norton & Company, 2016.

4. "Mobile Commerce: Opportunities, Applications, and Technologies" by Paul May, Cambridge University Press, 2020.

Reference Books:

1. "Social Commerce: Marketing, Technology and Management" by Efraim Turban, Judy Whiteside, David King, and Jon Outland, Springer, 2016.

2. "FinTech: The Technology Driving Disruption in the Financial Services Industry" by Parag Y. Arjunwadkar, CRC Press, 2018.

3. "The Future of Learning: EdTech in the Digital Age" by Cathy N. Davidson, MIT Press, 2022.

4. "Digital Health: Understanding the Benefits and Challenges" by Eric D. Perakslis, Oxford University Press, 2021.

5. "Entertainment in the Digital Age: Media, Technology, and Culture" by Robert C. Sickels, Bloomsbury Academic, 2020.

E-Books

1. "The Lean Marketplace: A Practical Guide to Building a Successful Online Marketplace Business" by Juho Makkonen and Cristóbal Gracia (Lean Marketplace Press, 2018)

MOOC / NPTEL/YouTube Links:

1. https://onlinecourses.swayam2.ac.in/imb25_mg44/preview

Savitribai Phule Pune University		
OEL-220E : Digital Business and Technology		
Teaching /scheme	**Credits**	**Examination Scheme**
Theory : 02 Hours/Week	02	**CCE** : 15 Marks **End-Semester:** 35 Marks

Course Objectives: The course aims to:

1. To UNDERSTAND digital transformation and its impact on business
2. To UNDERSTAND Digital Business Model Innovation, Learn Through Real-World Case Studies
3. To UNDERSTAND how automation supports to enhance Digital business.
4. To APPLY digital marketing strategies (SEO, social media), and emerging tech (AI, IoT)

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO.1 **UNDERSTAND** the concept of Digitization, Impact of Digital Marketing, processes, and strategies.
- CO.2 **COMPARE** digital business models using case studies.
- CO.3 **IMPLEMENT** basic automation tools in business workflows.
- CO.4 **UNDERSTAND** the Role of Technology in Startups and **Evaluate** E-commerce Platforms.

Course Contents

Unit I -Introduction to Digital Business (07 Hours)

Introduction to digitization, impact of digitization on business. Social media marketing, digital business models, concept of digital marketing and it's impact. Digital strategy and innovation.

Case Study: Sell products online via platforms like Amazon, Flipkart, and Shopify, reaching global customers 24/7

Unit II -Digital Business Model (07 Hours)

Introduction to digital business model innovation, key drivers of digital business model reinvention, types of digital business model, case study on anyone reinvented business organization..

Case study : Subscription-based streaming, original content production, personalized recommendations using AI

Unit III - Business Automation and Cyber Security- (08 Hours)

Introduction to Automation in Digital Business, Role of Automation, Automation Technologies, Automation Implementation and Integration, Impact of Automation on Digital Business. Introduction to Cyber security, Cyber security Measures and Best Practices.

Case study:

Unit IV - Emerging Tech and Entrepreneurship- (08 Hours)

Role of technology in modern startups, Digital marketing fundamentals: SEO, social media, email Marketing E-commerce platforms and tools (Shopify, Woo Commerce, etc.), Introduction to AI, IoT, and block chain in startups.

Case study: Automate tasks, analyze data, personalize user experiences, and develop smart products.

Learning Resources

Text Books:

1. Stephanie Diamond, "Digital Marketing All-In-One for Dummies".
2. Pradip Thomas, “Digital India: Understanding Information, Communication and Social Change".
3. George .Westerman, Didier Bonnet, and Andrew McAfee , “Leading Digital: Turning Technology into Business Transformation” , Harvard Business Press.
4. Amresh Bharati, “Digital Marketing” , Invincible Publication

Savitribai Phule Pune University		
OEL-220F : Personal Financial Management		
Teaching /scheme	**Credits**	**Examination Scheme**
Theory : 02 Hours/Week	02	**CCE** : 15 Marks **End-Semester:** 35 Marks

Course Objectives: The course aims to:

1. Introduce students to essential concepts of personal finance, budgeting, and savings.
2. Equip students with knowledge of banking, credit, and responsible borrowing.
3. Enable students to understand and evaluate investment and insurance options.
4. Foster informed financial decision-making for future financial security.

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1. **Create** a personal budget and set realistic financial goals.
- CO2. **Use** and utilize banking services and credit facilities securely.
- CO3. **Identify** and evaluate appropriate saving and investment options.
- CO4. **Apply** basic tax planning and insurance knowledge for future financial stability.

Course Contents

Unit I -Introduction to Personal Finance and Budgeting (07 Hours)

a) Importance and scope of personal financial management
b) Financial goal setting: short-term, medium-term, and long-term goals
c) Personal income and expenditure planning
d) Budgeting techniques and tracking tools (manual and digital)
e) Emergency fund planning
f) Understanding financial discipline and behavioral aspects of money

Unit II -Banking, Credit, and Digital Finance (07 Hours)

a) Basics of banking: types of accounts, bank statements, interest
b) Digital banking tools: UPI, NEFT, RTGS, mobile banking, e-wallets
c) Credit and debit cards: responsible use and differences
d) Loans: student, personal, and vehicle loans
e) Credit score: concept, importance, and factors
f) Digital security: phishing, fraud prevention, and cyber hygiene

Unit III - Saving and Investment Options -(08 Hours)

a) Importance of saving and types of saving schemes (FD, RD, PPF, etc.)
b) Introduction to investment: risk vs. return
c) Overview of mutual funds and SIPs
d) Concept of compounding and time value of money
e) Investment avenues: gold, real estate, stock market (basic concepts only)
f) Introduction to financial planning apps/tools

Unit IV- Insurance, Tax Basics, and Retirement Planning - (08 Hours)

a) Concept and types of insurance: life, health, and general
b) Nomination and claims: processes and importance

c) Basics of income tax: slabs, PAN, and tax-saving instruments
d) Retirement planning: EPF, NPS, and pension schemes
e) Common financial frauds and safety tips
f) Ethical financial behavior and long-term wealth planning

Learning Resources

Text Books:

1. Introduction to Personal Finance – C. Satyadevi (Himalaya Publishing House)
2. Financial Planning – B.S. Raman (United Publishers
3. Personal Finance in India – N. Sreeram, Cengage Learning

Reference Books:

1. Personal Finance by Jack R. Kapoor, Les R. Dlabay and Robert J. Hughes, Tat McGraw-Hill Publishing Company Ltd. New Delhi.
2. Financial Education by Reserve Bank of India – rbi.org.
3. Personal Finance columns in The Economic Times, The Business Line and Financial Express Daily News Papers.
4. Information Broachers of Post Offices, Banks, Mutual Funds, Insurance Companies

Web tools : -

1. Investopedia, Money control
2. SIP calculator, credit score checker (CIBIL demo)
3. UPI demo app (Google Pay / PhonePe for practice)
4. Internet Sources- BSE, NSE, SEBI, RBI, IRDA, AMFI etc.

MOOC/SWAYAM/NPTEL Courses:

1. Behavioral And Personal Finance - Course

Savitribai Phule Pune University		
OEL-220G- : Wine Technology		
Teaching /scheme	**Credits**	**Examination Scheme**
Theory : 02 Hours/Week	02	**CCE** : 15 Marks **End-Semester:** 35 Marks

Course Objectives: The course aims to:

1. Understand the history, classification, and global significance of wine.
2. Explain the wine production process from grape harvesting to aging and bottling.
3. Analyze the economic impact, trade dynamics, and marketing strategies of the wine industry
4. Explore emerging trends, sustainability practices, and career opportunities in wine making.

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1: Students will demonstrate knowledge of winemaking techniques- fermentation and maturation.
- CO2: Students will assess grape varieties, wne quality, flavor profiles used in different wine types.
- CO3: Students will evaluate wine business strategies, tourism models, and consumer preferences.

Course Contents

Unit I-Introduction to Wine, Winemaking and viticulture (07 Hours)

Introduction to different beverages, concept of wine, Health benefits of wine, History & Evolution of Winemaking Major Wine-Producing Regions, Wine Classifications & Types (Red, White, Rosé, Sparkling, Fortified), Basic Winemaking Process and important terminologies of wine, Importance of Grapes in Winemaking, Grape Varieties & Their Impact on Wine Quality, Global Wine Industry Overview

Unit II - Wine Production & Technology (07 Hours)

Wine Making Process-I (Pre-fermentation): Harvesting of grapes, crushing, preparation and extraction of must, maceration, Wine Making Process-II (Fermentation process): Concept of fermentation, types and parts of fermenter, parameters affecting fermentation, Wine Making Process-III (Post-fermentation): Flavour enhancement and aging of wine, barrel ageing and maturation in bottle, quality control, bottling and cellar system.

Unit III -Wine Economics & Trade - (08 Hours)

Role of Wine in Hospitality & Tourism, Wine Tourism Destinations & Business Models, Global Wine Market Trends, Career Opportunities in the Wine Industry

Unit IV - (08 Hours)

Learning Resources

Text Books:

1. Ronald S. Jackson (2002) Wine Testing a professional handbook
2. Ron s. Jockson (2000) Wine science principles practices & perception
3. Vine, Richard p (1997) Wine Appreciation

4. Emile Peynavd (1997) The taste of wine

5. Brue W. Zoecklein, Kenneth Fugelsang, Barry H. Gump Fred S. Nury (1999) Wine Analysis and Production

Savitribai Phule Pune University		
OEL-220H : Dairy Technology		
Teaching /scheme	**Credits**	**Examination Scheme**
Theory : 02 Hours/Week	02	**CCE** : 15 Marks **End-Semester:** 35 Marks

Course Objectives: The course aims to:

1. To equip the students with the knowledge and professional skills necessary to understand and apply principles of milk and milk processing in Dairy industry
2. To inculcate the knowledge and importance of quality control and preservation in Dairy industry.

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1: Student will acquire the knowledge about the opportunities in dairy field.
- CO2: Student will develop skills of milk and milk product processing
- CO3: Student will understand the causes of milk spoilage and prevention of milk and milk products from spoilage
- CO4: Student will develop skills required in the various sectors of dairy industry.
- CO5: Student will acquire the knowledge about the pathogen and milk borne diseases.
- CO6: Student will develop income generating potential

Course Contents

Unit I -Livestock diversity and its Management: (07 Hours)

Livestock diversity in India and its importance Role of livestock in Agriculture Selection of elite animals Characteristics of ideal dairy farm Management of milking animals Animal health management and its impact on milk quality Milking systems and hygienic milk production

Unit II - Milk Process Technology: (07 Hours)

Nutritional importance of milk and its constituents Collection methods of raw milk and its impact on milk quality Method of Sampling of raw milk. Quality assessment of raw milk Processing of milk and its significance: cooling, separation, standardization, homogenization and pasteurization and its types Types of milks and its production- pasteurized, standardized, toned, double toned, flavored milk. Production of milk products- Yogurt, butter, buttermilk, paneer, Dairy plant hygiene and sanitation, disposal of dairy waste

Unit III - Quality Assurance of Milk -(08 Hours)

Spoilage of milk and milk products by microorganism and its control., Different packaging Materials, importance of packaging in milk and milk product preservation Quality assurance of dairy products: Quality assurance (ISO 9001:2000) and food safety system (HACCP) Quality assessment of milk-detection of adulteration

Case study:

Unit IV - - (08 Hours)

Case study:

Learning Resources

Text Books:

1. Outline of Dairy Technology - Sukumar De, Oxford University Press 2008
2. Technology of Milk processing- Khan QA and Padmanabhan, ICAR, New Delhi.
3. Principle of Dairy Processing- J. N. Warner, Wiley Eastern Ltd. New Delhi.
4. A Text Book of Dairy Engineering ,C.N. Hall
5. Engineering for Dairy and Food Products , E.M. Farral
6. Food Engineering and Dairy Technology , Ing. H.G. Kessler
7. Modern Dairy Technology Vol I & II, R.K. Robinson
8. Dairy Technology and Engineering, Harpar and Hall
9. Dairy Processing Technology. Sangu, K.P.S (2002)
10. Robinson, R.K. (1991) Dairy Microbiology, The microbiology of milk, Applied Science publisher, London.
11. Pasteurized Milk Ordinance (PMO), Potter, N., Hotchkiss, J. H., 1995 Milk and milk products. In: Food Science, 5th Edition, Chapman
12. Fundamentals of Dairy Microbiology , J.B. Prajapati

Savitribai Phule Pune University		
OEL-22oI : Supply Chain Management		
Teaching /scheme	**Credits**	**Examination Scheme**
Theory : 02 Hours/Week	02	**CCE** : 15 Marks **End-Semester:** 35 Marks

Course Objectives: The course aims to:

1. To gain an understanding of how supply chain structure work for smooth transition.
2. To become familiar with flow of supply chain and its management.
3. To study the supply chain management building blocks.
4. To study the customer requirements and expected services.

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1: Describe the structure of Supply Chain Management
- CO2: Identify the various flows in real world supply chains
- CO3: Understand the key Operational Aspects in Supply Chain Management
- CO4: Evaluate the relationship between Customer Value and Supply Chain Management

Course Contents

Unit I -Supply Chain Structure & Flow (07 Hours)

Shift from enterprise to network, Structure of a SC, Push based SC, Pull based SC, Tradeoff between Push & Pull, Identifying appropriate Push & Pull Strategy for SC, Commodity & cost centric SC, Agile, Forward & Reverse SC, Product, Services, Information, Funds, Demand, Forecast flows in Up- stream & Downstream direction

Unit II -Total Supply Chain management (07 Hours)

business landscape – driving forces: Shift from Operations to Services, Impact of globalization & technological revolution, shift from linear SC to collaborative networks, power shifts in the SC- demands for flexibility of partnerships, core competencies, growth in outsourcing.

Unit III - Supply Chain management Building Blocks (08 Hours)

Overview of customer focus & demand, resources & capacity management, procurement & supplier focus, inventory management, operations management, distribution management in SCM

Unit IV -Customer Value (08 Hours)

Empowered consumer, Customer focused Marketing & SC service outputs, customer service – availability, operational performance, reliability. Customer satisfaction – customer expecta- tions, enhancing customer satisfactions, limitations of customer satisfaction. Customer success – achieving customer success, value added services, customer value requirement mapping

Learning Resources

Text Books:

1. Supply Chain & Logistics Management, Bowersox, Closs & Cooper, Tata McGraw Hill
2. Designing & Managing the SC – Concepts, Strategies & Case studies, Levi, Kaminsky et. al., Tata McGraw Hill

3. Supply Chain Management: Strategy Planning & Operations, Sunil Chopra, Peter Meindl, Pearson

Reference Books:

1. Supply Chain Management Process, System & Practice, Chandrasekaran, Oxford
2. Total Supply Chain Management, Basu & Wright, Elsevier
3. Logistics Management & Strategy, Harrison and van Hoek, Prentice Hall
4. Supply Chain Management, Mentzer, Response Books.
5. Logistics Management: The Supply Chain Imperative, Vindo Sople, Pearson Education

Savitribai Phule Pune University		
OEL-220J : Digital Manufacturing		
Teaching /scheme	**Credits**	**Examination Scheme**
Theory : 02 Hours/Week	02	**CCE** : 15 Marks **End-Semester:** 35 Marks

Course Objectives: The course aims to:

1. To understand the basic concepts modern digital factories and their design.
2. To understand digital twin technology and its applications.
3. To understand engineering knowledge management and its applications.
4. To analyse the supply chain strategies and modern security for digital manufacturing.

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1: Understand the fundamentals of digital manufacturing, concept design of 3D digital factory.
- CO2: Perception on digital twin, its implementation and cyber-physical integration.
- CO3: Develop concept of engineering knowledge management along with case studies.
- CO4: Conceptualize business models and supply chain strategies, different security systems.

Course Contents

Unit I - 3D Digital Factories (07 Hours)

The promise of 3D Digital Factories, Embracing digital design and new workflows, 3D additive printing, An integration of operational and information technologies, Conceptual design of a 3D digital factory.

Unit II - Digital Twin Technology (07 Hours)

Production planning and scheduling in a smart factory, Concept of digital twin, Cyber-physical integration, Implementing digital twin, Industrial case studies, Smart production resource allocation.

Unit III - Engineering Knowledge Management -(08 Hours)

Knowledge discovery and extraction, Knowledge representation and reasoning, Construction of the industrial knowledge graph, Knowledge graph-enabled knowledge evolvement, Industrial case studies.

Unit IV - Business Models, Supply Chain Strategy and Security Aspects (08 Hours)

Business models for the new enterprise, Supply chain strategies, Additive manufacturing and supply chain resiliency, Design customization and optimization, Risks and threats in distributed digitized manufacturing, Modern security for digital manufacturing.

Learning Resources

Text Books:

1. Chandrakant D. Patel (Editor), Chun-Hsien Chen (Editor), “Digital Manufacturing: Key Elements of a Digital Factory, Elsevier - Health Sciences Division, 2023.
2. Zhuming Bi, “Practical Guide to Digital Manufacturing”, Springer Nature Link, 2021.

3. Zude Zhou, Shane (Shengquan) Xie, Dejun Chen, “Fundamentals of Digital Manufacturing Science”, Springer-Verlag London Limited 2012.

4. Rene Wolf (Editor), Raffaello Lepratti (Editor), “Smart Digital Manufacturing: A Guide for Digital Transformation with Real Case Studies Across Industries”, Wiley-VCH; 1st Edition, Germany, 2020.

Reference Books:

1. Kaushik Kumar (Ed.), Divya Zindani (Ed.), J. Paulo Davim (Ed.), “Digital Manufacturing and Assembly Systems in Industry 4.0 (Science, Technology, and Management)”, CRC Press; 1st Edition, CRC Press, 2019

2. Sita Rani, Pankaj Bhambri, Sachin Kumar, Piyush Kumar Pareekh, “AI-Driven Digital Twin and Industry 4.0”, 1st Edition, CRC Press, 2004

3. James W. Cortada, “The Digital Hand: How Computers Changed The Work of American Manufacturing, Transportation, And Retail Industries”, Oxford University Press, 1st Edition, 2003

E books Links: -

1. https://maxbyte.co/e-book-inspiration-to-implementation-of-digital-manufacturing/
2. https://www.scientific.net/book/digital-manufacturing-automation-iii/978-3-03813-876-1
3. https://www.routledge.com/Digital-Manufacturing-and-Assembly-Systems-in-Industry-40/Kumar-Zindani-Davim/p/book/9780367779474?srsltid=AfmBOopuGTTuSD07DN30ZngUztGQDLy0MaN0rlq
4. https://onlinelibrary.wiley.com/doi/abs/10.1002/9781119865216.ch7
5. api.pageplace.de/preview/DT0400.9780429876615_A37402306/preview-9780429876615_A374023
6. https://www.mdpi.com/books/reprint/6232-smart-manufacturing
7. https://onlinelibrary.wiley.com/doi/book/10.1002/9781394195336

MOOC/SWAYAM/NPTEL Courses:

1. https://www.coursera.org/specializations/digital-manufacturing-design-technology
2. https://talentsprint.com/course/digital-manufacturing-smart-factories-iisc-bangalore
3. https://onlinecourses.nptel.ac.in/noc21_mg83/preview
4. https://professionalprograms.mit.edu/online-program-smart-manufacturing/
5. https://www.buffalo.edu/tcie/professional-education/course-list/digital-manufacturing-and-design-dmd7.html

Savitribai Phule Pune University, Pune

Maharashtra, India

Semester - IV

Open Elective - II		
Course Code	**Offering Faculty**	**Course Name**
OEL-221A	Interdisciplinary Studies	Project Management
OEL-221B	Science	Optimization Techniques
OEL-221C	Management	Principles and Practices of Management
OLE-221D	Commerce	Financial Management
OEL-221E	Management	Business Essentials for Rural Development
OEL-221F	Science	Nanoscience and Nanotechnology
OEL-221G	Interdisciplinary Studies	Industrial Organization Management

With effect from Academic Year 2025-26

Savitribai Phule Pune University		
OEL-221A : Project Management		
Teaching /scheme	**Credits**	**Examination Scheme**
Theory : 02 Hours/Week	02	**CCE** : 15 Marks **End-Semester:** 35 Marks

Prerequisite Courses, if any :

1. Programming and Problem Solving

Course Objectives: Students will be familiarized with

1. Fundamental principles of project management
2. Project planning, organizing, and controlling the projects
3. Skills in project scheduling, budgeting, and resource allocation
4. Risk management, quality control, and stakeholder management in projects
5. Project management concepts to real-world scenarios.

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1: Explain the principles of project management
- CO2: Use project management concepts to real-world scenarios
- CO3: Apply Agile Project Management
- CO4: Discuss the importance of risk management, quality control, and stakeholder management in projects
- CO5: Demonstrate skills in project planning, execution, and control

Course Contents

Unit I -Introduction to Project Management (07 Hours)

Project Definition, Project Life Cycle, processes and Knowledge areas in Project management, WBS and its types, introduction to PMBOK, portfolio Management, Traditional Vs Modern Project using PMBOK Concept

Case Study: Online Shopping

Unit II -Agile Software Development (07 Hours)

Introduction, Agile methods, Scrum, Comparison between Non Agile and Agile Project, Three stages of Agile Project, Plan driven and Agile development, Extreme programming, scaling agile methods, Roles and responsibilities, Scheduling and tracking.

Case Study : Analyze the same project using Agile. Create the three stages of the project

Unit III -Project Planning and Management (08 Hours)

Introduction to project planning, Project planning process, Agile project management, Gantt Chart, PERT chart, CPM, Microsoft Projects, and Primavera Project Management Software, Role of Project Manager, Objectives of Activity planning, Project Schedules, Activities, Sequencing and Scheduling,

Case study: Develop the Software project plan using Microsoft Projects or any open source tool like Jira, Kanban, extreme programming

Unit IV - Project Execution and Control (08 Hours)

Project execution: task assignment, tracking, and monitoring - Project control: schedule control, budget control, and quality control - Earned value management (EVM) and project performance measurement - Project reporting and communication

Risk management principles and concepts - Risk identification, analysis, and prioritization - Risk response planning and implementation - Risk monitoring and review

Learning Resources

Text Books:

1. “Project Management: The Managerial Process" by Erik W. Larson and Clifford F. Gray .
2. "Project Management: A Systems Approach to Planning, Scheduling, and Controlling" by Harold Kerzner
3. "Project Management for Engineering, Business, and Technology" by John M. Nicholas & Herman Steyn
4. Roger Pressman, “Software Engineering: A Practitioner‘s Approach”, McGraw Hill, ISBN 0–07–337597-

Reference Books:

1. "A Guide to the Project Management Body of Knowledge (PMBOK Guide)" by Project Management Institute (PMI)
2. "The Fast Forward MBA in Project Management" by Eric Verzuh
3. Pankaj Jalote, “An Integrated Approach to Software Engineering”, Springer, ISBN 13:9788173192715.
4. S K Chang, “Handbook of Software Engineering and Knowledge Engineering”, World Scientific, Vol I, II, ISBN: 978-981-02-4973-1

MOOC / NPTEL/YouTube Links: -

1. https://onlinecourses.swayam2.ac.in/cec20_cs07/preview
2. https://onlinecourses.nptel.ac.in/noc24_mg01/preview

Online Links: -

- https://www.atlassian.com/work-management/project-management
- https://www.atlassian.com/project-management
- https://ebookpdf.com/roger-s-pressman-software-engineering

Savitribai Phule Pune University		
OEL-221B : Optimization Techniques		
Teaching /scheme	**Credits**	**Examination Scheme**
Theory : 02 Hours/Week	02	**CCE** : 15 Marks **End-Semester:** 35 Marks

Prerequisite Courses :

1. Basic knowledge of mathematics and programming

Course Objectives: The course aims to:

1. Understand the fundamental principles and classifications of mathematical optimization problems.
2. Formulate real-life and engineering problems as mathematical models.
3. Apply classical and modern optimization techniques such as linear programming, nonlinear optimization, and integer programming.
4. Use heuristic and evolutionary algorithms to solve complex optimization problems relevant to AI and ML.
5. Analyze optimization models and evaluate solutions using appropriate tools and techniques.

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1: Define and classify various types of optimization problems in mathematical form.
- CO2: Apply graphical and simplex methods to solve linear programming problems.
- CO3: Apply optimization techniques to solve Transportation and Assignment problems.
- CO4 :Solve non linear problems Karush-Kuhn-Tucker theory.
- CO5 : Calculate numerical solution using various Numerical techniques

Course Contents

Unit I - Basic Concepts (07 Hours)

Historical Development; Engineering applications of Optimization; Formulation of real-life problems as mathematical models.

Case Study: Job scheduling in IT systems, Cost minimization in cloud services

Unit II -Linear Programming (07 Hours)

Standard form of linear programming (LP) problem; Canonical form of LP problem; Assumptions in LP Models; Elementary operations, Graphical method for two variable optimization problem; simplex method, Dual Simplex method

Case Study : Resource allocation in IT projects, Manpower scheduling, Karmarkar's projective scaling method

Unit III- Linear Programming Applications -(08 Hours)

Sensitivity analysis, Transportation and Assignment Problems

Case study: Use of software for solving linear optimization problems using graphical and simplex methods

Unit IV -Numerical Optimization Techniques- (08 Hours)

Basic theory, Method of Lagrange Multipliers, Karush-Kuhn-Tucker Theory, Convex optimization. line search methods, gradient methods, Newton's method, Conjugate direction methods, Quasi- Newton methods, Projected Gradient Methods

Case study: Use of software for Karush-Kuhn-Tucker theory Numerical calculation using softwar

Learning Resources

Text Books:

1. S.S. Rao – Engineering Optimization: Theory and Practice
2. Kalyanmoy Deb – Optimization for Engineering Design

Reference Books:

1. KantiSwarup – Operations Research
2. Chong and Zak – An Introduction to Optimization
3. Nocedal& Wright – Numerical Optimization

E books Links: -

1. Introduction to Optimization – MIT OpenCourseWare
2. Numerical Optimization – SpringerLink (online academic access)

MOOC/SWAYAM/NPTEL Courses:

1. https://archive.nptel.ac.in/courses/111/105/111105039/
2. https://onlinecourses.nptel.ac.in/noc20_ma23/preview
3. SWAYAM – Optimization for Machine Learning

Savitribai Phule Pune University		
OEL-221C : Principles and Practices of Management		
Teaching /scheme	**Credits**	**Examination Scheme**
Theory : 02 Hours/Week	02	**CCE** : 15 Marks **End-Semester:** 35 Marks

Prerequisite Courses :

1. Organizational Behavior, Fundamentals of Management

Course Objectives: The course aims to

1. To PRESENT a problem oriented in depth knowledge of Principle of Management
2. To PROVIDE students with a working knowledge of the skills and functions necessary to be an effective, efficient manager , leader with effective decision making
3. To ADDRESS the concepts and methods behind motivation and effective communication for solving real problems
4. To EXAMINE the management functions (planning, organizing, leading or influencing, and controlling) and the impact of those functions on the business organization

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO.1 UNDERSTAND how essential various functions of management are for every business manager.
- CO.2 APPLY the principles of management to the practical situations concerning the management of people and organizations and decision making in real business life.
- CO.3 DEVELOP effective communication and motivating abilities to solve real life problems.
- CO.4 PLAN and DEVELOP strategies for effective decision making under critical condition.

Course Contents

Unit I - Introduction to Management and Organization (07 Hours)

Management: Definition of Management, Nature, Scope, Purpose, Characteristics and Functions of Management. Evolution of Scientific Management, Modern Management, Principles of Management. Organization: What is Organization, Organizational Structure, Need and Purpose of Organization, Types of Organization.

Real World Assignment

1. Presentation on: Principles of Management by Different Management Gurus
2. Visit and Report to Understand Organizational Structure with Role and Responsibility of each Post/Designation

Case Study: Business management in manufacturing firms, Project management in construction, Organizational design in IT companies, Human resource management in startups, Operations management in service industries

Unit II - Manager, Leadership and Decision Making (07 Hours)

Manager: Who is a Manager? Roles of a Manager, Skills of an Effective Manager, Functions of a Manager

Leadership: Defining leadership and its role, leadership Style, Leadership Development, Leadership Behavior.

Decision Making: Nature and Process of Decision Making, Decision Making under Certainty and Uncertainty, Decision Making Steps & Processes, Brain-Storming

Real World Assignment : Real Life Case Which will Lead to Evolve Leadership and Decision Making Ability Among the Students

Exemplars / Practical Applications : Corporate management roles, Team leadership in project management, Executive decision-making in startups, Human resources leadership development, Strategic planning in organizations

Unit III - Motivation and Communication -(08 Hours)

Motivation: Concept, Theories – Classical and Modern, Importance, Financial and Nonfinancial Motivation, Positive and Negative Motivation, Group Motivation.

Communication: Definition, Meaning, Nature, Communication Process, Types and Barriers to Communication.

Real World Assignment: To understand Motivational and Effective Communication Strategies of any Ongoing Project Related to Mechanical Industry (Case Study based Approach)

Exemplars / Practical Applications: Employee motivation programs, Organizational behavior management, Leadership and team motivation, Corporate communication strategies, Change management and internal communication

Unit IV - Planning and Strategic Management- (08 Hours)

Planning: Why Management Process Starts With Planning, Steps in Planning, Planning Premises, Types of Planning, Barriers to Effective Planning, Operational Plan, Strategic Planning, Mckinsey's 7's Approach, SWOT Analysis.

Strategic Management : Meaning, Definition, Elements, Scope and Dimensions, Process, Importance, Strategic Decisions

Real World Assignment - Design Production Planning System for Manufacturing Industry / Case of Manufacturing Industry focusing of different functions such as Demand Forecasting, Production Scheduling, Material Management, Capacity Planning, Monitoring and Control

Exemplars / Practical Applications : Corporate strategic planning, Business operations management, Project planning and execution, SWOT analysis in market research, Strategic decision-making in startups

Learning Resources

Text Books:

1. Industrial Engineering and Management, Dr. O P Khanna, Dhanpat Rai and Publication, New Delhi
2. Industrial Engineering and Management, Banga and Sharma, Kahnna Publicartion, New Delhi
3. Principles of Engineering Management, Jishan he, Springer.
4. Management Principles Process and Practices by Anil Bhat, Arya Kumar Oxford Latest Edition
5. Principles and Practices of Management by Shejwalkar and Ghanekar Tata McGraw Hill Latest Edition

Reference Books:

1. Prasad, L.M., Principles and practice of Management, Sultan Chand & Sons
2. Gupta, R.N., Principles of Management, Sultan Chand & Co
3. Vikash Kumar, Principles and practice of Management, Laxmi Publication
4. J K Mitra, Principles and practice of Management. Oxford
5. T. Ramasamy, Principles of Management, Himalaya Latest Edition

E books Links: -

1. https://onlinecourses.nptel.ac.in/noc24_mg47/preview
2. https://archive.nptel.ac.in/courses/110/105/110105146/
3. https://www.youtube.com/watch?v=d3YgvEqheSc
4. https://www.youtube.com/playlist?list=PLBtFp6a9Py-f2zTWPQVGwaHX-PQ1dQUwS

Savitribai Phule Pune University		
OEL-221D : Financial Management		
Teaching /scheme	**Credits**	**Examination Scheme**
Theory : 02 Hours/Week	02	**CCE** : 15 Marks **End-Semester:** 35 Marks

Prerequisite Courses, if any :

1. Engineering Economics / Basic Economics (recommended).
2. Business environment and economic systems (recommended).

Course Objectives: The course aims to:

1. To introduce engineering students to the fundamental concepts of financial management.
2. To develop an understanding of financial statements and basic financial decision-making.
3. To equip students with tools to evaluate investment and financing options.
4. To enhance skills in applying financial principles to technical projects and business scenarios.
5. To create financial awareness useful in entrepreneurial or managerial roles.

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1: Understand key concepts and functions of financial management (BTL 2)
- CO2: Apply time value of money techniques and capital budgeting tools (BTL 3)
- CO3: Analyze financial statements using ratio analysis (BTL 4)
- CO4: Evaluate working capital needs for various business scenarios (BTL 5)
- CO5: Identify and classify sources of finance and understand basic cost of capital (BTL 2)

Course Contents

Unit I -Introduction to Financial Management (07 Hours)

- Nature, scope and functions of financial management
- Objectives: Profit vs. Wealth Maximization
- Role of Finance Manager
- Types of business finance: Equity, Debt, Internal financing
- Importance of finance for engineers and startups

Case Study: Role of finance in a tech startup , Real-world examples of financial decision making in engineering firms

Unit II - Time Value of Money & Capital Budgeting (07 Hours)

- Concept and significance of Time Value of Money
- Present Value (PV) and Future Value (FV) techniques
- Simple capital budgeting tools: Payback Period, NPV, IRR, ARR, PI.
- Engineering project investment evaluation examples **Case Study:** NPV calculation for a solar plant project, Payback period for a manufacturing automation upgrade

Unit III - Financial Statements & Ratio Analysis -(08 Hours)

- Introduction to financial statements: P&L, Balance Sheet, Cash Flow Statements
- Key ratios: Liquidity, Profitability, Solvency, Turnover Ratios.
- Simple analysis and interpretation of company annual reports with the help of ratio analysis.

Case study: Ratio analysis of a listed engineering company, Balance sheet reading for a medium-sized manufacturing firm.

Unit IV- Applications- (08 Hours)

- Concept and importance of working capital
- Components: Inventory, Receivables, Payables
- Operating cycle and estimation of working capital
- Application in manufacturing and service industries
- Numericals on Working Capital Management
- Numericals on Working Capital Requirement
- Sources of Finance & Cost of Capital –
  - Classification of sources: Short-term and Long-term
  - Equity, Debt, Retained earnings, Preference shares
  - Introduction to Cost of Capital: Concept of WACC
  - Role of banks, financial institutions, and capital markets

Case study:

- Working capital analysis for a construction project
- Inventory management for a robotics company
- Funding mix for an electric vehicle startup
- WACC calculation for capital budgeting decision

Learning Resources

Text Books:

- I.M. Pandey, Financial Management
- Prasanna Chandra, Financial Management
- Financial Management by I.M. Pandey, Vikas Publishing House
- Financial Management by Rustagi R.P., Taxmann Publications

Reference Books:

- Khan & Jain, Financial Management
- Van Horne, Financial Management and Policy
- Ross, Westerfield & Jordan, Corporate Finance

E books Links: -

- Financial Management eBook by IIMBx (edX)

MOOC/SWAYAM/NPTEL Courses:

- Financial Management for Managers – NPTEL (Prof. P.K. Jain, IIT Delhi)
- Basics of Financial Management – NPTEL (Prof. V. Sridhar, IIT Madras)

Savitribai Phule Pune University		
OEL-221E : Business Essentials for Rural Development		
Teaching /scheme	**Credits**	**Examination Scheme**
Theory : 02 Hours/Week	02	**CCE** : 15 Marks **End-Semester:** 35 Marks

Prerequisite Courses :

1. Basic Understanding of Business Concepts, Knowledge of Rural Development Issues, Analytical Skills, Communication Skills, Critical Thinking

Course Objectives: The course aims to:

1. To introduce the fundamental concepts of business and entrepreneurship with a focus on rural development.
2. To understand the structure, challenges, and opportunities of rural markets and rural enterprises.
3. To enable students to explore business models and government schemes that promote rural entrepreneurship.
4. To develop problem-solving and planning skills for designing sustainable rural business initiatives.

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1. Understand the dynamics of rural markets and the importance of rural business development.
- CO2. Apply entrepreneurial principles to identify and evaluate rural business opportunities.
- CO3. Develop basic marketing, financial, and operational plans for rural enterprises.
- CO4. Connect rural business ideas with relevant government schemes and sustainability practices.

Course Contents

Unit I -Introduction to Business and Rural Economy (07 Hours)

a) What is business? Types and forms of business organizations
b) Role of business in economic development
c) Overview of the Indian rural economy and demographics
d) Characteristics of rural markets and consumers
e) Economic activities in rural areas: agriculture, cottage industries, services
f) Challenges in rural business development: infrastructure, education, finance

Unit II - Essentials of Entrepreneurship for Rural Development (07 Hours)

a) Definition and traits of an entrepreneur

b) Importance of rural entrepreneurship
c) Steps in setting up a small business in rural areas
d) Business idea generation and opportunity identification
e) Case studies of successful rural entrepreneurs and enterprises
f) Social entrepreneurship and community-driven models

Unit III - Marketing, Finance, and Operations in Rural Business-(08 Hours)

a) Marketing mix (4Ps) and its relevance in rural markets
b) Rural marketing strategies: communication, pricing, and distribution
c) Basics of financial management: cost, revenue, profit, breakeven
d) Sources of finance: banks, microfinance, SHGs, NBFCs
e) Operational aspects: procurement, inventory, quality, workforce
f) Use of digital tools and mobile technology in rural business

Unit IV - Government Schemes, NGOs, and Sustainable Development- (08 Hours)

a) Key government schemes for rural business (PMEGP, MUDRA, NRLM, etc.)
b) Role of NABARD, KVIC, and other rural support institutions
c) NGOs and their contribution to rural development
d) Sustainable development goals (SDGs) and rural empowerment
e) Role of engineering and innovation in solving rural problems
f) Project work: Designing a rural business plan or sustainable solution

Learning Resources

Text Books:

1. Rural Development: Principles, Policies and Management Katar Singh, Sage Publications India
2. Rural Development in India: Past, Present and Future, Vasant Desai, Himalaya Publishing House
3. Rural Marketing, C.S. Rayudu, , Himalaya Publishing House
4. Rural Marketing in India, S.S. Acharya & N.L. Agarwal, , Oxford & IBH Publishing Co. Pvt. Ltd.

Reference Books:

1. Social Entrepreneurship and Rural Development, Dr. P.C. Jain, Regal Publications
2. Rural Marketing, S.M. Jha, Prentice Hall India
3. Indian Economy Dr. K.K. Dewett & M.H. Navalur, S. Chand Publishing
4. Rural Development: Some Grassroots Experiences Baldev Singh Rawat Publications

Govenment Resources: -

1. Planning Commission / NITI Aayog Reports E.g., Annual Reports on Rural Development Programmes, Strategy for New India @75

2. Ministry of Rural Development (India) Reports and updates on schemes like MGNREGA, PMGSY, NRLM Website: https://rural.nic.in

3. NABARD Publications Annual reports, rural finance studies, SHG and microfinance data Website: https://www.nabard.org

4. National Institute of Rural Development and Panchayati Raj (NIRDPR) Research papers and training materials for rural development professionals Website: https://nirdpr.org.in

MOOC/SWAYAM/NPTEL Courses:

1. Business Development: From Start to Scale - Course

Savitribai Phule Pune University		
OEL-221F : Nanoscience and Nanotechnology		
Teaching /scheme	**Credits**	**Examination Scheme**
Theory : 02 Hours/Week	02	**CCE** : 15 Marks **End-Semester:** 35 Marks

Course Objectives: The course aims to:

1. Demonstrate

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1: Utilize

Course Contents

Unit I - Introduction to Nanoscience and Nanotechnology (07 Hours)

Definition of nanoscience and nanotechnology, historical development, and significance of the nanoscale. Understanding the Nanoscale: Size and scale comparison, nanometer size range, properties at the nanoscale (quantum effects, surface area).

Unit II - Fundamentals of Nanomaterials (07 Hours)

Types of nanomaterials (nanoparticles, nanowires, nanotubes), properties (optical, mechanical, electrical).

Unit III - Synthesis and Characterization Techniques for Nanomaterials-(08 Hours)

Spoilage of milk and milk products by microorganism and its control., Different packaging Materials, importance of packaging in milk and milk product preservation Quality assurance of dairy products: Quality assurance (ISO 9001:2000) and food safety system (HACCP) Quality assessment of milk-detection of adulteration

Unit IV - Applications of Nanotechnology -(08 Hours)

Medicine: Drug delivery systems, diagnostic tools, cancer treatment, and biosensors. (10 lectures) Nanoelectronics: transistors, quantum dots, MEMS, and NEMS in everyday electronics (smartphones, computers). Energy and Environment: Nanomaterials in solar cells, batteries, supercapacitors, and water purification systems. Consumer Products Examples: nano-coatings in textiles, self-cleaning surfaces, cosmetics, food packaging.

Learning Resources

Text Books:

1. Introduction to Nanoscience and Nanotechnology" by Gabor L. Hornyak, Joydeep Dutta, H.F. Tibbals, and John J. Moore.

2. Nanotechnology: Principles and Practices" by S.K. Kulkarni.

Savitribai Phule Pune University		
OEL-221A : Industrial Organization Management		
Teaching /scheme	**Credits**	**Examination Scheme**
Theory : 02 Hours/Week	02	**CCE** : 15 Marks **End-Semester:** 35 Marks

Course Objectives: The course aims to:

1. To understand the basic concepts maagement quality of good leadership and teamwork, leadership skill, and industrial economics.
2. To explore the fundamentals of Industrial economics and Management.
3. To analyse and differentiate between marketing management and financial management.
4. To understand business organization structure and ownership.

Course Outcomes: Upon successful completion of this course, students will be able to:

- CO1: Discuss the fundamentals of management, quality of good leadership and teamwork, leadership skill, and industrial economics.
- CO2: Explain the importance of quality, technology management and quality management.
- CO3: Analyse and differentiate between marketing management and financial management
- CO4: Understand the difference between different types of business organizations, business ownership

Course Contents

Unit I -Management, Industrial Economics and Leadership (07 Hours)

Management: Meaning, scope, function, and importance of management. Difference between administration and management.

Leadership: Importance, Types: Autocratic, Democratic and Laissez-Faire Leadership, qualities of good Leader.

Industrial Economics: Definition, Demand and Supply concept, Law of demand and supply.

Unit II -Technology Management and Quality Management (07 Hours)

Technology Management & Its Classification: Definition, application and its scope. Classification its importance on National Economy.

Quality Management: Definition Types, Quality of design, Seven QC Tools, Poka Yoke (Mistake Proofing). Quality circles, Kaizen: Meaning and Implementation. TQM, 5S (Case study of Toyota, descriptive treatment). Six-Sigma.

Unit III - Marketing and Financial Management-(08 Hours)

Marketing Management: Meaning of Market, Marketing strategy, motives, types-Perfect Competition, Monopoly, Monopolistic completion and Oligopoly. Online Marketing (Digital Marketing).

Financial Management: Definition, Types of costs (Fixed, Variable, average, marginal, and total cost) and methods of costing price, capital. Debit, credit, Profit and loss statement, Balance sheet

Unit IV - Business Organization, Business Ownership (08 Hours)

Business Organizations: Line organization, Staff organization and Functional Organization.

Business Ownership and its Types: One person company Types of ownership, Sole proprietorship, Partnership (Act 1934), LLP (Limited Liability Partnership) (Act 2008).

Entrepreneurship: Importance and limitations of rational decision making, Decision making under certainty, uncertainty and risk, Small and medium scale industries in India.

Learning Resources

Text Books:

1. O.P. Khanna, "Industrial Engineering and Management", Dhanpat Rai Publication, New Delhi, 2018.
2. E. H. Mcgrath, "Basic Managerial Skills for All', 9th Edition, Prentice Hall of India, New Delhi, 2011.
3. Tarek M. Khalil, "Management of Technology", McGraw Hill Publication, US, 1999.
4. Prabuddha Ganguli, "Intellectual Property Rights", McGraw Hill Publication, 2017.
5. M. Y.Khan and P.K. Jain, "Management Accounting" 8th Edition, McGraw Hill Publication, 2021.

Reference Books:

1. C. B. Mamoria and V. S. P. Rao, "Personnel Management", Himalaya Publishing House, 30th Edition 2021.
2. Philip Kotler et al., "Marketing Management", Pearson Edition 2008.
3. I. M. Pandey, "Financial Management", 11th Edition, Vikas Publishing House Pvt. Ltd., Delhi, 2011. Philip Kotler-Marketing
4. John M. Kelly, Total Quality Management: How to Program for the High Performance Business", Standardsmedia, 2000.
5. Dale H. Besterfield and Carol Besterfield, "Total Quality Management", 5th Edition, Pearson Education, 2018

E books Links: -

1. https://knowledgegainer.delnet.in/Record/EB-0000133166
2. https://www.bloomsbury.com/us/industrial-economics-9781349233069/
3. https://info.email.online.hbs.edu/leadership-ebook

4. https://www.bloomsbury.com/us/technology-management-9781137431868/
5. https://my.uopeople.edu/pluginfile.php/57436/mod_book/chapter/121631/BUS5116TextbookQuali
6. https://open.umn.edu/opentextbooks/textbooks/introduction-to-intellectual-property-law
7. https://ecampusontario.pressbooks.pub/humanresourcesmgmt/
8. https://www.amazon.in/Marketing-Management-Keller-Philip-Kotler-ebook/dp/B071GNMDDM
9. https://www.amazon.in/Fundamentals-Financial-Management-Chandra-Bose-ebook/dp/B00K7YG36
10. https://www.sultanchandandsons.com/Images/BookImages/Chapters/628_TC%201279%20Booklet%
11. https://www.emporia.edu/documents/1737/Types_of_Business_Ownership.pdf?utm_source=chatgpt

YouTube Videos :

1. https://youtu.be/w-wxvJFfKEw
2. https://youtu.be/SoUjQpIO3YY
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4. https://youtu.be/5fvpsqPWZac
5. https://youtu.be/HX8_UdIwy58