

Savitribai Phule Pune University, Pune, Maharashtra, India



सावित्रीबाई फुले पुणे विद्यापीठ

Faculty of Science and Technology



National Education Policy (NEP)-2020 Compliant Curriculum

Second Year Engineering (2024 Pattern) in Information Technology

(With effect from Academic Year 2025-26)

Contents

Savitribai Phule Pune University		
Second Year of Engineering (2024 Course)		
(With effect from Academic Year 2025-26)		
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Preface

It is with great pride and a deep sense of responsibility that I present the NEP 2020-compliant detailed 2024 pattern curriculum for the **Second Year Bachelor of Engineering in Information Technology** at **Savitribai Phule Pune University, Pune**.

In alignment with the visionary framework of the **National Education Policy 2020**, this revised curriculum represents a transformative step towards creating a more holistic, multidisciplinary, and flexible engineering education. The focus is not only on deepening the technical knowledge base of our students, but also on fostering innovation, creativity, ethical thinking, and lifelong learning skills essential in the fast-evolving digital era.

The curriculum for the second year has been thoughtfully structured to strike a balance between core computing fundamentals—such as data structures and algorithms, object oriented programming, basics of computer network, computer graphics, database management systems, and software engineering—and emerging domains like digital business. In addition, we have integrated value-added courses, skill development modules, interdisciplinary learning components as open electives, and community engagement project to promote practical understanding and industry readiness.

This curriculum is the result of rigorous consultations, deliberations, and collaborative work by esteemed faculty members, industry experts, and academic stakeholders. I extend my heartfelt appreciation to all contributors for their commitment to excellence and innovation in education.

As we implement this forward-looking curriculum, we reaffirm our commitment to nurturing IT professionals who are not only technically sound but also socially responsible and globally competent.



Dr. Sudeep D. Thepade

Chairman, Board of Studies- Information Technology

Savitribai Phule Pune University

Pune

I

Abbreviations

AEC	Ability Enhancement Course
BSC	Basic Science Course
CCC	Co-Curricular Courses
CCE	Comprehensive Continuous Evaluation
CEP	Common Engineering Project
CO	Course Outcome
ELC	Experiential Learning Courses
ESC	Engineering Science Course
FP	Field Project
IKS	Indian Knowledge System
INT	Internship
MDM	Multidisciplinary Minor
NEP	National Education Policy
OE	Open Elective
OJT	On Job Training
PCC	Program Core Course
PEC	Programme Elective Course
PO	Program Outcomes
PR	Practical
PRJ	Project
PSO	Program Specific Outcome
RM	Research Methodology
TH	Theory
TU	Tutorials
VEC	Value Education Course
VSE	Vocational and Skill Enhancement Course

II

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

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

NEP 2020 Compliant Curriculum Structure

Second Year Engineering (2024 Pattern) – Information Technology

Semester III

Sr	Course Code	Course Title	Type of Course	Teaching Scheme			Examination Scheme						Credit			
				L	T	P	CCE	ESE	TW	PR	OR	Total	L	T	P	Total
1	PCC-201-ITT	Data Structures & Algorithms	PCC	3			30	70				100	3			3
2	PCC-202-ITT	Object Oriented Programming	PCC	3			30	70				100	3			3
3	PCC-203-ITT	Basics of Computer Network	PCC	3			30	70				100	3			3
4	PCC-204-ITT	Data Structures & Algorithms Lab	PCC			4			25	50		75			2	2
5	PCC-205-ITT	Object Oriented Programming Lab	PCC			2			25		25	50			1	1
6	OEL-220-ITT	Open Elective - I	OEL	2			15	35				50	2			2
7	MDM-230-ITT	Digital Electronics and Logic Design	MDM	2			30	70				100	2			2
8	EEM-240-ITT	Principles of Management & Entrepreneurship	EEM		1	2			25			25		1	1	2
9	VEC-250-ITT	Universal Human Vales and Professional Ethics	VEC	2			15	35				50	2			2
10	CEF-260-ITT	Community Engagement Project	CEP/F P			4			25		25	50			2	2
Total				15	1	12	150	350	100	50	50	700	15	1	6	22

CCE*: Comprehensive Continuous Evaluation

Open Elective I :

OEL-220-ITT -A : Digital Business

OR

OEL-220-ITT -B : Probability & Statistics

NEP 2020 Compliant Curriculum Structure
Second Year Engineering (2024 Pattern) – Information Technology

Semester IV

Sr	Course Code	Course Title	Type of Course	Teaching Scheme			Examination Scheme						Credit			
				L	T	P	CCE	ESE	TW	PR	OR	Total	L	T	P	Total
1	PCC-206-ITT	Database Management System	PCC	3			30	70				100	3			3
2	PCC-207-ITT	Computer Graphics	PCC	3			30	70				100	3			3
3	PCC-208-ITT	Software Engineering	PCC	2			30	70				100	2			2
4	PCC-209-ITT	Database Management System Lab	PCC			2			25	25		50			1	1
5	PCC-210-ITT	Computer Graphics Lab	PCC			2					25	25			1	1
6	OEL -221-ITT	Open Elective - II	OEL	2			15	35				50	2			2
7	MDM-231-ITT	Processor Architecture	MDM	2			30	70				100	2			2
8	VSE- 270-ITT	Digital Marketing and Social Media	VSEC			4			25	25		50			2	2
9	AEC-281-ITT	Business Communication Skills	AEC		1	2			50			50		1	1	2
10	EEM-241-ITT	E-Commerce	EEM		1	2			25			25		1	1	2
11	VEC-251-ITT	Environmental Studies	VEC	2			15	35				50	2			2
Total				14	2	12	150	350	125	50	25	700	14	2	6	22

CCE*: Comprehensive Continuous Evaluation

Open Elective II :

OEL -221-ITT - A : Financial Management

OR

OEL -221-ITT - B : Optimization Techniques

General Guidelines

Credit Specifications

- i Theory Courses: 13-15 hours of teaching per credit is required in a semester.
- ii Laboratory Course: 26-30 hours in laboratory activities per credit is required in a semester.
- iii Studio activities: Studio activities involve the engagement of students in creative or artistic activities. Every student is engaged in performing a creative activity to obtain a specific outcome. Studio-based activities involve visual- or aesthetic-focused experiential work. A minimum of 26-30 hours in studio activities per credit in a semester is required.
- iv Workshop-based activities: Courses involving workshop-based activities require the engagement of students in hands-on activities related to work/vocation or professional practice. Every student is engaged in performing a skill-based activity. Related to specific learning outcome(s). 26- 30 hours of workshop-based activities per credit in a semester is required.
- v Seminar/ Group Discussion: 13-15 hours of participation in seminar/ Group Discussion activity per credit in a semester is required.
- vi Internship: Credits for internship shall be one credit per two weeks of internship (or 36-40 hours of engagement), The internship shall be monitored jointly by the faculty and Industry/ Organisation Mentor. Internship of One Semester duration shall be offered either in the VII or VIII semesters. Courses offered during the Internship Semester shall be offered in online mode.
- vii Field-based Learning/ Practices: These are the courses requiring students to participate in field-based learning/projects generally under the supervision of faculty. A minimum of 26-30 hours of learning activities per credit in a semester is required.
- viii Community Engagement Projects: These are the courses requiring students to participate in field-based learning/projects generally under the supervision of faculty. The curricular component of 'community engagement and service' will involve activities that would expose students to the socio-economic issues in society so that the theoretical learnings can be supplemented by actual life experiences to generate solutions to real-life problems.
- ix 26-30 hours of contact time per credit in a semester along with 13-15 hours of activities such as preparation for community engagement and service, preparation of reports, etc., and independent reading and study with 2 credit courses.

Definition of Credit

- 1 hour Lecture (TH) per week per semester = 1 Credit
- 1 hours Tutorial (TU)per week per semester = 1 Credit
- 2 hours Practical (PR)/Laboratory per week = 1 Credit

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- 4 Credit theory courses shall be designed for a minimum of 50 hours of the Teaching-Learning process.
- 3 Credit theory courses shall be designed for a minimum of 40 hours of the Teaching-Learning process.
- Two-credit theory courses shall be designed for a minimum of 25 hours of the Teaching-Learning process
- One credit theory course shall be designed for a minimum of 15 hours of the Teaching-Learning process

Examinations:

- **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) :

- CCE of 30 marks based on all the Units of course syllabus to be scheduled and conducted at institute level.
- Case studies included under each unit are intended to support applied learning and are part of Comprehensive Continuous Evaluation
- 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.
- 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

- CCE of 15 marks based on all the Units of course syllabus to be scheduled and conducted at institute level. To design a Comprehensive Continuous Evaluation (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

VIII

SYLLABUS

SEMESTER - III

Savitribai Phule Pune University Second Year of Information Technology (2024 Course) Course Code: PCC-201-ITT Course Name: Data Structures & Algorithms		
Teaching Scheme	Credits	Examination Scheme
Theory :3 H/W	3	CCE - 30 Marks End Sem - 70 Marks
Tutorial :	-	
Prerequisite Courses , if any: Fundamental knowledge of programming language and basics of algorithms		
Companion Course , if any: Discrete Structures/Discrete Mathematics		
Course Objectives: <ul style="list-style-type: none"> To study data structures and their implementations and applications. To understand and apply appropriate data structures to implement stack and queue. Strategically select and apply appropriate data structures and algorithms for effectively solving problems that can be modeled using tree & graph To learn different file organizations. To learn and apply advanced algorithmic techniques such as Divide and Conquer, Greedy Method, and Dynamic Programming for problem solving 		
Course Outcomes: <ul style="list-style-type: none"> To Perform basic analysis of algorithms with respect to time and space complexity. To apply appropriate data structures to implement stack and queue. To design and specify the operations of a nonlinear-based abstract data type and implement them in a high-level programming language. Design different hashing functions To Solve real-life optimization problems using Divide and Conquer, Greedy, and Dynamic Programming strategies. 		
Course Contents		
Unit No: I	Introduction to Data Structures & Algorithms	07 Hours
Introduction to Data Structures: Data, Data Object, Data types, Abstract Data Types (ADT), Data structures, Classification of Data Structure: primitive and non-primitive, Static and Dynamic, Persistent and Ephemeral data structures Introduction to Algorithms: Definition and Characteristics of an algorithm, Algorithm Specification, Introduction to algorithm design strategies Performance Analysis- Time and space complexity, Asymptotic notations, Best, Average and worst cases. Finding complexity using step count method, Analysis of programming Constructs-Linear, Quadratic, Cubic, Logarithmic Basic Searching Algorithms: Linear Search, Binary Search Basic Sorting Algorithm: Bubble Sort, Selection Sort, Insertion Sort		
Exemplars /Case Studies	Case Study 1: Efficient Data Retrieval in Large Databases Case Study 2: Student Attendance Tracker	

Unit No: II	Linear Data Structures	07 Hours
Linked Lists: Singly LL, Doubly LL, Circular LL. Linked list as an ADT. Stack: Stack as an ADT, Arrays and Linked Lists implementation, Implicit vs explicit stack, Applications of stack: recursion, converting expressions from infix to postfix or prefix form, evaluating postfix or prefix form Queue: Queue as an ADT, Arrays and Linked Lists implementation, Types: Circular Queue, Double-ended Queue (Deque), Applications		
Exemplars/Case Studies	1. Linked Lists (Doubly LL): A music player application uses a doubly linked list to store songs in a playlist. Users can navigate forward and backward through the playlist. Each song node contains data about the song and references to both the previous and next songs. 2. Stack: Undo/Redo Feature in Text Editors. 3. Queue: In a network router, a queue is used to buffer packets for transmission. The packets arrive in order and are transmitted in the same order, ensuring smooth data flow through the network. In a real-time system, a deque could be used to handle urgent tasks at both ends of the queue.	
Unit No: III	Non- Linear data Structures	09 Hours
Tree- Definitions and Concepts, Representation of binary tree, Binary tree traversal (Inorder, postorder, preorder), Threaded binary tree, Binary search trees, Conversion of General Trees To Binary Trees, Applications Of Trees Some balanced tree mechanism, eg. AVL trees, 2-3 trees, Height Balanced, Weight Balance, Graph- Matrix Representation Of Graphs, Elementary Graph operations,(Breadth First Search, Depth First Search, Spanning Trees, Shortest path, Minimal spanning tree- Prim's and Kruskal's Algorithm) Heap: Heap data structure, Min and Max Heap, Heap sort, applications of heap		
Exemplars/Case Studies	1 Recommendation System for E-commerce (tree) 2 Optimizing Product Filtering Performance on a High-Traffic E-commerce Site(tree) 3 "India Airlines" Flight Search Optimization (Graph)	
Unit No: IV	Hashing, String processing Applications	08 Hours
Hashing: Hash Functions, Collision Handling Techniques (Chaining, Open Addressing) String Processing: Naïve String Matching, Rabin-Karp Algorithm, Knuth-Morris-Pratt (KMP) Algorithm Applications of DSA: , Social Network Graph Analysis, and AI Search Algorithms		
Exemplars/Case Studies	Case Studies on File Systems	
Unit No: V	Advanced Algorithms	07 Hours
Divide and Conquer: Merge Sort, Quick Sort, Matrix Multiplication; Greedy Algorithms: Activity Selection, Fractional Knapsack, Huffman Coding; Dynamic Programming: 0/1 Knapsack, Longest Common Subsequence (LCS), Floyd-Warshall.		

Exemplars/Case Studies	<p>1. Efficient Parcel Sorting in a Warehouse (Concepts: Merge Sort, Quick Sort)</p> <p>2. Optimizing Ad Slot Allocation in Online Streaming (Concepts: Activity Selection, Fractional Knapsack (Greedy))</p> <p>Scenario: Choose the best set of ads to show within a fixed break time to maximize revenue.</p>
Learning Resources	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Michael T. Goodrich, Roberto Tamassia, and David M. Mount , “Data Structures and Algorithms in C++" 2. R. Gilberg, B. Forouzan, “Data Structure: A Pseudo code approach with C++”, Cengage Learning. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Thomas H. Cormen, Charles E. Leiserson and Ronald L. Rivest, “Introduction to Algorithms”, 2nd Edition, The MIT Press, 2001, ISBN 0-262-03293-7. 2. Sartaj Sahni, “Data Structures, Algorithms and Applications in C++”, 2nd Edition, Universities Press. 3. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++” (2007), Second Edition, Pearson Education. 4. Goodrich, “Data Structures and Algorithms in C++”, Wiley. 	
e-Books:	
<p>Links to online SWAYAM/NPTEL Courses:</p> <ol style="list-style-type: none"> 1. NPTEL, “Introduction to Data Structures”, By Dr Gurpreet Singh Lehal Link: https://onlinecourses.swayam2.ac.in/cec25_hs62/preview 2. NPTEL, “Data Structures” By Dr. M. Deivamani Link: https://onlinecourses.swayam2.ac.in/cec25_ma15/preview 	

Savitribai Phule Pune University Second Year of Information Technology (2024 Course) Course Code: PCC-202-ITT Course Name : Object Oriented Programming		
Teaching Scheme	Credits	Examination Scheme
Theory : 3 Hours/Week	3	CCE- 30 Marks End-Sem- 70 Marks
Prerequisite Courses, if any: Programming and Problem Solving		
Companion Course, if any: Principles of Programming Languages		
Course Objectives: <ul style="list-style-type: none"> To apply the concepts of the object-oriented programming paradigm. To design and implement models for real-life problems using object-oriented programming. To develop effective object-oriented programming skills. 		
Course Outcomes: On completion of the course, students will be able to– CO1: Understand OOP concepts like classes, objects, inheritance, and polymorphism. CO2: Use methods, constructors, and memory management. CO3: Apply inheritance and polymorphism for code reuse. CO4: Handle exceptions and use generics with collections. CO5: Perform file handling and implement basic design patterns.		
Course Contents		
Unit No: I	Foundations of Object-Oriented Programming	06 Hours
Introduction to OOP: Limitations of Procedural Programming, Need for Object-Oriented Programming, Fundamentals of Object-Oriented Programming: Objects, Classes, Data Members, Methods, Messages, Data Encapsulation, Data Abstraction and Information Hiding, Inheritance, Polymorphism, Static and Dynamic Binding, Message Passing. Class: Creating a Class, Visibility/Access Modifiers, Encapsulation.		
Exemplars/Case Studies	Model a real world scenario (vehicle class, fruit class, student management in university etc.) using Object Oriented Paradigm	

Reference Books	Java: The Complete Reference by Herbert Schildt, Object-Oriented Programming with Java by E. Balagurusamy	
Unit No: II	Methods and Constructors	06 Hours
<p>Methods: Adding a Method to a Class, Returning a Value, Adding a Method That Takes Parameters, The this Keyword, Method Overloading, Object Creation, Using Object as a Parameter, Returning Objects, Array of Objects.</p> <p>Memory Allocation: new, Static Data Members, Static Methods.</p> <p>Constructors: Introduction, Use of Constructors, Characteristics of Constructors, Types of Constructors, Constructor Overloading.</p> <p>Garbage Collection: Destructors and Finalizers.</p>		
Exemplars/Case Studies	<ul style="list-style-type: none"> • Represent a vector using class and include appropriate methods to perform various tasks. • A book shop inventory 	
Reference Books	<ul style="list-style-type: none"> • Java: The Complete Reference by Herbert Schildt, • Object-Oriented Programming with Java by E. Balagurusamy 	
Unit No: III	Inheritance & Polymorphism	06 Hours
<p>Inheritance: Introduction, Need of Inheritance, Types of Inheritance, Benefits of Inheritance, Cost of Inheritance, Constructors in Derived Classes, Method Overriding, Abstract Classes and Interfaces.</p> <p>Polymorphism and Software Reuse: Introduction, Types of Polymorphism, Compile-Time and Run-Time Polymorphism, Mechanisms for Software Reuse, Efficiency and Polymorphism.</p>		
Exemplars/Case Studies	<ul style="list-style-type: none"> • A bank account system 	
Reference Books	<ul style="list-style-type: none"> • Java: The Complete Reference by Herbert Schildt, • Object-Oriented Programming with Java by E. Balagurusamy 	
Unit No: IV	Exception Handling and Generic Programming	06 Hours

Exception Handling:

Errors, Types of Errors, Exceptions and Their Types, Exception-Handling Fundamentals, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, User-Defined Exceptions using throw.

Generics: Introduction, Introduction to Language-Specific Collection Interfaces: List Interface and Set Interface, Collection Classes: ArrayList Class and LinkedList Class.

Exemplars/Case Studies	<ul style="list-style-type: none">Exception handling and generic programming using array list (ArrayList class)	
Reference Books	<ul style="list-style-type: none">Java: The Complete Reference by Herbert Schildt,Object-Oriented Programming with Java by E. Balagurusamy	
Unit No: V	File Handling and Design Patterns	06 Hours
<p>File Handling: Introduction; Concepts of Streams, Stream Classes, Byte Stream Classes, Character Stream Classes, Using Streams and Other Useful I/O Classes, Using the File Class, Input/output Exceptions, Creation of Files, Reading/Writing Characters, Reading/Writing Bytes, Handling Primitive Data Types, Concatenating and Buffering Files, Random Access Files.</p> <p>Design Patterns: Introduction, Types of Design Patterns, Adapter, Singleton, Iterator.</p>		
Exemplars/Case Studies	<ul style="list-style-type: none">Student Management System	
Reference Books	<ul style="list-style-type: none">Java: The Complete Reference by Herbert Schildt,Object-Oriented Programming with Java by E. Balagurusamy,Head First Design Patterns by Eric Freeman & Elisabeth Robson, O'Reilly	

Learning Resources**Text Books:**

1. Java: The Complete Reference by Herbert Schildt, McGraw-Hill
2. Object-Oriented Programming with Java by E. Balagurusamy, McGraw-Hill

Reference Books:

1. Head First Java by Kathy Sierra & Bert Bates, O'Reilly
2. Effective Java by Joshua Bloch, Addison-Wesley
3. Head First Design Patterns by Eric Freeman & Elisabeth Robson, O'Reilly

e-Books:

1. Java: The Complete Reference (PDF/ePub) (*Free e-book platforms*)
2. Head First Java (PDF)
3. Java Programming Tutorials (w3schools)

GeeksforGeeks Java Programming

Links to online SWAYAM/NPTEL Courses:

1. **Programming in Java – NPTEL (Prof. Debasis Samanta, IIT Kharagpur)**
<https://onlinecourses.nptel.ac.in/noc23-cs85>
2. **Object-Oriented Programming in Java – NPTEL (Prof. D. Parameswaran, IIT Madras)**
<https://onlinecourses.nptel.ac.in/noc22-cs30>
3. **Introduction to Programming in Java – SWAYAM**
https://swayam.gov.in/nd1_noc20_cs35

Savitribai Phule Pune University Second Year Engineering Information Technology (2024 Course) Course Code: PCC-203-ITT Course Name: Basics of Computer Network		
Teaching Scheme	Credits	Examination Scheme
Theory : 3 H/W	3	CCE -30 Marks ESE - 70 Marks
Practical : -		
Prerequisite Courses, if any: Fundamentals of Communication Systems, Basic Electronics and Cabling		
Companion Course, if any: ---		
Course Objectives: <ul style="list-style-type: none"> To understand data communication principles and basic terminology of network concepts. To learn about different communication standards To introduce students to local, metropolitan and wide area networks use the standard OSI reference model as a framework and to the Internet protocol suite and network tools and programming using various networking technologies. To understand different network protocols 		
Course Outcomes: <ul style="list-style-type: none"> CO1: Student will able to learn about the principles of data communication and network components. CO2: Student will able to learn about how computer networks are organized with the concept of layered approach CO3: Student will able to learn about how signals are used to transfer data between nodes. CO4: Student will able to learn about how packets in the Internet are delivered. CO5: Student will able to learn about how routing protocols work CO6: Student will able to learn about applications of OSI/TCP-IP Model 		
Course Contents		
Unit No: I	Introduction to Computer Networking Fundamentals	06 Hours
Communication Systems: Overview of data transmission systems, including key elements like sender, receiver, medium, and protocols. Networks: Concept of interconnected devices for data exchange, categorized by scale (e.g., LAN, MAN, WAN) and structure. Topologies: Physical and logical arrangements of network nodes, such as star, ring, mesh, and hybrid. Protocols: Rules governing data exchange, ensuring reliable communication across networks. Network Architecture: Structured design using layered models for efficient data transfer. OSI Model: A seven-layer framework defining network functions, from physical to application layers. TCP/IP Suite: A practical set of protocols for internet communication, including IP, TCP, and application-layer protocols.		
Exemplars/Case Studies	Case study on LAN setup in a small office.	
Learning Outcomes	Understand network types, topologies, and layered models.	
Unit No: II	Data Communications	06 Hours
Signals: Characteristics of analog and digital waveforms used in data transmission. Digital-to-Digital: Encoding digital data into digital signals. Analog-to-Digital: Converting analog signals to digital (e.g., PCM). Digital-to-Analog: Modulating digital data onto analog signals. Analog-to-Analog: Transforming analog signals (e.g., AM, FM). Transmission Modes: Communication directions, including simplex, half-duplex, and full-duplex. Modulation: Methods to encode data onto carrier signals (e.g., amplitude, frequency, phase modulation). Multiplexing: Strategies like Frequency Division Multiplexing (FDM) and Time Division Multiplexing (TDM) to share a medium. Transmission Media: Wired: Cables such as twisted pair, coaxial, and optical fiber. Wireless: Radio waves, microwaves, and infrared.		

Switching Techniques: Circuit Switching: Dedicated path for communication. Packet Switching: Data divided into packets for transmission. Datagram Approach: Connectionless packet delivery. Virtual Circuit: Connection-oriented packet routing.		
Exemplars/Ca se Studies	Analysis of fiber optics in high-speed internet.	
Learning Outcomes	Explain signal types, encoding, and media characteristics.	
Unit No: III	Data Link Layer and Multiple Access Protocols	06 Hours
Basics of ALOHA protocols, Basics of CSMA/CD protocols, Ethernet LANS, Connecting LAN and back-bone networks- Repeaters, Hubs, Switches, Bridges, Router and Gateways Error Detection and Correction: Checksum, CRC, Data Link Control: Framing, Flow and Error Control, Noiseless Channels, Noisy channels, (Stop and Wait ARQ, Sliding Window Protocol, Go Back N, Selective Repeat) HDLC, Point-to-Point Protocol. Access Control: TDM, CSMA/CD, and Channelization (FDMA, TDMA, and CDMA).		
Exemplars/Cas e Studies	Study of Ethernet in campus networks.	
Learning Outcomes:	Analyze data link protocols and access control mechanisms.	
Unit No: IV	Networks Layer	06 Hours
Logical Addressing: Internet protocols: Address Mapping and Error Reporting; Delivery, Forwarding, and Routing. Network Layer: Logical Addressing, IPv4 Addresses, IPv6 Addresses, Virtual-Circuit Networks: Frame Relay and ATM, Transport Layer: Process-Process Delivery: UDP, TCP.		
Exemplars/Cas e Studies	Case study on IPv4/IPv6 adoption in modern networks.	
Learning Outcomes:	Understand addressing, routing, and packet delivery.	
Unit No: V	Overview of Networking Technologies	06 Hours
<u>OSI/TCP-IP Layer Protocols:</u> Overview of DNS, Overview of WWW, URL, Email architecture, HTTP protocol Application layers: DNS, SMTP, POP, FTP, HTTP, Remote Logging, Electronic Mail, and File Transfer, Basics of WiFi (Fundamental concepts only), Transport Layer: Process-to-Process Delivery: UDP, TCP, and SCTP; Congestion Control and Quality of Service.		
<u>Emerging Networking Technologies:</u> Wireless Connectivity: Technologies like Wi-Fi (802.11 standards) and Bluetooth for short-range communication. Mobile networks: Evolution from 4G to 5G, enabling high-speed, low-latency communication. Cloud Networking: Fundamentals of cloud-based network architectures. Concepts of virtualization, software-defined networking (SDN), and network function virtualization (NFV) for scalable services. Internet of Things (IoT): Basics of IoT network frameworks and protocols (e.g., MQTT, CoAP). Applications of IoT in smart devices, home automation, and industrial systems.		
Exemplars/Cas e Studies	Analysis of HTTP/2 in web browsing. Case study on IoT in smart cities	
Learning Outcomes	Apply transport and application layer protocols Explore modern networking trends and applications	

Savitribai Phule Pune University Second Year of Information Technology (2024 Course) Course Code: PCC-204-ITT Course Name: Data Structures & Algorithms Lab		
Teaching Scheme	Credits	Examination Scheme
Practical : 4 Hrs /wk	2	TW : 25 PR :50
Course Objectives: <ol style="list-style-type: none"> 1. To study data structures and their implementations and applications. 2. To understand and apply appropriate data structures to implement stack and queue. 3. Strategically select and apply appropriate data structures and algorithms for effectively solving problems that can be modeled using tree & graph 4. To learn different file organizations. 5. To learn and apply advanced algorithmic techniques such as Divide and Conquer, Greedy Method, and Dynamic Programming for problem solving 		
Course Outcomes: <ol style="list-style-type: none"> 1. To perform basic analysis of algorithms with respect to time and space complexity. 2. To apply appropriate data structures to implement stack and queue. 3. To design and specify the operations of a nonlinear-based abstract data type and implement them in a high-level programming language. 4. Design different hashing functions 5. To Solve real-life optimization problems using Divide and Conquer, Greedy, and Dynamic Programming strategies. 		
Guidelines for Instructor's Manual The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant. The instructor's manual should include prologue, university syllabus, conduction & Assessment guidelines, topics under consideration-concept, objectives, outcomes, algorithm written in pseudo language, sample test cases and references. Experiments to be conducted Part A in C++ and Part B in python.		
Guidelines for Student's Lab Journal <ol style="list-style-type: none"> 1. The laboratory assignments are to be submitted by students in the form of journals. The Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory Concept, algorithms, printouts of the code written using coding standards, sample test cases etc.) 2. Practical Examination will be based on the term work. 3. Candidate is expected to know the theory involved in the experiment. 4. The practical examination should be conducted if the journal of the candidate is completed in all respects and certified by concerned faculty and head of the department. 5. All the assignment mentioned in the syllabus must be conducted. 		
Guidelines for Lab /TW Assessment <ol style="list-style-type: none"> 1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc. 2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out. 3. Appropriate knowledge of usage of software and hardware such as compiler, debugger, coding standards, algorithm to be implemented etc. should be checked by the concerned faculty member(s). 		
Guidelines for Laboratory Conduction The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The instructor may set multiple sets of assignments and distribute		

among batches of students. It is appreciated if the assignments are based on real world problems/applications. All the assignments should be conducted on multicore hardware and 64-bit open-source software.
Guidelines for Practical Examination
Both internal and external examiners should jointly set problem statements for practical examination. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at the time of evaluation to judge the student's understanding of the fundamentals, effective and efficient implementation. The evaluation should be done by both external and internal examiners.
List of Assignments
Virtual Laboratory
<ul style="list-style-type: none"> · https://ds1-iiith.vlabs.ac.in/data-structures-1/ · https://ds2-iiith.vlabs.ac.in/data-structures-2/ · http://cse01-iiith.vlabs.ac.in/
PART A (Using C++)
1. Searching and Sorting -- CO1, CO2
Design a program to maintain a student database that performs the following tasks: <ol style="list-style-type: none"> 1. Add and store student details (ID, Name, CGPA) using dynamically allocated memory. 2. Expand the student list using realloc() as new entries are added. 3. Implement Linear Search and Binary Search to find student records by ID. 4. Implement at least two Sorting Algorithms (Bubble Sort, Selection Sort, or Insertion Sort) to sort student records by: <ul style="list-style-type: none"> o Name (Alphabetically) o CGPA (Ascending/Descending) 5. Analyze and compare the performance of search operations before and after sorting.
2. Stack : CO1, CO2
Implement stack as an abstract data type using singly linked list and use this ADT for conversion of infix expression to postfix, prefix
3. Circular Queue -- CO1, CO2
Implement Circular Queue using Array. Perform following operations on it. <ol style="list-style-type: none"> a) Insertion (Enqueue) b) Deletion (Dequeue) c) Display (Note: Handle queue full condition by considering a fixed size of a queue.)
PART B (Using Python)
4. Binary Search Tree -- CO1, CO2, CO3
Implement binary search tree and perform following operations: <ol style="list-style-type: none"> a) Insert (Handle insertion of duplicate entry) b) Delete c) Search d) Display tree (Traversal) e) Display - Depth of tree f) Display - Mirror image g) Create a copy h) Display all parent nodes with their child nodes i) Display leaf nodes j) Display tree level wise
5. Graph: Minimum Spanning Tree -- CO1, CO2, CO3
Represent a graph of your college campus using adjacency list /adjacency matrix. Nodes should represent the various departments/institutes and links should represent the distance between them. Find minimum spanning tree <ol style="list-style-type: none"> a) Using Kruskal's algorithm.

b) Using Prim's algorithm.
6. Heap Sort -- CO1, CO2, CO4
Design and implement the Heap Sort algorithm to efficiently sort an array of integers in ascending order. The implementation should be optimized for time and space complexity and should clearly demonstrate the working principles of heap data structures (min-heap or max-heap as applicable)
7. Divide and Conquer (Merge Sort) - CO1, CO2, CO5
Sort Online Orders by Delivery Time using Merge Sort. Problem Statement: You are given a list of online orders, each with an estimated delivery time in minutes. Write a program to sort these orders using the Merge Sort algorithm so the delivery system can prioritize quicker deliveries first.
8. Greedy Algorithm (Fractional Knapsack) - CO1, CO2, CO5
Maximize Profit by Shipping Partial Orders (Fractional Knapsack) Problem Statement: You run a shipping company and need to load a truck with parcels of different weights and profits. The truck has a limited weight capacity. Write a program to choose parcels (even partially) to maximize profit using the Fractional Knapsack strategy.
9. String Processing: Naïve String Matching - CO1, CO2, CO4
<p>Given:</p> <p>1 A text string text of length n.</p> <p>1 A pattern string pattern of length m.</p> <p>Objective:</p> <p>Find all starting indices i in the text such that the substring text[i:i+m] is exactly equal to the pattern pattern, using the Naive String Matching Algorithm approach.</p> <p>Constraints:</p> <p>1 $0 \leq m \leq n$</p> <p>1 Characters in text and pattern can be any valid characters (e.g., a-z, A-Z, digits, etc.)</p>
10. AI search Algorithm -CO1, CO2, CO4, CO5
To design and implement a maze navigation system that enables an agent to find an optimal path from a starting point to a goal using AI search algorithms. The system should be capable of solving both static and dynamic mazes and should visualize the pathfinding process.

Savitribai Phule Pune University Second Year of Information Technology (2024 Course) Course Code: PCC-205-ITT Course Name: Object Oriented Programming Lab		
Teaching Scheme	Credits	Examination Scheme
Practical : 2 Hrs/wk	1	TW : 25 OR :25
Prerequisite Courses, if any : 1. Good understanding of Programming and Problem-Solving concepts		
Course Objectives: 1. To understand principles of object-oriented programming (OOP). 2. To understand role of Object-oriented paradigm in program design. 3. To demonstrate Object-oriented programming concepts using Java Programming language		
Course Outcomes: Upon successful completion of this course, students will be able to: CO1: Apply fundamental constructs like control statements, for implementing an application. CO2: Implement java programs using, class, objects, constructors in Java, arrays, managing I/O CO3: Apply object-oriented features like Inheritance, Polymorphism, Dynamic binding for implementing an application. CO4: Apply concepts of exception handling, multi-threading for implementing an application.		
Guidelines for Instructor's Manual		
The instructor's manual is to be developed as a hands-on resource and reference. The instructor's manual need to include prologue (about University/program/ institute/ department/foreword/ preface etc.), University syllabus, conduction & Assessment guidelines, topics under consideration concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references.		
Guidelines for Student's Lab Journal		

1. The laboratory assignments are to be submitted by student in the form of journal.
2. Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- OOP feature/Concept in brief, algorithm, flowchart, test cases, conclusion/analysis.
3. Program codes with sample output of all performed assignments are to be submitted as hardcopy.
4. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided.
5. Use of DVD containing students programs maintained by lab In-charge is highly encouraged.
6. For reference one or two journals may be maintained with program prints at Laboratory.

Guidelines for Lab /TW Assessment

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

Guidelines for Oral Examination

1. **Internal and external examiners** should jointly prepare oral questions based on the syllabus.
2. During the oral assessment, the examiner should focus on:
 - a. The student's **ability to explain the implemented code** and underlying logic.
 - b. **Understanding of core concepts** like classes, inheritance, polymorphism, and exception handling.
 - c. Answering **supplementary questions** to assess advanced learning and application of concepts.
3. The student should demonstrate **clear communication** and **effective problem-solving skills**.

Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. The instructor may set multiple sets of assignments without changing its complexity level and distribute among batches of students. Encourage students for the use of industry coding standards such as appropriate use of Hungarian notation, Indentation and comments. Use of open-source software is encouraged. Set of suggested assignment list is provided, instructors may take different case studies with similar complexity level. Operating System recommended: - 64-bit Open-source Linux or its derivative
Programming tools recommended: - JAVA IDE

List of Assignments

1. Classes and Object- CO1, CO2

Design a class Complex with data members for real and imaginary parts. Provide default and parameterized constructors. Write a program to perform arithmetic operations on two complex numbers.

2. Polymorphism- CO1, CO3

Identify commonalities and differences between Publication, Book, and Magazine classes. Use title, price, and copies as common attributes and saleCopy() as a common method. Include author, orderCopies() in Book, and orderQty, currentIssue, receiveIssue() in Magazine. Write a program to order book copies and display total publication sales.

3. Inheritance - CO1, CO3

Design an inheritance hierarchy for an employee payroll system. Create an Employee class with fields like Emp_name, Emp_id, Address, Mail_id, and Mobile_no. Inherit Programmer, Team Lead, Assistant Project Manager, and Project Manager from it. Add Basic Pay and calculate DA (97%), HRA (10%), PF (12%), and Staff Club Fund (0.1%) for salary slip generation.

4. Dynamic Binding - CO1, CO3

Design a base class Shape with double-type values and a method compute_area(). Derive Triangle and Rectangle classes from it. Make compute_area() abstract and override it in derived classes. Use dynamic binding to calculate and display the area based on user input.

5. Interface - CO1, CO3

Implement an interface for vehicles with methods like gearChange(), speedUp(), and applyBrakes(). Create classes Bicycle, Car, and Bike implementing these functionalities in their own way.

6. Exception Handling - CO4

Create a program to handle ArithmeticException, ArrayIndexOutOfBoundsException, and NumberFormatException. The user enters two numbers, and their division is shown. Handle invalid inputs and division by zero.

7. Template (Generics) - CO4

Write a generic program using a collection class to count elements with specific properties such as even, odd, prime numbers, or palindromes.

8. File Handling - CO5

Implement a student record database using files with the following operations:

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

Each student has Student_id, Name, Roll_no, Class, Marks, and Address.

Text Books:

1. **Java: The Complete Reference** by Herbert Schildt, McGraw-Hill
2. **Object-Oriented Programming with Java** by E. Balagurusamy, McGraw-Hill

Reference Books:

1. **Core Java Volume I – Fundamentals** by *Cay S. Horstmann*
2. **Effective Java** by *Joshua Bloch*

Savitribai Phule Pune University**Second Year of Information Technology (2024 Course)****Course Code:** OEL-220-ITT -A**Course Name:** Digital Business

Teaching Scheme	Credits	Examination Scheme
Theory : 2 Hrs /wk	2	CCE -15 Marks ESE - 35 Marks

Course Objectives: This course equips students -

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

These skills prepare students to navigate and innovate within the dynamic digital economy effectively.

Course Outcomes: Upon completion, students will

- Understand the digital economy's societal impact,
- Apply digital strategies practically
- Gain proficiency in tools like data analytics and AI
- 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 No: I	Foundations of Digital Business	06 Hours
<p>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.</p>		
Exemplars/Case Studies	<ul style="list-style-type: none"> • Amazon's Digital Ecosystem: How Amazon integrates AI-driven recommendations, cloud computing (AWS), and marketplace strategies to dominate e-commerce. • Nike's Digital Transformation: Leveraging data analytics and direct-to-consumer (D2C) models to enhance customer engagement via the Nike+ app. 	

Reference Books	<ul style="list-style-type: none"> • ""Digital Business and E-Commerce Management" by Dave Chaffey, Tanya Hemphill, and David Edmundson-Bird, 7th Edition, Pearson, 2019. • "The Digital Transformation Playbook" by David L. Rogers, Columbia Business School Publishing, 2016.
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Unit No: II	Mobile, Social, and IoT-Driven Commerce	06 Hours
<p>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.</p>		
Exemplars/Case Studies	<ul style="list-style-type: none"> • Starbucks Mobile App: Use of mobile payments and loyalty programs to drive customer retention and sales through personalized offers. • Xiaomi's IoT Strategy: Integration of IoT in smart home devices and wearables to create a connected ecosystem for consumers. 	
Reference Books	<ul style="list-style-type: none"> • "Mobile Commerce: Opportunities, Applications, and Technologies" by Paul May, Cambridge University Press, 2020. • "Social Commerce: Marketing, Technology and Management" by Efraim Turban, Judy Whiteside, David King, and Jon Outland, Springer, 2016. 	

Unit No: III	Digital Business Ecosystem	06 Hours
<p>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.</p>		
Exemplars/Case Studies	<ul style="list-style-type: none"> • Alibaba's E-Marketplace: How Alibaba uses its platform to connect buyers and sellers globally, leveraging blockchain for supply chain transparency. • eBay's Dynamic Pricing: Implementation of e-auctions and algorithmic pricing to optimize seller outcomes and buyer satisfaction. 	
Reference Books	<ul style="list-style-type: none"> • "E-Commerce 2023: Business, Technology, and Society" by Kenneth C. Laudon and Carol Guercio Traver, 18th Edition, Pearson, 2023. • "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. 	

Unit No: IV	Digital Business Applications - I:	06 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.		
Exemplars /Case Studies	.Revolut's Fintech Disruption: How Revolut uses mobile banking and open banking to challenge traditional financial institutions. . Coursera's EdTech Growth: Leveraging online platforms and gamification to deliver scalable education globally.	
Reference Books	. "FinTech: The Technology Driving Disruption in the Financial Services Industry" by Parag Y. Arjunwadkar, CRC Press, 2018. . "The Future of Learning: EdTech in the Digital Age" by Cathy N. Davidson, MIT Press, 2022.	

Learning Resources
Text Books <ul style="list-style-type: none"> . "Digital Business and E-Commerce Management" by Dave Chaffey, Tanya Hemphill, and David Edmundson-Bird, 7th Edition, Pearson, 2019. . "E-Commerce 2023: Business, Technology, and Society" by Kenneth C. Laudon and Carol Guercio Traver, 18th Edition, Pearson, 2023. . "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. . "Mobile Commerce: Opportunities, Applications, and Technologies" by Paul May, Cambridge University Press, 2020. . "The Digital Transformation Playbook" by David L. Rogers, Columbia Business School Publishing, 2016.

Reference Books:

- . "Social Commerce: Marketing, Technology and Management" by Efraim Turban, Judy Whiteside, David King, and Jon Outland, Springer, 2016.
- . "FinTech: The Technology Driving Disruption in the Financial Services Industry" by Parag Y. Arjunwadkar, CRC Press, 2018.
- . "The Future of Learning: EdTech in the Digital Age" by Cathy N. Davidson, MIT Press, 2022.
- . "Digital Health: Understanding the Benefits and Challenges" by Eric D. Perakslis, Oxford University Press, 2021.
- . "Entertainment in the Digital Age: Media, Technology, and Culture" by Robert C. Sickels, Bloomsbury Academic, 2020.

e-Books:

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

Links to online SWAYAM/NPTEL Courses:

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

Savitribai Phule Pune University Second Year of Information Technology (2024 Course) Course Code: OEL-220-ITT -B Course Name: Probability & Statistics		
Teaching Scheme	Credits	Examination Scheme
Theory : 2 Hrs /wk	2	CCE -15 Marks ESE - 35 Marks
Prerequisite Courses, if any: Set Theory and Logic, Differential and Integral Calculus, Basic Linear Algebra		
Companion Course, if any: Data Science or Machine Learning Foundations, Statistical Inference, Numerical Methods		
Course Objectives: <ul style="list-style-type: none"> To introduce the foundational principles of probability theory. To study random variables, distributions, and expectation. To analyze statistical measures including mean, variance, and higher-order moments. To impart knowledge of sampling theory and estimation techniques. To develop skills in hypothesis testing for real-world applications. 		
Course Outcomes: <ul style="list-style-type: none"> CO1: Apply probability theory to model uncertain systems and events. L3 CO2: Analyze and interpret various probability distributions. L4 CO3: Use moment generating functions and inequalities (Markov and Chebyshev) to analyze random variables. L4 CO4: Apply population parameters using sampling and construct confidence intervals. L3 CO5: Conduct statistical hypothesis tests to support decision-making. L3 		
Course Contents		
Unit No: I	Probability Fundamentals and Set Theory	05Hours
Algebra of sets, Axiomatic, classical, and frequentist definitions of probability, Conditional probability, independence, Bayes' theorem.		
Exemplars/ Case Studies	<ul style="list-style-type: none"> Medical Testing and False Positives Context: Use of conditional probability and Bayes' Theorem in understanding false positives in COVID-19 tests. Learning Outcome: Apply conditional probability and Bayes' Theorem to real-world diagnostic scenarios. 	
Reference Books	S.M. Ross , Introduction to Probability and Statistics for Engineers and Scientists – Chapters 1–2 V.K. Rohatgi & A.K. Md. E. Saleh , An Introduction to Probability and Statistics – Chapter 2 H.J. Larson , Introduction to Probability Theory and Statistical Inference – Chapter 1	

Unit No: II	Random Variables and Expectation	05 Hours
Types of random variables (discrete, continuous, mixed), PMF, PDF, CDF, Expectation, variance, higher-order moments, Moment generating functions, Markov and Chebyshev inequalities		
Exemplars/Case Studies	Warranty Analysis in Manufacturing Context: Modeling the life of a product (e.g., a LED bulb) using exponential and normal distributions. Learning Outcome: Calculate expected life, variance, and reliability.	
Reference Books	E.J. Dudewicz & S.N. Mishra , Modern Mathematical Statistics – Chapter 3 V.K. Rohatgi , An Introduction to Probability and Statistics – Chapters 3–4 S.M. Ross , Introduction to Probability and Statistics – Chapters 3–4 Mood, Graybill & Boes , Introduction to the Theory of Statistics – Chapters 2–3	

Unit No: III	Distributions and Functions of Random Variables	05 Hours
Binomial, Poisson, Geometric, Exponential, Normal, Gamma, Beta, Transformation techniques, Joint distributions, marginal and conditional distributions, Covariance, correlation, bivariate normal distribution		
Exemplars/Case Studies	<ul style="list-style-type: none"> Traffic Flow Modeling Using Poisson Distribution Context: Modeling the number of vehicles passing a toll gate per minute using Poisson distribution. Learning Outcome: Understand real-world applications of discrete distributions and parameter estimation. 	
Reference Books	<ul style="list-style-type: none"> S.M. Ross – Chapters 5–6 W.W. Hines & D.C. Montgomery, Probability and Statistics in Engineering – Chapter 4 V.K. Rohatgi – Chapter 5 Mood, Graybill & Boes – Chapters 4–5 	

Unit No: IV	Hypothesis Testing and Decision Theory	07 Hours
<u>Introduction to Sampling and Estimation:</u> Sampling distributions, Central Limit Theorem, Point estimation: unbiasedness, consistency, Maximum likelihood and method of moments, Confidence intervals Hypothesis formulation, critical regions, Type I & II errors, Neyman-Pearson lemma, Z, t, Chi-square, and F tests, Goodness-of-fit, tests for proportions and variance, Applications in engineering and sciences		
Exemplars/Case Studies	<u>Market Survey for Launching a New Product</u> <ul style="list-style-type: none"> Context: A company samples 100 consumers to estimate the average monthly expenditure on a fitness product. Learning Outcome: Construct confidence intervals and evaluate sample bias. <u>A/B Testing in E-commerce</u> <ul style="list-style-type: none"> Context: Comparing two website versions to determine which leads to better conversion rates using hypothesis testing. Learning Outcome: Formulate null and alternative hypotheses, conduct z/t-tests, and interpret results. 	
Reference Books	<ul style="list-style-type: none"> Dudewicz & Mishra – Chapters 5–6 J.S. Milton & J.C. Arnold, Introduction to Probability and Statistics – Chapters 6–7 Rohatgi & Saleh – Chapters 6–7 Mood, Graybill & Boes – Chapter 6 S.M. Ross – Chapter 7 Mood, Graybill & Boes – Chapters 7–9 Milton & Arnold – Chapter 9 W.W. Hines & D.C. Montgomery – Chapter 8 	

Learning Resources					
S.N	Book Title	Author(s)	ISBN	Publisher	Edition / Year
1	Introduction to Probability and Statistics for Engineers and Scientists	Sheldon M. Ross	978-0124157822	Academic Press (Elsevier)	5th Edition, 2014
2	An Introduction to Probability and Statistics	V.K. Rohatgi, A.K. Md. E. Saleh	978-1118294405	Wiley	3rd Edition, 2015
3	Modern Mathematical Statistics	E.J. Dudewicz, S.N. Mishra	978-0471030151	Wiley	1st Edition, 1988
4	Introduction to the Theory of Statistics	A.M. Mood, F.A. Graybill, D.C. Boes	978-0070428645	McGraw-Hill	3rd Edition, 1974
5	Introduction to Probability and Statistics	J.S. Milton, J.C. Arnold	978-0079130341	McGraw-Hill Education	4th Edition, 2003
6	Introduction to Probability Theory and Statistical Inference	H.J. Larson	978-0471866453	Wiley	3rd Edition, 1982
7	Probability and Statistics in Engineering	W.W. Hines, D.C. Montgomery, D.M. Goldsman, C.M. Borror	978-0470631472	Wiley	4th Edition, 2003
Ebooks: <ul style="list-style-type: none"> Introduction to Probability and Statistics for Engineers and Scientists Author(s): Sheldon M. Ross Publisher: Academic Press (Elsevier) Edition/Year: 5th Edition, 2014 ISBN: 978-0123948113 https://minerva.it.manchester.ac.uk/~saralees/statbook3.pdf An Introduction to Probability and Statistics Author(s): Vijay K. Rohatgi, A.K. Md. Ehsanes Saleh, Publisher: Wiley Edition/Year: 2nd Edition, 2000 ISBN: 978-0471326724 https://www.usb.ac.ir/FileStaff/5518_2023-2-8-8-33-53.pdf Modern Mathematical Statistics Author(s): Edward J. Dudewicz, Satya N. Mishra Publisher: Wiley Edition/Year: 1st Edition, 1988 ISBN: 978-0471814726 https://archive.org/details/modernmathematic0000dude/page/n5/mode/2up 					
NPTEL / SWAYAM Video Lectures NPTEL - Probability and Statistics by Prof. H.K. Kesavan (IIT Madras) NPTEL - Probability and Statistics by Prof. Somesh Kumar (IIT Kharagpur) SWAYAM – Fundamentals of Probability and Statistics					

Savitribai Phule Pune University Second Year of Information Technology (2024 Course) Course Code: MDM-230-ITT Course Name: Digital Electronics and Logic Design		
Teaching Scheme	Credits	Examination Scheme:
Theory :2 Hrs/wk	2	CCE:30 Marks ESE:70 Marks
Prerequisite Courses, if any: Basics of Electronics Engineering		
Companion Course, if any:		
Course Objectives: 1. To learn and understand basic digital design techniques. 2. To develop design and implementation skills of combinational and sequential Logic circuits. 3. To introduce Computer organization and Computer Architecture.		
Course Outcomes: On completion of the course, students will be able to– CO1: Perform Binary Arithmetic and Logical Operations and code conversions CO2: Design and Implement Combinational Circuits. CO3: Differentiate combinational and sequential circuits and use flip flops for various applications CO4: Design and Implement Sequential Circuits. CO5: Explain Organization and Architecture of Computer systems		
Course Contents		
Unit No: I	Introduction To Digital Electronics	06 Hours
Digital Logic families: Digital IC Characteristics; TTL: Standard TTL characteristics, Operation of TTL NAND gate; CMOS: Standard CMOS characteristics, operation of CMOS NAND gate; Comparison of TTL & CMOS. Signed Binary number representation and Arithmetic: Sign Magnitude, 1's complement & 2's complement representation, unsigned Binary arithmetic (addition, subtraction, multiplication, and division), subtraction using 2's complement; IEEE Standard 754 Floating point number representations. Codes: Binary , BCD, octal, hexadecimal, Excess-3 , Gray code & their conversions		
Exemplars/Case Studies	1) CMOS 4000 series ICs 2) Practical applications of various codes in computers	
Reference Books	Modern Digital Electronics", R.P. Jain, Tata McGraw-Hill, Third Edition	

Unit No: II	Combinational Logic Design	06 Hours
Logic minimization: Representation of truth-table, SOP form, POS form, Simplification of logical functions, Minimization of SOP and POS forms, don't care Conditions. Reduction techniques: K-Maps up to 4 variables CLC design using SSI chips – Code converters, Half- Adder, Full Adder, Half Subtractor, Full Subtractor, n bit Binary adder Introduction to MSI functions & chips - Multiplexers (IC 74151 and IC 74153), Decoder / Demultiplexer (IC 74138), Binary adder (IC 7483). Design using MSI chips: BCD adder using IC 7483, Implementation of logic functions using IC 74153, IC 74151 & 74138.		
Exemplars/Case Studies	Quine–McCluskey Minimization Technique, Encoder (IC 74147), BCD to 7 segment decoder driver (IC 7447)	
Reference Books	Modern Digital Electronics", R.P. Jain, Tata McGraw-Hill, Third Edition	

Unit No: III	Flip Flops and their Applications	06 Hours
Introduction to sequential circuits. Difference between combinational circuits and sequential circuits, memory element – latch.		

Flip- Flops: Design, truth table, excitation table of SR, JK, D, T flip flops. Study of flip flops with asynchronous and synchronous Preset & Clear, Master Slave configuration, conversion from one type to another type of flip flop. Study of flip flop ICs - 7473, 7474, 7476 Application of flip-flops – Bounce elimination switch, Counters- asynchronous, synchronous and modulo counters, Study of modulus n counter ICs- 7490 & their applications to implement mod counters	
Exemplars/Case Studies	Simple Traffic Light controller
Reference Books	Modern Digital Electronics”, R.P. Jain, Tata McGraw-Hill, Third Edition

Unit No: IV	Introduction to Computer Architecture Sequential Logic Design	06 Hours
Registers- Buffer register, shift register types - SISO, SIPO, PISO & PIPO, applications of shift registers - ring counter, twisted ring counter Basic design steps- State diagram, State table, State reduction, State assignment, Mealy and Moore machines representation Sequence generators using counters & sequence detector using Moore & Mealy model		
Exemplars/Case Studies	Electronic Voting Machine (EVM)	
Reference Books	Modern Digital Electronics”, R.P. Jain, Tata McGraw-Hill, Third Edition	

Unit No: V	Introduction to Computer Architecture	06 Hours
Computer organization & computer architecture , organization, functions & types of computer units- CPU(typical organization ,Functions , Types), Memory (Types & their uses in computer), IO(types & functions) & system bus(Address, data & control , Typical control lines, Multiple-Bus Hierarchies); Von Neumann & Harvard architecture; Instruction cycle state diagram Von Neumann Machine: Structure of IAS computer, Registers: PC,MAR,MBR,IR,AC,MQ,IBR and their roles Control unit : Control signals & typical organization of hard wired & micro programmed Control Unit.		
Exemplars/Case Studies	8086 Architecture	
Reference Books	Computer organization and architecture, designing for performance” by William Stallings, Prentice Hall, Eighth edition	

Learning Resources
Text Books 1. “Modern Digital Electronics”, R.P. Jain, Tata McGraw-Hill, Third Edition 2. “Computer organization and architecture, designing for performance” by William Stallings , Prentice Hall ,Eighth edition
Reference Books 1. “Digital Design”, M Morris Mano, Prentice Hall, Third Edition 2. “Computer organization” , Hamacher and Zaky, Fifth Edition 3. “Computer Organization and Design: The Hardware Software Interface” D. Patterson, J. Hennessy, Fourth Edition, Morgan Kaufmann 4. “ Microprocessors and interfacing-programming and hardware” Douglas V. Hall and SSSP Rao, McGraw-Hill ,Third Edition
e-Books
Links to online SWAYAM/NPTEL Courses https://onlinecourses.nptel.ac.in/noc24_ee17/preview https://onlinecourses.nptel.ac.in/noc25_ee20/preview

Savitribai Phule Pune University		
Second Year of Information Technology (2024 Course)		
Course Code: EEM-240-ITT		
Course Name: Principles of Management & Entrepreneurship		
Teaching Scheme	Credits	Examination Scheme
Tutorial : 1 hr/wk	1	TW - 25 Marks
Practical : 2 hrs/wk	1	
Prerequisite Courses, if any: None		
Companion Course, if any: None		
Course Objectives: The objectives of this course are: <ul style="list-style-type: none">To explain fundamental management functions and the planning/decision-making process.To describe organizational structure, staffing, and leadership.To demonstrate understanding of motivation and control systems in management.To explain entrepreneurship and the entrepreneurship development process.To illustrate small-scale industries, supporting agencies, and financing for entrepreneurs.To summarize project report preparation and industrial ownership structures		
Course Outcomes: After successful completion of the course, students will be able to: CO1: Articulate core management functions, planning, and decision-making. CO2: Analyze organizational structure, staffing, and leadership in tech teams. CO3: Explain motivation and control systems in management. CO4: Demonstrate understanding of entrepreneurship and its development. CO5: Evaluate small-scale industries, support agencies, project reporting, and industrial ownership.		
Course Contents For Tutorial		
Unit No: I	Management and Planning Fundamentals	03 Hours
Definition, nature, and characteristics of management, Scope and functional areas, Management as art, science, and profession, Management vs. administration, Roles and levels of management, Development of management thought (classical to modern), Planning: nature, importance, objectives, types (meaning only), Decision-making and planning process, planning hierarchy		
Exemplars/Case Studies	Google’s adoption of OKRs for strategic planning and innovation alignment.	
Reference Books	Robbins & Coulter, “Management”, Pearson Lumen Learning: Principles of Management	
Unit No: II	Organizing, Staffing, Directing, and Controlling	03 Hours
Organization: nature, purpose, principles, types, departmentation, committees, Centralization vs. decentralization; span of control, MBO & MBE, Staffing: process of selection and recruitment, directing: leadership styles, motivation theories, communication, coordination (meaning, importance, techniques), Controlling: steps, essentials, methods		
Exemplars/Case Studies	Netflix’s team structure and leadership approach for creative project management.	
Reference Books	Northouse, “Leadership: Theory and Practice”, SAGE Robbins & Coulter, “Management”, Pearson	
Unit No: III	Entrepreneurship and Entrepreneurial Development	03 Hours

Entrepreneur: meaning, evolution, functions, types, emerging class, Concept and stages of entrepreneurship, Role of entrepreneurs in economic development, Entrepreneurship in India; barriers to entrepreneurship		
Exemplars/Case Studies	<i>The journey of Freshworks from a startup to a global SaaS provider</i>	
Reference Books	S.S. Khanka, "Entrepreneurial Development", S. Chand Ries, "The Lean Startup", Crown Business	
Unit No: IV	Small Scale Industries and Institutional Support	03 Hours
SSI: definition, characteristics, objectives, scope, role in economic development, Steps to start an SSI; government policy and support, Impact of liberalization, privatization, globalization, WTO/GATT on SSI, Supporting agencies: TECKSOK, KIADB, KSSIDC, KSIMC, DIC, SISI, NSIC, SIDBI, KSFC, Single Window Agency		
Exemplars/Case Studies	<i>Zoho's growth as a bootstrapped Indian small-scale software company.</i>	
Reference Books	Vasant Desai, "Small Scale Industries and Entrepreneurship", Himalaya Government of India MSME Portal	
Unit No: V	Project Preparation and Industrial Ownership	03 Hours
Project: meaning, identification, selection, report preparation (need, significance, contents, formulation, errors), Guidelines by Planning Commission, network analysis, project appraisal, Feasibility studies: market, technical, financial, social, Industrial ownership: partnership (definition, characteristics, types, agreement, registration, rights/duties, advantages/disadvantages), sole proprietorship (features, scope, pros/cons)		
Exemplars/Case Studies	<i>Razorpay's project report and funding journey in the Indian fintech ecosystem.</i>	
Reference Books	Prasanna Chandra, "Projects: Planning, Analysis, Selection, Financing, Implementation, and Review", McGraw Hill Metrick & Yasuda, "Venture Capital and the Finance of Innovation", Wiley	

Learning Resources
Text Books <ul style="list-style-type: none"> Gupta, R. N. (2014). <i>Principles of Management</i>. New Delhi: S. Chand & Sons. ISBN: 9788121924580 Prasad, L. M. (2019). <i>Principles and Practice of Management</i> (9th ed.). New Delhi: Sultan Chand & Sons. ISBN: 81-979992-1-5 Khanka, S. S. (2013). <i>Entrepreneurial Development</i> (4th ed.). New Delhi: S. Chand & Company Ltd. McGraw Hill Education. (2020). <i>Principles of Management</i>. New Delhi: McGraw Hill.
Reference Books <ul style="list-style-type: none"> Robbins, S. P., & Coulter, M. (2022). <i>Management</i> (15th ed.). Pearson Education. Bateman, T. S., & Snell, S. A. (2017). <i>Management: Leading & Collaborating in a Competitive World</i> (13th ed.). New York: McGraw Hill Education. King'ori Ndegwa, A., & Linyiru, B. M. (2021). <i>Principles of Entrepreneurship and Project Management</i>. CARI Journals. Walnut Publication. (2020). <i>A Textbook on Principles and Practices of Entrepreneurship</i>. Walnut Publication.
e-Books <ul style="list-style-type: none"> Open Textbook Library. (2017). <i>Principles of Management</i>. https://open.umn.edu/opentextbooks/textbooks/693 Saylor Academy. (2020). <i>Principles of Management</i>:

<p><i>Entrepreneurship.</i> https://learn.saylor.org/mod/book/view.php?id=60507&chapterid=48240</p>
<p>Links to online SWAYAM/NPTEL Courses</p> <ul style="list-style-type: none"> • Entrepreneurship By Prof. C Bhaktavatsala Rao IIT Madras • https://onlinecourses.nptel.ac.in/noc20_mg35/preview • Entrepreneurship Management by By Sujit Mukherjee Maulana Abul Kalam Azad University of Technology https://onlinecourses.swayam2.ac.in/cec24_mg28/preview • Entrepreneurship Essentials By Prof. Manoj Kumar Mondal IIT Kharagpur https://onlinecourses.nptel.ac.in/noc25_ge11/preview • NOC:Principles of Management, IIT Roorkee by Prof. Usha Lenka https://nptel.ac.in/courses/110107150
<p>List of Assignments:</p>
<p>Assignment 1</p> <p>Title: Entrepreneurial Mindset Reflection</p> <p>Objective: 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.</p> <p>Task Description: Write a reflective essay (500–600 words) addressing 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</p>
<p>Assignment 2</p> <p>Title: Idea Generation Challenge</p> <p>Objective: To foster creativity, structured brainstorming, and the ability to identify potential business opportunities based on real-world problems.</p> <p>Task Description:</p> <ol style="list-style-type: none"> 1. Generate Business Ideas using any structured brainstorming technique (e.g., mind mapping, SCAMPER). Ideas can be tech-based, social impact, service-based, or product-based. 2. Select one idea that you find most promising. 3. Write a 1-page Concept Summary, including: <ul style="list-style-type: none"> Problem Identified Solution Overview Target Audience Market Potential
<p>Assignment 3</p> <p>Title: Organizational Structure Design</p> <p>Objective: To understand organizational hierarchy and reporting relationships in a tech startup.</p> <p>Task Description: Draw an organogram for a hypothetical AI/ML startup, labelling key departments and reporting lines. Write a 200-word explanation justifying your structure and its suitability for innovation and agility.</p>
<p>Assignment 4</p>

<p>Title: Recruitment Process Simulation</p> <p>Objective: To explore staffing and selection processes in a technology context.</p> <p>Task Description: Design a recruitment workflow for hiring an AIML engineer. Include job description, sourcing channels, selection criteria, and interview stages. Present as a flowchart and provide a brief explanation (150–200 words).</p>
<p>Assignment 5</p> <p>Title: Small Scale Industry Setup Plan</p> <p>Objective: To plan the launch of a small-scale AI/ML business, considering regulatory and operational steps.</p> <p>Task Description: Outline the steps to register and launch a small-scale AI/ML business in India, including compliance, funding options, and government support schemes. Present as a checklist with brief explanations for each step.</p>
<p>Assignment 6</p> <p>Title: Competitive Analysis Report – Know Your Rivals</p> <p>Objective: To develop strategic thinking by analysing competitors and identifying market positioning opportunities.</p> <p>Task Description: Competitor Profile: Select 2–3 existing companies/startups that offer similar products/services to your business idea. Describe each competitor’s strengths, weaknesses, target customers, and unique selling points. (300–350 words) Comparison Matrix: Create a side-by-side matrix comparing your business with the chosen competitors in terms of features, pricing, brand presence, and customer experience. Opportunity Gap: Conclude with a 200-word write-up on how your idea fills a market gap or offers a superior value proposition.</p>
<p>Assignment 7</p> <p>Title: Mapping Institutional Support</p> <p>Objective: To identify and evaluate support agencies for tech entrepreneurs in India.</p> <p>Task Description: Create a table listing at least five Indian agencies (e.g., SIDBI, NSIC, DIC) supporting startups. For each, summarize their services, eligibility, and application process in 3–4 sentences.</p>
<p>Assignment 8</p> <p>Title: Project Report Drafting</p> <p>Objective: To practice project planning and reporting for a tech venture.</p> <p>Task Description: Prepare a mini project report for a proposed AI/ML solution, including project objectives, feasibility studies (market, technical, financial, social), and a basic network diagram. The report should be 3–4 pages.</p>

Savitribai Phule Pune University Second Year of Information Technology (2024 Course) Course Code: VEC-250-ITT Course Name: Universal Human Values And Professional Ethics		
Teaching Scheme	Credits	Examination Scheme
Theory : - : 2 Hrs./Week	2	CCE – 15 ESE - 35
Prerequisite Courses, if any: --		
Companion Course, if any: --		
Course Objectives: <ul style="list-style-type: none"> To help students understand the need, basic guidelines, content and process for value education. To enable students to understand harmony in the human being, family, society, and nature. To develop an understanding of the holistic perception of harmony at all levels of existence. To facilitate students in applying these understandings to live a fulfilling and responsible life. 		
Course Outcomes: At the end of the course, students will be able to: After completing this course, the students will be able to: <ul style="list-style-type: none"> CO1: Understand the significance of universal human values and ethical human conduct. CO2: Apply the concepts of harmony in self and relationships in real-life scenarios. CO3: Evaluate the interconnection between individual, society, and nature from a holistic perspective. CO4: Develop commitment to self-exploration, self-regulation, and social responsibility. 		
Course Contents		
Unit I :	Introduction to Value Education and Harmony in the Human Being	07 Hrs
<ul style="list-style-type: none"> Need, Basic Guidelines, and Content of Value Education Self-exploration: What is it? – Its content and process The Basic Human Aspirations – Continuous Happiness and Prosperity Understanding the Human Being as a Co-existence of Self ('I') and Body Harmony of Self with the Body: Sanyam and Health Activities of the Self and the Body – Understanding the needs of Self and Body 		
Unit II :	Harmony in Family and Society	07 Hrs
<ul style="list-style-type: none"> Harmony in the Family – Trust and Respect as the Foundation Nine Universal Values in Relationships Justice and Responsibility in Human Conduct Harmony in the Society – Resolution, Prosperity, Fearlessness, and Co-existence Four Orders of Nature – Self, Material Order, Plant/Bio Order, Animal Order 		

Unit III:	Harmony in Nature and Existence	08 Hrs
<ul style="list-style-type: none"> Understanding Harmony in Nature – Interconnectedness and Mutual Fulfillment Holistic Perception of Harmony: Existence as Co-existence Natural Acceptance and Self-regulation as a Way of Life Cyclicity in Nature and Responsibility of Human Being Implications of Imbalance in Nature: Environmental and Societal Consequences 		
Unit IV:	Professional Ethics and Application of Values	08 Hrs
<ul style="list-style-type: none"> Competence in Professional Ethics: Ability to Utilize Values in Decision-Making Ethical Human Conduct – The Foundation of Universal Human Order Vision for a Value-Based Society Case Studies: Ethical Dilemmas in the IT Sector Integration of Human Values with Technical Education 		

Learning Resources

Text Books

1. AICTE Model Curriculum for Universal Human Values
2. Gaur, R. R., Sangal, R., and Bagaria, G. P. Human Values and Professional Ethics 3rd revised ed., PHI, Excel Books Pvt. Ltd., New Delhi, 2010.
3. "Human Values" – M. Govindrajran, S. Natrajan, V.S. Senthil Kumar (PHI Learning)
4. "Professional Ethics and Human Values" – R.S. Naagarazan (New Age International)

Websites and Online Resources

- <https://uhv.org.in/>

Links to online SWAYAM/NPTEL Courses

- Exploring Human Values: Visions of Happiness and Perfect Society (<https://npTEL.ac.in/courses/109104068>)
- Moral Thinking: An Introduction to Values and Ethics (https://onlinecourses.npTEL.ac.in/noc24_hs169/preview)
- NPTEL Course: "Human Values and Ethics" by Prof. V. S. Ravi
Link: [NPTEL - Human Values and Ethics](#)
- NPTEL Course: "Human Values" by Prof. R.R. Gaur (IIT Kanpur)
Link: [NPTEL - Human Values](#)
- Value Education Workshop Videos by AICTE/UGC
Link: <https://www.aiCTE-india.org> > Education > Universal Human Values
- UGC Video Resources for Human Values
Search: "UGC Human Values Video Lectures" on YouTube or SWAYAM

Guidelines for Continuous Assessment – 15 Marks

Objective: Encourage student engagement, self-exploration, reflection, and participation in class discussions and activities.

Suggested Components:

Component	Description	Marks
1. Reflective Journal/Assignments	Weekly personal reflections on class topics, including self-exploration exercises, case study responses, or social observations.	5
2. Group Discussion/Presentation	Active participation in value-based group discussions or presentations (e.g., harmony in family, sustainable living, ethical dilemmas in IT, etc.).	3
3. Class Attendance & Participation	Regular attendance with meaningful classroom interaction.	2
4. Practical/Field Activity	Short practical task: e.g., interviewing family members, conducting a group activity, or community service reflection.	3
5. Viva Voce / Open Book Oral Exam	Brief oral discussion to assess personal understanding of core concepts.	2

Note: Faculty can customize the weightage slightly to suit the nature of class activities or institute policy.

Savitribai Phule Pune University Second Year of Information Technology (2024 Course) Course Code: CEF-260- ITT Course Name: Community Engagement Project			
Teaching Scheme		Credits	Examination Scheme
Practical	: 4 H/w	2	Term Work – 25 Marks ORAL – 25 Marks
Prerequisite Courses, if any: Students should have prior knowledge of Familiarity with problem-solving methodologies and project planning Basic programming knowledge is essential			
Course Objectives: The objective of this course is to provide students with <ul style="list-style-type: none"> To identify and analyze environmental issues faced by local communities. To identify the use of technology for societal needs. To design and implement innovative solutions using computer engineering principles to address identified problems. To work in a team with individual contributions to the project development. 			
Course Outcomes: After successful completion of the course, Students will be able to : <ul style="list-style-type: none"> Apply their engineering knowledge to analyze communities' need based on real-world environmental problems. Design real-world applications by considering suitable requirements. Implement real-world applications using suitable tools and technology. Work in a team with individual contributions to the development of the project. Communicate and demonstrate technical information effectively through project reports, presentations, and interactions with community members and mentors. 			
Course Guidelines for Implementation			
<ul style="list-style-type: none"> The purpose of this course is to empower students with the knowledge, skills, and mindset needed to leverage technology for addressing environmental and societal needs. Through a hands-on approach, students will learn to identify, analyze, and solve environmental issues faced by local communities using computer engineering principles. By designing and implementing innovative solutions, students will not only gain technical proficiency but also develop teamwork, collaboration, and communication skills essential for making a positive impact on communities and the environment. Team Formation, Guide Allocation, and Project Identification: <ul style="list-style-type: none"> 3-4 students can form a team within the same or different disciplines. Students are expected to explore and understand environmental challenges that communities face, such as pollution, waste management, water scarcity, resource depletion, climate change, energy transition, natural disasters, biodiversity loss, land degradation, etc. The project coordinator, in consultation with a panel of experts, assigns project guides from the same program to provide guidance and support to the teams throughout the project. The identified problem statement addressing environmental challenges must be registered with the project coordinator by the team after consulting with their respective project guide. Field visits are encouraged to identify the problem statements. Collaborative Work and Progress Reporting: Each student on the team must work collaboratively and contribute significantly to the design and development of solutions for registered problem statements, focusing on environmental challenges faced by the community. Students should work at least 4 hours per week and shall meet their assigned project guide regularly (at least twice a week) and report the progress of the project work, emphasizing 			

the application of community engineering principles.
Students are expected to Incorporate suggestions from the earlier review.

Documentation and Reporting:

- Students shall maintain a record of all meetings, remarks given by the guide/reviewers, and progress of the work in the project diary, presented during each review presentation.
- For the final assessment, students shall complete the project report in all aspects, including formatting, duly signed by the project guide, Head of the Department.

Data Submission and Additional Outputs:

- Students shall submit all data related to project work in soft copy to their guides, including the project report, A3 size poster, presentation, paper, etc., focusing on community engineering solutions.
 - Students' groups can conduct an awareness programme on Health and Hygiene or in Organic Farming or in Fisheries, about renewable energy, e-waste OR their selected project topic
- Oral Examination shall consist of presentation and demonstration of the project work carried out by the project groups.

Mode of Evaluation:

Review-I - Problem Identification: (Mid Semester) (Weightage: 50%)

- Students must identify a specific problem statement related to community engineering projects.
- The problem statement should be relevant to environmental science/study-related societal needs and address a real-world issue.
- A brief presentation outlining the identified problem and its significance should be submitted. The presentation should include the background of the problem, literature review, proposed solution approach, and initial findings or developments.
- Students should be prepared to present their progress to a review committee.

Review-II – (Weightage: 50%) (at the end of semester) Solution Development:

- Projects will be evaluated based on the effectiveness of the solution designed and developed using fabrication, coding, modeling, product design, process design, or other relevant processes for identified problem statement. Outcome Evaluation:
- The project outcome will be assessed regarding its technical feasibility, economic viability, societal impact, and environmental sustainability.
- A detailed report covering the problem identification, literature review, methodology, progress made, challenges faced, and future plan should be submitted.
- Teams must prepare an e-document, uploaded along with a plagiarism check report, detailing their project work and findings.
- Each team member must submit their report, highlighting their individual contributions with a brief abstract of the total work in the initial part of the document. Reports must be unique, and the review will be based on individual contributions.

Learning Resources:

Reference Book:

- Waterman, A. *Service-Learning: A Guide to Planning, Implementing, and Assessing Student Projects*. Routledge, 1997.
- Beckman, M., and Long, J. F. *Community-Based Research: Teaching for Community Impact*. Stylus Publishing, 2016.
- *Design Thinking for Social Innovation*. IDEO Press, 2015.
- Dostilio, L. D., et al. *The Community Engagement Professional's Guidebook: A Companion to The Community Engagement Professional in Higher Education*. Stylus Publishing, 2017

Web Links

- UNESCO: Education for Sustainable Development <https://www.unesco.org>
- EPICS (Engineering Projects in Community Service) <https://engineering.purdue.edu/EPICS>
- Ashoka: Innovators for the Public <https://www.ashoka.org>
- Design for Change <https://www.dfcworld.com>
- NPTEL course: Ecology and Society, https://onlinecourses.nptel.ac.in/noc20_hs77/preview

SYLLABUS

SEMESTER - IV

Savitribai Phule Pune University Second Year of Information Technology (2024 Course) Course Code: PCC-206- ITT Course Name: Database Management System		
Teaching Scheme	Credits	Examination Scheme
Theory : 03 H/W	03	CCE: 30 Marks ESE: 70 Marks
Prerequisite Courses, if any: Data Structures & Algorithms		
Companion Course, if any: --		
Course Objectives: <ol style="list-style-type: none"> 1. To establish a strong conceptual foundation in database systems, covering fundamental principles, technologies, and best practices. 2. To understand the fundamental concepts of Relational Database Management System. 3. To introduce systematic approaches for database design, including Entity-Relationship modeling and normalization techniques. 4. To equip students with hands-on experience in SQL and procedural extensions (PL/SQL) for effective database interaction. 5. To familiarize with the key aspects of transaction processing, concurrency control and recovery management. 6. To learn and understand various database architectures and applications. 7. To introduce the recent trends in database technology. 		
Course Outcomes: <p>CO1: Explain the fundamental concepts, architecture, and functionalities of database management systems.</p> <p>CO2: Analyze and design relational database (RDBMS) model to represent real-world database applications and demonstrate RDBMS principles.</p> <p>CO3: Improve the database design through normalization.</p> <p>CO4: Formulate database queries using SQL and PL/SQL for efficient data retrieval and manipulation.</p> <p>CO5: Demonstrate ACID properties for transaction management and describe concurrency control protocols.</p> <p>CO6: Explore and discuss recent trends in database technologies.</p>		
Course Contents		
Unit No: I	Introduction to Database Management System	08 Hours
<p>Basic concepts, Advantages of DBMS over file processing systems, Data abstraction and Data independence, Database languages, Components of a DBMS and Overall structure of DBMS, Multi-user DBMS architecture, Data Modeling: Basic concepts, entity, attributes, relationships, relations, constraints, keys, Data models.</p> <p>ER and EER diagrams: Components of ER model, Conventions, Converting ER diagrams into tables, EER Model components, converting EER diagram into tables.</p>		
Exemplars/Case Studies	<ol style="list-style-type: none"> 1. Library Management System: Exemplar <ul style="list-style-type: none"> · Students understand basic DBMS concepts · They apply E-R model concepts to represent book and user data. · Sample Activity: Create an ER diagram and relational schema for the system. 2. Online Retail Store (e.g., Amazon): Case Study <ul style="list-style-type: none"> · Students analyze how DBMS supports operations like search, filters, and checkout. 	

Unit No: II	Relational Model and Database Design	08 Hours
<p>Relational Model: Relational Model Concepts (Domains, Attributes, Tuples, and Relations), Relational Model Constraints, Relational Database Schemas, Codd's rules.</p> <p>Database design: Features of good relational database design, Purpose of Normalization, Data Redundancy and Data Anomalies, Functional Dependencies, Normal Forms (1NF, 2NF, 3NF, BCNF).</p>		
Exemplars/Case Studies	Student/Timetable/ Reservation any Data Management System	

Unit No: III	Structured Query Language (SQL) & Procedural SQL (PL/SQL)	08 Hours
<p>Introduction to SQL, Basic Data Types and SQL Syntax, Data Definition Language (DDL), Constraints, Data Manipulation Language (DML), Clauses with SELECT statement: WHERE, ORDER BY, Pattern Matching with LIKE, IN, BETWEEN, Aggregate functions with GROUP BY and HAVING, Joins, Sub-queries, Set Operations, Views, Index.</p> <p>Introduction to PL/SQL: Overview of PL/SQL architecture, control structures, Cursors, PL/SQL Advanced Features: Procedures and Functions, Triggers.</p>		

Unit No: IV	Transaction Management and Concurrency Control	08 Hours
<p>Transaction Management: Introduction to Database Transaction, Transaction states, ACID Properties, Concept of Schedule: Serial and concurrent Schedule. Serializability: Conflict and View, Cascaded Schedules, Recoverable Schedules.</p> <p>Concurrency Control and Recovery Management: Need for Concurrency Control, Lock-based protocols, Time stamp based protocol, Validation-based protocol, Multiple Granularity, Deadlock. Recovery Techniques: Shadow-Paging, Log-based Recovery, Check Point.</p>		

Unit No: V	Emerging Trends in Database Technologies	06 Hours
<p>Needs, Challenges with traditional databases, Need for scalability, flexibility, and speed.</p> <p>NoSQL Databases: Definition and types: Document, Key-Value, Column, Graph; Example using MongoDB.</p> <p>Cloud Databases: What is DBaaS (Database-as-a-Service), Examples: AWS/Google Firebase; Benefits: scalability, cost, easy setup.</p> <p>Introduction to Modern Database:</p> <p>Big Data and Hadoop: Basics of Big Data, Introduction to Hadoop and HDFS, Real-world examples (e.g., social media, online shopping), Simple explanation of how they store relationships.</p> <p>AI/ML with Databases: Basic idea of machine learning inside databases, Real-world applications: recommendations, fraud detection.</p>		

Exemplars/Case Studies	<ul style="list-style-type: none"> · Short quiz on types of NoSQL databases · Assignment: Compare SQL vs NoSQL · Viva on real-life applications of modern databases · Mini-project idea: Student Attendance using NoSQL DB
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Learning Resources

Text Books:

1. Silberschatz A., Korth H., Sudarshan S, “Database System Concepts”, McGraw Hill Publication, Sixth Edition.

Reference Books:

1. Elmasri R., Navathe S., “Fundamentals of Database Systems”, Pearson Education, Fourth Edition.
2. G. K. Gupta “Database Management Systems”, Tata McGraw Hill.
3. Date C., “An Introduction to Database Systems”, 8th Edition, Pearson Education
4. Ramkrishna R., Gehrke J., “Database Management Systems”, 3rd edition, McGraw Hill.
5. Oracle PL/SQL Programming by Steven Feuerstein.
6. Reese G., Yarger R., King T., Williams H, “Managing and Using MySQL”, Shroff Publishers and Distributors Pvt. Ltd., 2nd Edition.
7. Sadalage, P. J., Fowler, M., “NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence”, Addison-Wesley.
8. MongoDB. (a.n.d.). MongoDB Manual. Retrieved from MongoDB Official Documentation.
9. Mahmood, Z. (Ed.), “Cloud Computing: Concepts, Technology and Architecture”, Springer.
10. White, T., “Hadoop: The Definitive Guide”, 4th ed., O’Reilly Media.

Links to online SWAYAM/NPTEL Courses:

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

Savitribai Phule Pune University Second Year of Information Technology (2024 Course) Course Code: PCC-207-ITT Course Name: Computer Graphics		
Teaching Scheme	Credits	Examination Scheme
Theory : 3 Hrs./Week	3	CCE – 30 Marks End-Sem – 70 Marks
Prerequisite Courses, if any: Basic Mathematics		
Companion Course, if any: --		
Course Objectives: <ul style="list-style-type: none"> To acquaint students with the foundational concepts and terminology of computer graphics. To explain standard algorithms for generating and rendering graphical primitives. To demonstrate the use of mathematical transformations for manipulating graphical objects. To present methods for polygon filling, clipping, and color representation. To enable the development of interactive graphics and animations using modern tools. 		
Course Outcomes: On completion of the course, students will be able to: CO:1 Define fundamental concepts and identify hardware components in computer graphics. CO:2 Apply algorithms to draw and fill basic geometric shapes. CO:3 Apply mathematical transformations and projections techniques on graphical objects. CO:4 Implement techniques for polygon filling, clipping, and color modeling. CO:5 Develop interactive graphics and animations.		
Course Contents		
Unit No: I	Graphics Primitives and OpenGL Basics	06 Hours
Introduction to Computer Graphics: Definition, significance, and applications, Display devices: CRT, LCD, LED; frame buffer, resolution, aspect ratio Graphics Primitives: Pixel, line, circle, polygon basics (types: convex, concave and complex) Introduction to OpenGL: Architecture, primitives, attributes, Simple modeling and rendering of 2D/3D objects		
Exemplars/Case Studies	GLUT, OpenGL Architecture Review Board (ARB)	
Reference Books	Donald D. Hearn and Baker, "Computer Graphics with OpenGL", 4th Edition, ISBN-13:9780136053583. D. Rogers, "Procedural Elements for Computer Graphics", 2nd Edition, Tata McGraw-Hill Publication, 2001, ISBN 0 – 07 – 047371 – 4.	

Unit No: II	Rasterization, Filling, and Clipping Algorithms	07 Hours
Scan Conversion Algorithms: Line drawing: DDA, Bresenham, Circle drawing: DDA, Bresenham, Midpoint Polygon Filling Algorithms: Flood fill, seed fill, scan fill 2D clipping: Cohen-Sutherland, Sutherland-Hodgman, Weiler-Atherton		
Exemplars/Case Studies	Guard-band clipping technique and its use in rendering software	
Reference Books	S. Harrington, "Computer Graphics", 2nd Edition, McGraw-Hill Publications, 1987, ISBN 0 07– 100472 – 6. D. Rogers, "Procedural Elements for Computer Graphics", 2nd Edition, Tata McGraw-Hill Publication, 2001, ISBN 0 – 07 – 047371 – 4.	

Unit No: III	2D, 3D Transformations and Projections	07 Hours
2D Transformations: Homogeneous coordinates, translation, scaling, rotation, shear, Rotation about an arbitrary		

point	
3D Transformations: Translation, scaling, rotation, shear, Rotation about an arbitrary axis	
Projections: Parallel (orthographic: isometric, dimetric, trimetric; oblique: cavalier, cabinet), Perspective (1, 2, and 3-point vanishing points)	
Exemplars/Case Studies	Use of transformations and projections in any real time software
Reference Books	<i>Introduction to Computer Graphics</i> by David J. Eck (Open Textbook Library)

Unit No: IV	Color, Shading, and Hidden Surfaces	05 Hours
Color Models: Properties of light, CIE chromaticity diagram, RGB, HSV, CMY color models Illumination Models: Ambient, diffuse, specular reflection, Phong and Warn models, multiple light sources Hidden Surface Elimination: Algorithms: z-buffer, Painter's, Warnock		
Exemplars/Case Studies	Study of Shading Algorithm (Flat, Gouraud, Phong shading)	
Reference Books	D. Rogers, "Procedural Elements for Computer Graphics", 2nd Edition, Tata McGraw-Hill Publication, 2001, ISBN 0 – 07 – 047371 – 4.	

Unit No: V	Curves, Fractals, and Introduction to Animation	05 Hours
Curves: Introduction, interpolation, approximation, Blending functions, B-Spline, Bezier curves Fractals: Introduction, classification, Fractal generation: snowflake, Hilbert curve, Applications (e.g., coastline measurement) Introduction to Animation and Gaming: Basics of animation: keyframe, morphing, motion specification		
Exemplars/Case Studies	Study of Gaming platforms (NVIDIA, i8060), advances in gaming, Open-source tools: Unity, Maya, Blender	
Reference Books	Introduction to Computer Graphics by David J. Eck (Open Textbook Library) S. Harrington, "Computer Graphics", 2nd Edition, McGraw-Hill Publications, 1987, ISBN 0 07– 100472 – 6.	

Learning Resources
Text Books <ul style="list-style-type: none"> S. Harrington, "Computer Graphics", 2nd Edition, McGraw-Hill Publications, 1987, ISBN 0 07– 100472 – 6. Donald D. Hearn and Baker, "Computer Graphics with OpenGL", 4th Edition, ISBN-13: 9780136053583. D. Rogers, "Procedural Elements for Computer Graphics", 2nd Edition, Tata McGraw-Hill Publication, 2001, ISBN 0 – 07 – 047371 – 4.
Reference Books <ul style="list-style-type: none"> J. Foley, V. Dam, S. Feiner, J. Hughes, "Computer Graphics Principles and Practice", 2nd Edition, Pearson Education, 2003, ISBN 81 – 7808 – 038 – 9. D. Rogers, J. Adams, "Mathematical Elements for Computer Graphics", 2nd Edition, Tata McGraw Hill Publication, 2002, ISBN 0 – 07 – 048677 – 8.
e-Books <ul style="list-style-type: none"> <i>Introduction to Computer Graphics</i> by David J. Eck (Open Textbook Library https://open.umn.edu/opentextbooks/textbooks/420)
Links to online SWAYAM/NPTEL Courses <ul style="list-style-type: none"> NPTEL: Computer Graphics (https://nptel.ac.in/courses/106103224) NPTEL: Introduction to Computer Graphics (https://nptel.ac.in/courses/106102065)

Savitribai Phule Pune University Second Year of Information Technology (2024 Course) Course Code: PCC-208-ITT Course Name: Software Engineering		
Teaching Scheme	Credits	Examination Scheme
Theory : 02 H/W	02	CCE: 30M ESE : 70M
Prerequisite Courses, if any: Programming and Problem Solving		
Companion Course, if any:		
Course Objectives: The objective of this course is <ul style="list-style-type: none"> To introduce the students with a comprehensive understanding of software engineering principles, methodologies, and tools. To equip students with the skills necessary to design, develop, test, and maintain high-quality software systems in a systematic, disciplined, and efficient manner. To emphasizes both theoretical foundations and practical applications of software development, including software process models, requirements engineering, design techniques, project management, testing strategies, and quality assurance. 		
Course Outcomes: On completion of the course, learner will be able to – CO1: Apply Software Development Life Cycle: Students will be able to apply the software development life cycle to develop software systems. CO2: Apply software engineering principles, processes, and models in software development. CO3: Analyze document software requirements using appropriate techniques and tools and Design software systems using structured and object-oriented design approaches. CO4: Apply software testing methods and quality assurance techniques to evaluate software correctness and reliability. CO5: Manage software projects using project planning, estimation, risk management, and configuration management strategies.		
Course Contents		
Unit No: I	Introduction to Software Engineering Lifecycle (SDLC)	06 Hours
Software Engineering Fundamentals: Introduction to software engineering, The Nature of Software, Defining Software, Software Engineering Practice. Software Process: A Generic Process Model, defining a Framework Activity, Identifying a Task Set, Process Patterns, Process Assessment and Improvement, Prescriptive Process Models, The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Concurrent Models, A Final Word on Evolutionary Processes. Unified Process, Agile software development: Agile methods, plan driven and agile development.		
Unit No: II	Software Requirement Analysis and Design	07 Hours

Requirements Analysis: Problem Analysis, Data Flow Diagrams, Data Dictionaries, Requirements Documentation, Requirements Validation, Software Requirement and Specifications, Requirements Management, Change Management Form, Structure of SRS, Developing Use Cases, Building the Requirements Model.

Design Concepts: Structural design, behavior design, functional design, UML Diagrams, Design Pattern.

Unit No: III	Estimation and Scheduling	08 Hours
<p>Estimation for Software Projects: The Project Planning Process, Defining Software Scope and Checking Feasibility, Resources management, Reusable Software Resources, Environmental Resources, Software Project Estimation, Decomposition Techniques, Software Sizing, Problem-Based Estimation, LOC-Based Estimation, FP-Based Estimation, Object Point (OP)-based estimation, Process- Based Estimation, Process-Based Estimation, Estimation with Use Cases, Use-Case–Based Estimation, Reconciling Estimates, Empirical Estimation Models, The Structure of Estimation Models, The COCOMO II Mode, Preparing Requirement Traceability Matrix</p> <p>Project Scheduling: Project Scheduling, Defining a Task for the Software Project, Scheduling.</p> <p>Suggested Free Open Source Tools: Gantt Project, Agantty, Project Libre.</p>		

Unit No: IV	Risks and Configuration Management	06 Hours
<p>Risk Management: Software Risks, Risk Identification, Risk Projection, Risk Refinement, Risk Mitigation, Monitoring, and Management, The RMMM Plan.</p> <p>Software Configuration Management: Software Configuration Management, The SCM Repository The SCM Process, Configuration Management for any suitable software system.</p> <p>Suggested Free Open Source Tools: CF Engine Configuration Tool, Puppet Configuration Tool, Git, GitHub, GitLab, Apache subversion (SVN).</p>		

Unit No: V	Manual and Automated Software Testing	07 Hours
<p>Software Quality Assurance Plan, Unit testing, integration testing, black box and white box testing, regression testing, performance testing, object-oriented testing, Automation testing, Test Strategies for WebApps, Validation Testing, Validation-Test Criteria, Verification and validation of Software.</p> <p>Suggested Free Open Source Tools: Selenium, JUnit.</p>		

Learning Resources

Text Books:

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

Reference Books:

1. Carlo Ghezzi, “Fundamentals of Software Engineering", PHI, ISBN-10: 0133056996
2. Rajib Mall, “Fundamentals of Software Engineering”l, PHI, ISBN-13: 978-8120348981
3. Pankaj Jalote, “An Integrated Approach to Software Engineering”l, Springer, ISBN 13:9788173192715.
4. S K Chang, “Handbook of Software Engineering and Knowledge Engineering”l, World Scientific, Vol I, II, ISBN: 978-981-02-4973-1
5. Tom Halt, “Handbook of Software Engineering”, Clanye International ISBN- 10: 1632402939

e-Books:

<https://ebookpdf.com/roger-s-pressman-software-engineering>

Links to online SWAYAM/NPTEL Courses

- **https://swayam.gov.in/nd1_noc19_cs69/preview**
- **https://onlinecourses.swayam2.ac.in/cec20_cs07/preview**

<p align="center">Savitribai Phule Pune University Second Year of Information Technology (2024 Course) Course Code: PCC-209-ITT Course Name: Database Management System Lab (Practical)</p>		
Teaching Scheme	Credits	Examination Scheme
Practical : 02 H/W	01	TW: 25 M PR :25 M
Syllabus for		
<p>Course Objectives:</p> <ol style="list-style-type: none"> 1. Understand the fundamental concepts of database management. 2. To provide a strong formal foundation in database concepts, recent technologies and best industry practices. 3. To understand significance of SQLite. 4. To provide systematic database design approaches covering conceptual design, logical design and an overview of physical design. 5. To learn database implementation using MySQL. 6. To programme PL/SQL including stored procedures, stored functions and triggers. 		
<p>Course Outcomes: After completion of this course student will be able to</p> <p>CO1: To analyze database models and entity relationship models. CO2: To understand the relational database systems. CO3: To design and implement a database schema for a given problem-domain. CO4: To populate and query a database using SQL DDL and DML commands. CO5: To implement PL/SQL including stored procedures, stored functions and triggers. CO6: To design a backend database of any one organization: CASE STUDY.</p>		
Guidelines for Instructor's Manual		
The faculty member should prepare the laboratory manual for all the experiments and it should be made available to the laboratory instructor/Assistant.		
Guidelines for Student's Lab Journal		
<ol style="list-style-type: none"> 1. Student should submit term work in the form of handwritten journal based on specified list of assignments. 2. Practical Examination will be based on all the assignments in the lab manual. 3. Candidate is expected to know the theory involved in the experiment. 4. The practical examination should be conducted if and only if the journal of the candidate is complete in all respects. 		
Guidelines for Practical Assessment		
<ol style="list-style-type: none"> 1. Examiners will assess the student based on performance of students considering the parameters such as timely completion of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc. 2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory and implementation of experiments he/she has carried out. 3. Appropriate knowledge of usage of software and hardware related to respective laboratory should be checked by the concerned faculty member. 		
Suggested List of Laboratory Assignments		
Group A: Study of Databases		
<ol style="list-style-type: none"> 1. Study of MySQL Open source software. Discuss the characteristics like efficiency, scalability, performance and transactional properties 2. Study of SQLite: What is SQLite? Uses of SQLite. Comparison with SQL. 		
Group B: MySQL		
Design any database with at least two entities and relationships between them. Draw suitable ER/EER		

diagram for the system.

Implement the database using DDL and DML statements.

Create tables with primary key and foreign key and other constraints.

Perform following operations:

- a. Alter table
- b. Drop table
- c. Index operations
- d. Relational operators
- e. Pattern matching
- f. Aggregate functions with group by and having clauses
- g. Nested queries
- h. Set operators
- i. Views
- j. Sorting

Group C: PL/SQL

1. Write and execute PL/SQL stored procedure and function to perform a suitable task on the database. Demonstrate its use.
2. Write and execute suitable database triggers.

Reference Books

1. Dr. P. S. Deshpande, "SQL and PL/SQL for Oracle 10g Black Book", DreamTech.
2. Ivan Bayross, "SQL, PL/SQL: The Programming Language of Oracle", BPB Publication.
3. Reese G., Yarger R., King T., Williams H, "Managing and Using MySQL", Shroff Publishers and Distributors Pvt. Ltd., 2nd Edition.

Savitribai Phule Pune University Second Year of Information Technology (2024 Course) Course Code: PCC-210-ITT Course Name: Computer Graphics Lab (Practical)		
Teaching Scheme	Credits	Examination Scheme
Practical : 02 H/W	01	OR: 25 M
Prerequisites: Basic Geometry, Trigonometry, Vectors and Matrices, Data Structures and Algorithms		
Course Objectives: <ol style="list-style-type: none"> 1. To acquaint the learners with the concepts of Computer Graphics. 2. To acquaint the learners with the concepts of various Computer Graphics Libraries for implementation. 3. To implement the various algorithms for generating and rendering the objects. 4. To get familiar with mathematics behind the transformations. 5. To understand and apply various methods and techniques regarding animation. 		
Course Outcomes: On completion of this course student will be able to – CO1: Apply line& circle drawing algorithms to draw the objects. CO2: Apply polygon filling methods for the object. CO3: Apply polygon clipping algorithms for the object. CO4: Apply the 2D transformations on the object. CO5: Implement the curve generation algorithms. CO6: Demonstrate the animation of any object using animation principles.		
Guidelines for Instructor's Manual		
The instructor 's manual is to be developed as a reference and hands-on resource. It should include prologue (about university/program/ institute/ department/foreword/ preface), University syllabus, conduction and Assessment guidelines, topics under consideration, concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references.		
Guidelines for Student's Lab Journal		
<ol style="list-style-type: none"> 1. The laboratory assignments are to be submitted by student in the form of journal. 2. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, Date of Completion, Objectives, Problem Statement, Software and Hardware requirements, Assessment grade/marks and assessor's sign, Theory- Concept in brief, algorithm, flowchart, test cases, Test Data Set (if applicable), mathematical model (if applicable), conclusion/analysis. 3. 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. 4. Use of DVD containing students' programs maintained by lab In-charge is highly encouraged. 5. For reference one or two journals may be maintained with program prints at Laboratory. 		
Guidelines for Laboratory /Term Work Assessment		
<ul style="list-style-type: none"> • Continuous assessment of laboratory work should be based on overall performance of Laboratory assignments by a student. • Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage. • Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness. 		
Guidelines for Practical Examination		
<ol style="list-style-type: none"> 1. Internal and external examiners should jointly prepare oral questions based on the syllabus. 2. During the oral assessment, the examiner should focus on: <ol style="list-style-type: none"> a. The student's ability to explain the implemented code and underlying logic. b. Understanding of core concepts like classes, inheritance, polymorphism, and exception handling. 3. Answering supplementary questions to assess advanced learning and application of concepts. 4. The student should demonstrate clear communication and effective problem-solving skills. 		
Guidelines for Laboratory Conduction		

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. The instructor may set multiple sets of assignments without changing its complexity level and distribute among batches of students. Encourage students for the use of industry coding standards such as appropriate use of Hungarian notation, Indentation and comments. Use of open-source software is encouraged. Set of suggested assignment list is provided, instructors may take different case studies with similar complexity level.

Operating System Recommended: Linux (Ubuntu, Fedora, Debian, etc.) – 64-bit open-source Linux or its derivative recommended.

Experiments 1–7:

- Implement all programs using either **C++** or **Java** object-oriented programming language.
- Emphasize use of classes, inheritance, polymorphism, and operator overloading where applicable.
- Use **any standard graphics libraries** (e.g., OpenGL for C++, Java 2D or JavaFX for Java) for graphical output.

Experiment 8 (Mini Project):

- Use any **open-source software** (e.g., Blender, OpenToonz, Pencil2D) to create an animation clip.
- The mini-project should demonstrate creativity and understanding of animation principles.
- Submit source files and a brief report/documentation along with the animation clip.

List of Assignments

1. Line Drawing Algorithms – CO2

Write a program to draw a line using DDA and Bresenham's line drawing algorithms.

2. Circle Drawing Algorithm – CO2

Write a program to draw a circle using the Midpoint circle drawing algorithm.

3. Polygon Filling using Scanline Algorithm – CO2, CO4

Write a program to draw a concave polygon and fill it with a desired color using the scanline fill algorithm.

4. Line Clipping using Cohen-Sutherland Algorithm – CO4

Write a program to implement the Cohen-Sutherland line clipping algorithm.

5. 2D Transformations with Operator Overloading – CO3

Write a program to draw a 2D object (such as a triangle or rectangle) and perform basic transformations: translation, rotation, and scaling. Use operator overloading in your implementation.

6. Fractal Pattern Generation – CO2, CO3

Write a program to generate a fractal pattern (e.g., snowflake, Hilbert curve, or Koch curve).

7. Interactive Graphics Application – CO5

Write a program to create an interactive graphical application (e.g., bouncing ball, moving car, or simple game) using object-oriented concepts such as inheritance and polymorphism.

8. Mini Project: Animation Clip Creation – CO5

Mini Project: Create an animation clip (such as animated scenes, character movement, or game cutscene) using any open-source software (e.g., Blender, OpenToonz, or Pencil2D).

Savitribai Phule Pune University Second Year of Information Technology (2024 Course) Course Code :OEL -221-ITT – A Course Name: Financial Management		
Teaching Scheme	Credits	Examination Scheme
Theory : 2H/W	02	CCE : 15 ESE : 35
Prerequisite Courses: <ul style="list-style-type: none"> Engineering Economics / Basic Economics (recommended). Business environment and economic systems (recommended). 		
Companion Course: Project Management (recommended).		
Course Objectives: <ol style="list-style-type: none"> To introduce engineering students to the fundamental concepts of financial management. To develop an understanding of financial statements and basic financial decision-making. To equip students with tools to evaluate investment and financing options. To enhance skills in applying financial principles to technical projects and business scenarios. To create financial awareness useful in entrepreneurial or managerial roles. 		
Course Outcomes: 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 No: I	Introduction to Financial Management	06 Hours
<ul style="list-style-type: none"> 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 		
Exemplars/Case Studies	Role of finance in a tech startup Real-world examples of financial decision making in engineering firms	
Reference Books	Khan & Jain, Financial Management, Tata McGraw-Hill Prasanna Chandra, Financial Management, McGraw-Hill	

Unit No: II	Time Value of Money & Capital Budgeting	06 Hours
<ul style="list-style-type: none"> 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 		
Exemplars/Case Studies	NPV calculation for a solar plant project Payback period for a manufacturing automation upgrade	
Reference Books	I.M. Pandey, Financial Management	

	Van Horne, Financial Management and Policy
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Unit No: III	Financial Statements & Ratio Analysis	06 Hours
<ul style="list-style-type: none"> ● 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. 		
Exemplars/Case Studies	Ratio analysis of a listed engineering company. Balance sheet reading for a medium-sized manufacturing firm.	
Reference Books	T.S. Grewal, Introduction to Accountancy. M.Y. Khan & Jain, Financial Management.	

Unit No: IV	Working Capital Management	08 Hours
<ul style="list-style-type: none"> ● 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 <p>Sources of Finance & Cost of Capital –</p> <ul style="list-style-type: none"> ● 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 		
Exemplars/Case Studies	-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	
Reference Books	I.M. Pandey, Financial Management Bhattacharya, Working Capital Management Prasanna Chandra, Fundamentals of Financial Management Ross, Westerfield & Jordan, Corporate Finance	

Learning Resources:
<ul style="list-style-type: none"> ● I.M. Pandey, Financial Management ● Prasanna Chandra, Financial Management
Text Books:
<ul style="list-style-type: none"> ● Financial Management by I.M. Pandey, Vikas Publishing House ● Financial Management by Rustagi R.P., Taxmann Publications.
Reference Books:
<ul style="list-style-type: none"> ● Khan & Jain, Financial Management ● Van Horne, Financial Management and Policy ● Ross, Westerfield & Jordan, Corporate Finance
e-Books:
<ul style="list-style-type: none"> ● Financial Management eBook by IIMBx (edX)
Links to online SWAYAM/NPTEL Courses:
<ul style="list-style-type: none"> ● 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 Second Year of Information Technology (2024 Course) Course Code: OEL -221-ITT – B Course Name: Optimization Techniques		
Teaching Scheme	Credits	Examination Scheme
Theory : 2 H/W	2	CCE: 15 ESE: 35
Prerequisite Courses, if any: Basic knowledge of mathematics and programming		
Companion Course, if any:		
Course Objectives: By the end of this course, students will be able to: <ol style="list-style-type: none"> 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:		
CO No.	Course Outcome Statement	Bloom's Level
CO1	Define and classify various types of optimization problems in mathematical form.	Understand
CO2	Apply graphical and simplex methods to solve linear programming problems.	Apply
CO3	Apply optimization techniques to solve Transportation and Assignment problems.	Apply
CO4	Solve non linear problems Karush-Kuhn-Tucker theory.	Apply
CO5	Calculate numerical solution using various Numerical techniques.	Apply
Course Contents		
Unit No: I	Introduction and Basic Concepts	05 H
Historical Development; Engineering applications of Optimization; Formulation of real-life problems as mathematical models.		
Exemplars/Case Studies	Job scheduling in IT systems, Cost minimization in cloud services	
Reference Books	S.S. Rao – <i>Engineering Optimization</i> , Vedula, S. and Mujumdar, P. P., <i>Water Resources Systems: Modeling Techniques and Analysis</i> , Tata-McGraw Hill, 2005.	

Unit No: II	Linear Programming	05 H
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		
Exemplars/Case Studies	Resource allocation in IT projects, Manpower scheduling, Karmarkar's projective scaling method	
Reference Books	N. S. Kambo, <i>Mathematical Programming Techniques</i> , East West Press, 1997.	

	H.A. Taha – <i>Operations Research: An Introduction</i>
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Unit No: III	Linear Programming Applications	05 H
Sensitivity analysis, Transportation and Assignment Problems		
Exemplars/Case Studies	Use of software for solving linear optimization problems using graphical and simplex methods	
Reference Books	E.K.P. Chong and S.H. Zak, <i>An Introduction to Optimization</i> , 2nd Ed., Wiley, 2010. Nocedal & Wright – <i>Numerical Optimization</i>	

Unit No: IV	Numerical Optimization Techniques	05 H
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		
Exemplars/Case Studies	Use of software for Karush-Kuhn-Tucker theory Numerical calculation using software	
Reference Books	<ul style="list-style-type: none"> Ahuja, Magnanti, Orlin – <i>Network Flows</i> Papadimitriou and Steiglitz – <i>Combinatorial Optimization</i> Rajasekharan & Pai – <i>Neural Networks, Fuzzy Logic and Genetic Algorithms</i> Goldberg – <i>Genetic Algorithms in Search, Optimization & Machine Learning</i> 	

Learning Resources
Text Books:- S.S. Rao – <i>Engineering Optimization: Theory and Practice</i> Kalyanmoy Deb – <i>Optimization for Engineering Design</i>
Reference Books:- KantiSwarup – <i>Operations Research</i> Chong and Zak – <i>An Introduction to Optimization</i> Nocedal& Wright – <i>Numerical Optimization</i>
e-Books:- <i>Introduction to Optimization</i> – MIT OpenCourseWare <i>Numerical Optimization</i> – SpringerLink (online academic access)

Links to online SWAYAM/NPTEL Courses

<https://archive.nptel.ac.in/courses/111/105/111105039/>

https://onlinecourses.nptel.ac.in/noc20_ma23/preview

[SWAYAM – Optimization for Machine Learning](#)

Savitribai Phule Pune University Second Year of Information Technology (2024 Course) Course Code: MDM-231-ITT Course Name: Processor Architecture		
Teaching Scheme	Credits	Examination Scheme
Theory : 02 H/W	02	CCE:30 ESE:70
Prerequisite Courses, if any: Logic Design & Computer Organization		
Companion Course, if any:		
Course Objectives: 1. To study architectural details of PIC 18 microcontroller. 2. Explore the knowledge and skills required to interface PIC microcontrollers with external peripherals and to develop embedded applications 3. To study applications of PIC through various interfacing devices		
Course Outcomes: On completion of this course student will be able to – <ul style="list-style-type: none"> • CO1: Apprehend the fundamentals of PIC Microcontroller • CO2: Students will be able to analyze the difference between microprocessor and microcontroller-based systems. • CO3: Apply embedded C programming to configure and control I/O ports, and implement timer-based applications using polling and interrupt techniques on PIC18 microcontrollers. • CO4: Interface and program external devices with a PIC microcontroller to design functional embedded system solutions. • CO5: Analyze architectural details of ARM processor and apprehend the current trends in Processor Architecture 		
Course Contents		
Unit No: I	Fundamentals of PIC Microcontroller	08 Hours
Introduction Of Microcontroller, Microprocessor Vs Microcontroller, What is PIC Microcontroller, Architecture, Core Components of Microcontroller, Types of PIC Microcontrollers, Development Tools, Programming Languages for PIC Microcontroller, Typical Applications of PIC Microcontroller.		
Exemplars/Case Studies	PIC-Based Temperature and Humidity Monitoring System	

Reference Books	<p>Peatman, John B, “Design with PIC Microcontroller”, Pearson Education PTE</p> <p>Ramesh Gaonkar, “Fundamentals of Microcontrollers and Applications In Embedded Systems(with the PIC18 Microcontroller Family)”Thomson/Delmar Learning; 1 edition (January 8, 2007), ISBN:978-1401879143</p>
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Unit No: II	PIC Microcontroller Architecture	08 Hours
<p>Introduction to microcontroller, Criteria for selection of microcontroller, Features and architecture, Comparison of PIC 18 series microcontrollers; Details of Pins, Pin Diagram PIC 18 internal Architecture: ALU, EEPROM, RAM, IO Ports, Timer, ADC, Serial port PIC18 microcontroller programming model, Bus architecture Registers of PIC18F, Interrupts of PIC18F Program memory and data memory organization</p>		
Exemplars/Case Studies	Compare and contrast PIC18 microcontrollers with other microcontroller families, such as PIC16, Arduino, and Raspberry Pi.	
Reference Books	<p>M.Bates, “PIC Microcontrollers”, Newnes, 2011</p> <p>Ramesh Gaonkar, “Fundamentals of Microcontrollers and Applications in Embedded Systems (with the PIC 18 Microcontroller Family)”, Penram International publications (Ind) Pvt. Ltd.</p>	

Unit No: III	PIC I/O Ports Timer, Counter	08 Hours
<p>I/O Port Programming in PIC18 Microcontroller (Structure and configuration of I/O Ports (PORTx, TRISx, LATx) , Bit-level I/O Control and Manipulation (Bitwise operations), Programming examples using Embedded C), Timers and Counters in PIC18 Microcontroller (Timer/Counter modules (Timer0, Timer1, etc.) and associated Registers, Delay Generation using Timers, Timer Programming in Embedded C)</p>		
Exemplars/Case Studies	Smart LED Blinker with Timer Interrupts	
Reference Books	Design with PIC Microcontrollers” by John B. Peatman	

Unit No: IV	PIC Interfacing	08 Hours
<p>Interrupt: Interrupt Structure of PIC18F with SFR, PORTB change Interrupts, use of timers with interrupts</p> <p>CCP modes: Capture, Compare and PWM generation, DC Motor speed control with CCP, Block diagram of in-built ADC with Control registers, Sensor interfacing using ADC: All programs in embedded C.</p> <p>Interfacing of LED, Interfacing 16X2 LCD and Key board, 7-segment display interfacing, Interfacing Relay & Buzzer.</p> <p>Basics of Serial communication protocols: Study of RS232, I2C, SPI, UART, Serial communication programming using Embedded C.</p>		
Exemplars/Case Studies	Temperature-Controlled Fan System, Smart Water Level Controller, Digital Attendance System Using Keypad and LCD	
Reference Books	Muhammad Ali Mazidi, Danny Causey, RolinMcKinlay, “PIC Microcontroller and Embedded Systems: Using Assembly and C for PIC18”, 4th Edition by, Pearson international edition	

Unit No: V	Current Trends in Processor Architecture	08 Hours
<p>ARM & RISC: ARM and RISC design philosophy, Introduction to ARM processor & its versions, Features & advantages of ARM processor, Suitability of ARM processor in embedded applications, Programmers model. CPSR registers, Difference between PIC and ARM, Improving performance current techniques of processor architectures</p>		
Exemplars/Case Studies	Exploring use cases in automotive, IoT and data centers	
Reference Books	Muhammad Ali Mazidi, SarmadNaimi, “ARM Assembly Language Programming & Architecture”	

Learning Resources

Text Books:

1. Muhammad Ali Mazidi, Danny Causey, RolinMcKinlay, “PIC Microcontroller and Embedded Systems: Using Assembly and C for PIC18”, 4th Edition by, Pearson international edition

Reference Books:

1. Peatman, John B, “Design with PIC Microcontroller”, Pearson Education PTE

2. Ramesh Gaonkar, “Fundamentals of Microcontrollers and Applications in Embedded Systems (with the PIC18 Microcontroller Family)” Thomson/Delmar Learning; 1 edition (January 8, 2007), ISBN:978-1401879143

3. Microchip’s PIC18FXXX Data Sheet

Links to online SWAYAM/NPTEL Courses

Course Title : Microprocessors and Microcontrollers By Prof. Santanu Chattopadhyay, Dept. of Electrical Engineering, IIT Kharagpur Course

Details : https://onlinecourses.nptel.ac.in/noc22_ee12/preview Lectures available on <https://archive.nptel.ac.in/courses/108/105/108105102/>

SWAYAM - “Introduction to Embedded System Design” by IIT Kharagpur <https://swayam.gov.in>

Savitribai Phule Pune University Second Year of Information Technology (2024 Course) Course Code: VSE- 270-ITT Course Name: Digital Marketing and social media		
Teaching Scheme	Credits	Examination Scheme
Practical :04	2	Term Work :25 Practical : 25
Prerequisite Courses, if any: Understanding of design thinking and planning is essential.		
Companion Course, if any:		
Course Objectives: This course aims at enabling students, 1. To understand the basic concept of Digital Marketing. 2. To understand the basics of Mobile Marketing. 3. To familiarize with the knowledge of E-mail Marketing. 4. To introduce a comprehensive set of digital marketing tools commonly used in the industry. 5. To provide practical skills and knowledge necessary to utilize tools effectively for marketing purposes. 6. To develop strategic approaches in selecting and implementing appropriate digital marketing tools based on specific marketing objectives and target audiences		
Course Outcomes: After learning the course, the students should be able to: 1. Understand the core concepts of Digital Marketing. 2. Understand the basics of Email & Mobile Marketing. 3. Use Search Engine Optimization tools for digital marketing campaigns. 4. Use social media marketing tools for digital marketing campaigns. 5. Apply digital marketing strategies using Mailchimp and WordPress. 6. Apply strategic digital advertising techniques through Google Ads, create visually compelling graphics with Canva, and produce engaging video content on YouTube		
Course Deliverables for Practical Sessions		
Introduction to Digital marketing		
The Concept , Need & Evolution of Digital Marketing, Reason for growing Importance of Digital Marketing in India, Digital Marketing: Types & Examples. The concept of Digital Marketing Mix, 7 P's of Online Marketing: Product, Price, Promotion, Place People, Process, Physical evidence, Methods of Online Marketing promotion. Case Study on Digital Marketing		

Social Media Analytics
Types of Analytics in Social Media: Analytics, Listening, Advertising Analytics, Analytics from CMS and CRM, The Analytics Process, Metrics, Dashboards, and Reports. Google Analytics Features, Benefits, and Limitations, Google Analytics Reports, Creating custom reports, Dashboard and Segments

Key Performance Indicators
Selecting and Preparing KPIs, Pages and Landing Pages, Event Tracking and AdSense, Site Search, Optimizing Your Search Engine Marketing Consumer Generated Contents (CGC), Impact of social media, Advantages and Disadvantages of social media, Types of social media, social media for Business use, Community Building Principles

Search Engine Optimization (SEO)
Search Engine Optimization Basics, Keyword Research, SEO Tool- SEMrush: Overview and Features, Top Search Engine Ranking Factors. Case Study: Dominos India: Building Traffic through content propagation

DM tools
Overview of Hootsuite: Dashboard and Features, Social Media Listening and Monitoring, Social Media

Publishing and Scheduling. Campaign using Mailchimp: Overview of Mailchimp Features and Interface, Building Email Lists and Segmentation, Creating Email Campaigns: Templates and Content Design. Advertising tools: Google Ads, Canva Interface.

Guidelines:

- The laboratory assignments are to be submitted by students in the form of a journal.
- Journal consists of a prologue, certificate, table of contents and handwritten write-up of each assignment.

Guidelines for Laboratory/Term Work Assessment:

- Continuous assessment of laboratory work is done based on overall performance and Laboratory performance of students.
- Every evaluation for a laboratory assignment should offer a grade or marks based on parameters with appropriate weightage.
- Suggested parameters for overall assessment as well as each Laboratory assignment include- timely completion, performance, innovation, efficiency, punctuality and neatness.

Guidelines for Laboratory Conduction:

- Assignments on all concepts are mandatory.
- Assignments on all concepts should be implemented using digital marketing tools.
- Use of open-source tools is to be encouraged.

1	<p>Keyword Research and SEO Optimization</p> <p>Using SEO tools such as SEMrush, conduct keyword research for a specific industry or topic: Create a list of high-volume and relevant keywords, and propose on-page and off-page SEO optimizations for a hypothetical website based on the keyword research findings.</p>
2	<p>Social Media Content Calendar</p> <p>Select a social media management tool like Hootsuite. Plan and create a social media content calendar for a one-week period, including content types, posting schedule, and target audience segments. Use the scheduling feature of the chosen tool to schedule posts across different Social media platforms.</p>
3	<p>Email Marketing Campaign</p> <p>Choose an email marketing platform such as Mailchimp or Constant Contact. Design and execute an email marketing campaign for a fictional product or service. Create email templates, segment the email list, and schedule the campaign. Analyze the campaign performance metrics such as open rates, click-through rates, and conversions.</p>
4	<p>Social Media Advertising Campaign</p> <p>Create a Facebook Business Manager account. Develop a social media advertising campaign on Facebook or Instagram for a chosen target audience. Define campaign objectives, audience targeting criteria, ad formats, and budget allocation. Monitor campaign performance metrics</p> <p>Such as reach, engagement, and conversion rates.</p>
5	<p>Leveraging Instagram Influencers for Brand Promotion</p> <p>Create an Instagram influencer outreach plan to promote a new line of eco-friendly skincare products, aiming to increase brand visibility and drive online sales among environmentally-conscious consumer</p>
6	<p>Creating Canva Designs for YouTube Channel Branding</p> <p>Design graphics for branding a YouTube channel focused on cooking tutorials. The channel name is "Tasty Bites Kitchen." The graphics to be created include a channel banner, a profile Picture (channel logo), and a thumbnail template for video thumbnails.</p>

7	Understand web analytics using tools like Google Analytics Analyze website performance using Google Analytics and identify areas for optimization and improvement
8	Create website using Word Press Using Word press Plug-ins- Different Plug-ins, social media Plug-ins, page builder plug-ins: the elementor, how to insert a section, Google Micro sites create a website.
Learning Resources	
Text Books: <ol style="list-style-type: none"> 1. The digital marketing Handbook, A step by step guide, Mohit Pawar, 2015 Edition. 2. Advanced Web Metrics with Google Analytics, SYBEX, Brian Clifton, Second Edition. 3. Social Media Analytics Strategy, Alex Goncalves, Apress 	
Reference Books: <ol style="list-style-type: none"> 1. Ian Dodson, The art of Digital Marketing, 2016, Wiley, 978-1-119-26570-2. 2. Vandana Ahuja, Digital Marketing, Oxford University Press, 2015, ISBN-10. ISBN:0199455449. 	
e-sources: <ol style="list-style-type: none"> 1. https://skillshop.exceedlms.com/student/collection/648385-digital_marketing 2. https://www.coursera.org/courses?query=digital%20marketing 	
Links to online SWAYAM/NPTEL Courses	

Savitribai Phule Pune University		
Second Year of Information Technology (2024 Course)		
Course Code: AEC-281-ITT		
Course Name: Business Communication Skills		
Teaching Scheme	Credits	Examination Scheme
Practical : 2 hrs / week	1	Term Work –50 marks
Tutorial : 1 hr / week	1	
Prerequisite Courses, if any: Basic knowledge of English grammar and usage Familiarity with general communication in academic settings		
Companion Course, if any: EEM-241-AIM/ITT: E-Commerce Why? It aligns well with business communication applications in online transactions, digital consumer interaction, and corporate correspondence. Additional Potential Companion Course PCC-206-AIM/ITT: Software Engineering Why? Communication is crucial in software development—especially in requirement gathering, documentation, agile practices, and team collaboration. VSE-270-AIM/ITT: Digital Marketing and Social Media Why? Strong synergy with communication in marketing campaigns, digital storytelling, persuasive writing, and client communication. OEL-221-AIM/ITT: Open Elective II – Financial Management / Optimization Techniques Why? Financial professionals and analysts must communicate findings, reports, and recommendations clearly—relevant for teaching data-supported communication.		
Course Objectives:		
<ul style="list-style-type: none">To explain the basic concepts of ideal communications by having the learners perform a self-assessment, goal setting, and understanding business related verbal and non-verbal communication.To build confidence and clarity of speech with the students by having them participate in academic and corporate group discussions, extempore speeches, interviews, and formal presentations.To improve students’ reading, writing and analytical capabilities by testing their listening skills, verbal ability, preparing business reports, and writing structured essays.To promote responsible and socially acceptable AI communications by teaching the integration of AI tools (e.g. ChatGPT, Grammarly, MS Copilot) into writing, collaboration, editing, and digital professionalism within the course.		
Course Outcomes:		
After successful completion of this course, the learner will be able to:		
<ul style="list-style-type: none">CO1: Self assess and construct self and academic goals while professionally introducing themselves through reflection and personal branding techniques.CO2: Interact with the students and engage them in group discussions and professionalism to observe demonstration of competence in verbal and non-verbal communication.CO3: Utilize listening and reading comprehension skills to analyze, interpret, and respond appropriately to workplace communication materials.CO4: Prepare business documents such as reports, essays, and professional emails which use elucidation, appropriate tone, and intention.CO5: Apply productivity technologies such as AI ChatGPT, Grammarly, and MS Copilot to optimize written communications and elevate business relations.CO6: Demonstrate collaboration and presentation skills, as well as team interaction in professional role play scenarios such as interviews and group work.		
COURSE CONTENTS		
Unit No: I	Foundations of Business Communication & Understanding Self & Communication	
Course	<ul style="list-style-type: none">CO1: Self assess and construct self and academic goals while professionally introducing	

Outcomes	themselves through reflection and personal branding techniques. <ul style="list-style-type: none">● CO2: Interact with the learners and engage them in group discussions and professionalism to observe demonstration of competence in verbal and non-verbal communication.● CO4: Prepare business documents such as reports, essays, and professional emails which use elucidation, appropriate tone, and intention.	
TOPICS COVERED <ul style="list-style-type: none">○ Introduction to communication process○ Self-introduction and SWOC○ SMART goal setting○ Verbal and non-verbal communication○ Communication cycle and barriers○ Digital etiquette in business communication		
Tutorial Components	Understanding Communication process SWOC Analysis and SMART Goal Setting Communication Cycle & Barriers 7 Cs of Effective Communication	
Practical Components	Structured Self-Introduction Role play for Verbal & Non-Verbal Communication Communication break downs	
Exemplars/Case Studies	Email thread analysis Personal SWOC reflection sample Breakdown in communication due to barriers	
Reference Books	1. <i>Business Communication – Meenakshi Raman & Prakash Singh (OUP)</i> 2. <i>Soft Skills: Know Yourself & Know the World – K. Alex (S. Chand)</i> 3. <i>Personality Development and Soft Skills – Barun K. Mitra (OUP)</i>	
Bloom’s Taxonomy Level	SWOC Analysis Goal Setting Communication Cycle & Barriers 7 Cs of Effective Communication Self-Introduction Verbal & Non-Verbal Communication	Analyze Create Understand Evaluate Apply Apply & Analyze

Unit No: II	Business Writing: Professional Documents, Reports, Emails	
Course Outcomes	<ul style="list-style-type: none">• CO1: Self assess and construct self and academic goals while professionally introducing themselves through reflection and personal branding techniques.• CO3: Utilize listening and reading comprehension skills to analyze, interpret, and respond appropriately to workplace communication materials.• CO5: Apply productivity technologies such as AI ChatGPT, Grammarly, and MS Copilot to optimize written communications and elevate business relations.	
TOPICS COVERED		
<ul style="list-style-type: none">○ Business emails and letters. Understanding tone and format.○ Intra-organizational communications like memos, circulars.○ Writing agenda, proposal, drafting meeting minutes.○ Various forms of business reports: Types, structures, executive summaries.○ AI for business document formatting, Grammarly, ChatGPT prompting.		
Tutorial Components	Strategies Identifying formats of emails and reports Prompt design for AI-assisted writing Analysis of documents produced by AI and those edited by humans.	
Practical Components	Writing an email with review from peers Based on business situation, drafting minutes of a meeting Writing a business report using AI support Using AI tools to proofread business communication	
Exemplars/Case Studies	Effective vs poorly written emails An example of business proposal using AI tool input An analysis of output got from Grammarly/ChatGPT	

Reference Books	<ol style="list-style-type: none"> 1. <i>Effective Technical Communication</i> – M. Ashraf Rizvi (McGraw Hill) 2. <i>Business Communication</i> – Meenakshi Raman & Prakash Singh (OUP) 3. <i>HBR Guide to Better Business Writing</i> – Bryan A. Garner 	
Bloom's Taxonomy Level	Format & Tone of Business Writing Writing professional documents Developing effective tone AI Vs human content Reports, emails, proposals	Understand Apply Analyze Evaluate Create

Unit No: III	Developing Listening, Reading with AI Integration	
Course Outcomes	<ul style="list-style-type: none">• CO3: Utilize listening and reading comprehension skills to analyze, interpret, and respond appropriately to workplace communication materials.• CO5: Apply productivity technologies such as AI ChatGPT, Grammarly, and MS Copilot to optimize written communications and elevate business relations.• CO6: Demonstrate collaboration and presentation skills, as well as team interaction in professional role play scenarios such as interviews and group work.	
TOPICS COVERED		
<ul style="list-style-type: none">○ Active listening techniques in a professional and academic setting.○ Readings: strategies such as skimming, scanning, summarizing, and making inferences.○ Developing professional vocabulary & language structure.○ Incorporating AI tools: using AI in paraphrasing, suggestion of words, grammar checks, and summarization.		
Tutorial Components	Reading business-related documents and critical analysis Interpretation and comprehending business language Applying AI Platforms to enhance grammar and lexical resource Discussing active listening in professional set up and overcoming barriers	
Practical Components	Active Listening activity using audio/video-based content Group discussion and evaluating based on reading professional communication Using AI platforms to generate summary of business reports or information	
Exemplars/Case Studies	TED Talk or business podcast with post-listening Q&A Business magazine or report summary exercise Grammarly and ChatGPT output comparison Workplace communication samples for verbal analysis	
Reference Books	<i>1. Effective Technical Communication – M. Ashraf Rizvi (McGraw Hill)</i> <i>2. Business Communication – Meenakshi Raman & Prakash Singh (OUP)</i> <i>3. Soft Skills – K. Alex (S. Chand)</i> <i>4. Word Power Made Easy – Norman Lewis (for verbal ability enhancement)</i>	
Bloom’s Taxonomy Level	Active Listening Strategies Reading Comprehension Grammar & Vocabulary AI-Aided Summarization & Correction Summarizing Written/Spoken Content	Understand, Apply Analyze Apply Analyze & Create Create

Unit No: IV	Professional Speaking: Interviews, Presentations & Digital Delivery	
Course Outcomes	<ul style="list-style-type: none"> • CO2: Interact with the learners and engage them in group discussions, and professionalism to observe demonstration of competence in verbal and non-verbal communication. • CO4: Prepare business documents such as reports, essays, and professional emails which use elucidation, appropriate tone, and intention. 	

	<ul style="list-style-type: none">• CO5: Apply productivity technologies such as AI ChatGPT, Grammarly, and MS Copilot to optimize written communications and elevate business relations.• CO6: Demonstrate collaboration and presentation skills, as well as team interaction in professional role play scenarios such as interviews and group work.	
TOPICS COVERED <ul style="list-style-type: none">○ Structured presentation methods○ Storytelling alongside the elevator pitch and non-verbal communication○ The different interview forms (HR, technical, behavioural) and the use of the STAR method○ Virtual manners, annunciation, posture, and body movements○ Incorporating AI: Using AI technologies to draft and polish presentations, and Practicing interviews through AI mock interview platforms		
Tutorial Components	Preparing a personal elevator pitch using AI assistance Structuring presentations: content flow, visual logic Discussing common interview questions and ideal responses	
Practical Components	Mock interviews in pairs or panels (face-to-face and online) Team-based technical presentations with Q&A	
Exemplars/Case Studies	Real-world interview simulations and feedback videos Success/failure analysis of virtual interviews (e.g., poor lighting, miscommunication) AI vs. human-generated presentation content comparisons	
Reference Books	1. <i>The Quick and Easy Way to Effective Speaking – Dale Carnegie</i> 2. <i>The Art of Public Speaking – Stephen E. Lucas</i> 3. <i>Interview Skills that Win the Job – Michael Spiropoulos</i> 4. <i>TED Talks: The Official Guide to Public Speaking – Chris Anderson</i>	
Bloom’s Taxonomy Level	Presentation Mock Interview AI Powered Speech for Presentation Non-verbal communication in Interview Peer Review and Response	Understand, Create Apply, Analyze Apply, Evaluate Understand, Apply, Evaluate

Unit No: V	Teamwork, Cross-Cultural & AI-Augmented Digital Communication
Course Outcomes	<ul style="list-style-type: none">• CO4: Prepare business documents such as reports, essays, and professional emails which use elucidation, appropriate tone, and intention.• CO5: Apply productivity technologies such as AI ChatGPT, Grammarly, and MS Copilot to optimize written communications and elevate business relations.• CO6: Demonstrate collaboration and presentation skills, as well as team interaction in professional role play scenarios such as interviews and group work.
TOPICS COVERED <ul style="list-style-type: none">○ Theories pertaining to team work and strategies for collaborative communication.○ Soft skills: managing disputes, dealings, empathy, and other.○ Cross-cultural and cross-discipline communication.○ Professionalism in the digital world (including social media etiquette).○ AI Technology: Applying artificial intelligence in the LinkedIn and social media profile, as well as resume enhancements.	
Tutorial Components	Case-based discussions on team conflict and resolution Reviewing intercultural communication scenarios Crafting effective LinkedIn and other social media summaries using AI tools
Practical Components	Team simulation: solving a case collaboratively (online/offline) Peer review and refinement of LinkedIn other social media profiles and netiquette

	Role-play: handling team conflicts or multicultural client interactions	
Exemplars/Case Studies	Cross-cultural miscommunication examples Remote teamwork case: success & failure scenarios LinkedIn profile critiques: real and AI-generated comparisons	
Reference Books	<ol style="list-style-type: none"> 1. <i>Business Communication – Meenakshi Raman & Prakash Singh (OUP)</i> 2. <i>Soft Skills: Know Yourself & Know the World – K. Alex (S. Chand)</i> 3. <i>Effective Technical Communication – M. Ashraf Rizvi (McGraw Hill)</i> 	
Bloom's Taxonomy Level	Team Communication & Collaboration Conflict Resolution & Empathy Digital etiquette & professional conduct Cross-Cultural adaptation	Apply, Evaluate Understand, Apply Apply, Evaluate Understand, Apply

PROPOSED TUTORIAL SESSIONS – 10 sessions (1 hr/week)

Sr. No.	Tutorial Title	Content Covered	Mapped Unit
1	Understanding the Communication Process	Elements of communication, types, channels, and the communication cycle	Unit I
2	SWOC Analysis & SMART Goal Setting	Personal reflection, strength mapping, and drafting actionable goals	Unit I
3	7 Cs of Effective Communication & Barriers	Clarity, conciseness, correctness, barriers to communication, and remedies	Unit I
4	Analyzing Business Emails & Report Formats	Email structure, tone, subject line relevance, formal vs informal communication styles	Unit II
5	Prompt Design for AI-Assisted Business Writing	Framing professional prompts for AI tools like ChatGPT and Copilot for business communication	Unit II
6	Reading Comprehension & Inference Activities	Skimming, scanning, understanding implied meaning, and drawing conclusions from texts	Unit III
7	Using AI Tools for Grammar, Vocabulary & Summarization	Grammarly, Reverso, ChatGPT use for rephrasing, paraphrasing, and vocabulary suggestions	Unit III
8	Structuring Presentations & Visual Logic	Organizing flow, designing slides, storytelling, and visual hierarchy	Unit IV
9	Interview Strategy & STAR Technique	Behavioural interview frameworks, question prep, self-assessment rubrics	Unit IV
10	Case-Based Reflection on Team Conflict & Cross-Cultural Communication	Scenarios on miscommunication in multicultural or virtual teams and collaborative solutions	Unit V

Proposed Practical Sessions – 10 Sessions (2 hours / week)			
S. No.	Practical Session	Mapping CO	Bloom's Level
1.	Self-Introduction, SWOC, SMART Goal Setting	CO1	Apply, Analyze, Create
2.	Verbal & Non-Verbal Communication Roleplay	CO2, CO4	Understand Apply, Evaluate
3.	Group Discussion on Professional / Abstract Topics	CO2, CO4, CO6	Apply, Analyze, Evaluate
4.	Drafting Business Emails and Reports using AI Tools	CO1, CO5	Apply, Evaluate, Create
5.	Drafting Minutes of Meeting and Professional Proposals	CO1, CO3, CO5	Apply, Analyze, Create
6.	Listening & Reading Comprehension with AI-Aided Summarization	CO3, CO5	Understand, Analyze, Create
7.	AI-Powered Business Vocabulary Builder	CO3, CO5	Apply, Analyze
8.	Team Activity, Conflict Resolution, and Collaborative Decision Making	CO4, CO6	Understand, Apply, Evaluate
9.	Team Presentation with Visual Support (using AI for visuals/scripts)	CO2, CO5, CO6	Apply, Create, Evaluate
10.	Mock Interview: Technical/HR with Peer & AI Feedback	CO2, CO5, CO6	Apply, Analyze, Evaluate

Learning Resources
Textbooks <ol style="list-style-type: none"> 1. Raman, Meenakshi & Singh, Prakash – Business Communication (Oxford University Press) - A comprehensive guide covering core concepts of business communication with case studies and real-world applications. 2. Rizvi, M. Ashraf – Effective Technical Communication (McGraw Hill) - Focuses on technical and business writing, presentations, and formal communication techniques used in engineering contexts.
Reference Books <ol style="list-style-type: none"> 1. K. Alex – Soft Skills: Know Yourself & Know the World (S. Chand) - Ideal for self-awareness, communication styles, and interpersonal skill development. 2. Barun K. Mitra – Personality Development and Soft Skills (Oxford University Press) Covers aspects of body language, interviews, emotional intelligence, and self-presentation. 3. Garner, Bryan A. – HBR Guide to Better Business Writing (Harvard Business Review Press) Practical advice on improving clarity, tone, and structure in business documents. 4. Carnegie, Dale – The Quick and Easy Way to Effective Speaking - Timeless techniques on public speaking and persuasive communication.
e-Books <ol style="list-style-type: none"> 1. Business Communication: Process and Product – Mary Ellen Guffey (Cengage Learning) [Available on: Cengage Learning eLibrary or EBSCOhost for institutional access] 2. AI for Communicators – Free eBook from Grammarly or OpenAI blog archives Focus on responsible AI use in communication (PDF format downloadable)

<p>3. LinkedIn Learning – Business Writing Fundamentals integrated workbook for learners (requires institutional LinkedIn access)</p>	<p>eCourse with</p>
<p>Links to online SWAYAM/NPTEL Courses</p>	
<p>1. NPTEL – Soft Skills Development Prof. T. Ravichandran (IIT Kanpur) https://nptel.ac.in/courses/109104115</p>	
<p>2. SWAYAM – Business Communication Prof. M. S. Nagi Reddy (IIT Kharagpur) https://onlinecourses.swayam2.ac.in/imb22_mg21/preview</p>	
<p>3. NPTEL – Developing Soft Skills and Personality Prof. T. Ravichandran (IIT Kanpur) https://nptel.ac.in/courses/109104107</p>	
<p>4. SWAYAM – Enhancing Soft Skills and Personality University of Hyderabad https://onlinecourses.swayam2.ac.in/cec20_ge17/preview</p>	

Savitribai Phule Pune University		
Second Year of Information Technology (2024 Course)		
Course Code: EEM-241-ITT		
Course Name: E-Commerce		
Teaching Scheme	Credits	Examination Scheme
Tutorial : 1	1	TW – 25 Marks
Practical : 2	1	
Tutorial :		
Prerequisite Courses, if any: Basic Knowledge of Computer Systems, Web Technologies, Internet, Networking Fundamentals		
Companion Course, if any: Web Technologies, Digital Marketing, Entrepreneurship Development		
Course Objectives:		
<div>1. Understand the fundamental concepts of E-Commerce, including its definition, scope, features, business models, and comparison with traditional commerce.</div> <div>2. Understand the components of E-Commerce infrastructure, including hardware, software, payment technologies, cloud services, and security tools.</div> <div>3. Analyse various E-Commerce payment systems, highlighting their types, technologies, gateways, and associated legal and security frameworks.</div> <div>4. Apply digital marketing and sales strategies to online platforms, focusing on branding, pricing, communication, and current trends.</div> <div>5. Evaluate different E-Business models and construct suitable internet-based solutions based on structure, evolution, and business needs.</div> <div>6. Identify potential E-Commerce security threats and recommend appropriate tools and practices for secure transactions and data protection.</div>		
Course Outcomes (COs)		
By the end of this course, students will be able to:		
CO1: Understand core concepts, scope, features, types, and models of E-Commerce, and compare them with traditional commerce.		
CO2: Understand the technological infrastructure required for E-Commerce, including hardware, software, payment systems, cloud services, and monitoring tools.		
CO3: Analyze the structure and functionality of various E-Commerce payment systems, and evaluate security protocols and legal aspects involved in online transactions.		
CO4: Apply digital marketing techniques, web selling models, and pricing strategies to create an effective online presence and customer engagement.		
CO5: Develop E-Business models by understanding their elements, evolution, and the implementation of internet-based solutions.		
CO6: Identify key security threats in E-Commerce and recommend appropriate cryptographic, authentication, and data protection mechanisms.		
Recommended Deliverables during Tutorial Sessions		
Introduction to E-Commerce - 02 Hrs		
<div><div></div><div><ul style="list-style-type: none">○ Definition and Scope of E-Commerce○ Features and Benefits of E-Commerce○ Types of E-Commerce○ E-Commerce Business Models and Examples○ Digital Markets and Digital Goods○ Traditional Commerce vs. E-Commerce○ E-Commerce Trade Cycle</div></div>		

○ Advantages and Disadvantages of E-Commerce	
Exemplars/Case Studies	<ol style="list-style-type: none"> 1) E-Commerce Models in India (Amazon India, Flipkart, IndiaMART, OLX, Freelancer.com) 2) Online Marketplaces & M-Commerce (Amazon Marketplace, Paytm, BigBasket, Google Play Store) 3) Subscription & Digital Content Platforms (Netflix, Coursera/Udemy, Google Play Store) 4) Online Service Platforms (IRCTC, Zomato) 5) Hybrid and Specialized Models (Freelancer.com, BigBasket, Zomato – revisited for their multi-model strategies)
Reference Books	<ol style="list-style-type: none"> 1. E-Commerce 2023: Business, Technology, Society <ul style="list-style-type: none"> • Author: Kenneth C. Laudon, Carol Guercio Traver • Publisher: Pearson 2. Introduction to E-Commerce <ul style="list-style-type: none"> • Author: Jeffrey F. Rayport, Bernard J. Jaworski • Publisher: McGraw-Hill

Technology Backbone of E-Commerce - 03 Hrs

<ul style="list-style-type: none"> ○ Introduction to E-Commerce Infrastructure ○ Hardware Technologies for E-Commerce ○ Software Technologies for E-Commerce ○ Payment and Transaction Technologies ○ Cloud Services and DevOps for E-Commerce ○ Security and Monitoring Tool 	
Exemplars/Case Studies	<ol style="list-style-type: none"> 1) Scalable Cloud Infrastructure in E-Commerce (AWS, Alibaba Cloud, Netflix on AWS, Amazon using AWS) 2) Enterprise Hardware & Hosting Solutions (Dell EMC for eBay, Flipkart infrastructure, Magento, Shopify) 3) Backend Development & DevOps Practices (Java & Spring – Amazon, Jenkins & Kubernetes – Flipkart, Netflix DevOps) 4) Security Infrastructure in E-Commerce (SSL Certificates, Firewalls – Myntra/Amazon, Cloudflare) 5) Monitoring & Analytics Systems (Splunk, Cloudflare – Analytics & CDN)
Reference Books	<ol style="list-style-type: none"> 1. E-Commerce Basics: Technology Foundations and E-Business Applications <ul style="list-style-type: none"> • Author: Gary P. Schneider • Publisher: Pearson 2. E-Business Fundamentals <ul style="list-style-type: none"> • Author: Peter Eckersley, Paul Jackson, Lisa Harris • Publisher: Routledge

E-Commerce Payment Solutions: An Overview - 03 Hours

<ul style="list-style-type: none"> ○ Introduction to Payment Systems ○ Traditional Payment Model ○ Characteristics of Payment Systems ○ Online Payment Basics ○ Types of E-Commerce Payment Systems ○ Payment Instruments and Technologies ○ SET Protocol for Credit Card Payment ○ Payment Gateways and Service Providers ○ Security in Online Payments ○ Internet Technologies and the Banking Industry ○ Regulatory and Legal Framework ○ Trends and Innovations in Payment Systems 	
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Exemplars/Case Studies	<ol style="list-style-type: none"> 1) Foundation and Evolution of Electronic Payments: Visa, MasterCard, RBI, Government Payments, NEFT, GDPR 2) Digital Wallets, Postpaid Models & Contactless Payments: Paytm Wallet, Amazon Pay Later, ZestMoney, Smart Cards, PhonePe, Google Pay 3) Real-Time Payment Systems & Mobile Apps: Google Pay, BHIM App, UPI 123PAY, SBI YONO, HDFC NetBanking 4) Payment Gateways and Integration Platforms: Razorpay, BillDesk, PayU, Stripe, IRCTC, PayPal 5) Security & Authentication in Digital Payments: Two-Factor Authentication, PCI DSS Compliance, RBI Security Guidelines, GDPR
Reference Books	<ol style="list-style-type: none"> 1. Electronic Payment Systems for E-Commerce <ul style="list-style-type: none"> • Author: Donal O'Mahony, Michael A. Hines • Publisher: Springer 2. Payment Technologies for E-Commerce <ul style="list-style-type: none"> • Author: Stefan Schmid, Dieter Uckelmann • Publisher: Springer

E-Commerce Marketing & Sales Revolution - 02 Hours

	<ul style="list-style-type: none"> ○ Introduction to Online Selling and Marketing ○ Selling on the Web: Revenue Models and Building a Web Presence ○ Online Marketplaces and Platforms ○ Website as a Selling Platform ○ Marketing on the Web: Strategies and Communication ○ Creating and Maintaining Brands on the Web ○ Emerging Web Selling and Marketing Models ○ Digital Marketing Fundamentals ○ Paid Advertising and Campaigns ○ Pricing Strategies and Discounts ○ Customer Support and Service ○ Legal and Ethical Considerations in Online Marketing ○ Emerging Trends in Web Selling and Marketing
Exemplars/Case Studies	<ol style="list-style-type: none"> 1) Online Seller Empowerment & Direct Sales: Meesho, Nykaa, Lenskart 2) Multi-Seller Marketplaces & Seller Tools: Amazon, Flipkart, Snapdeal 3) Social & Influencer Marketing Strategies: Zomato, boAt Lifestyle, CRED, Trell, Moj 4) Digital Marketing Platforms & Paid Advertising: HubSpot, Google Digital Garage, Facebook Ads (Mamaearth), Google Ads (Cleartrip) 5) Customer Engagement & Compliance: Flipkart Big Billion Days, Amazon Chatbot Support, ASCI Guidelines, EU Cookie Consent Law, Live Commerce (Myntra, Flipkart), WhatsApp Business
Reference Books	<ol style="list-style-type: none"> 1. E-Commerce Marketing: Strategies for Engaging in E-Business <ul style="list-style-type: none"> • Author: Henry Chan, Raymond Lee • Publisher: Wiley 2. Sizzle: Advanced E-Commerce SEO <ul style="list-style-type: none"> • Author: Lou Storiato • Publisher: Self-published / Online

E-Business Fundamentals and Model Development -03 Hrs

	<ul style="list-style-type: none"> ○ Definition and Characteristics of E-Business ○ Elements and Structure of E-Business ○ Evolution and Stages of E-Business ○ E-Business Models ○ Impact of E-Business ○ Challenges in E-Business ○ Characteristics of Internet-Based Software and E-Business Solutions ○ Developing an E-Business Model
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Exemplars/Case Studies	<ol style="list-style-type: none"> 1) Early E-Business and Direct Models: IBM, Dell, Walmart 2) Platform and Marketplace Models: Amazon, Zomato, Etsy, Snapdeal 3) Subscription and Disruptive Models: Netflix, Uber 4) Cloud Solutions and SaaS Platforms: Salesforce CRM, Shopify 5) Security, Privacy, and Financial Ecosystems: Yahoo Data Breaches, Paytm Expansion
Reference Books	<ol style="list-style-type: none"> 1. e-Business Fundamentals <ul style="list-style-type: none"> • Author: Peter Eckersley, Paul Jackson, Lisa Harris • Publisher: Routledge 2. E-Business Essentials <ul style="list-style-type: none"> • Author: Efraim Turban, Jae Kyu Lee, David King • Publisher: Springer

E-Commerce Security: Tools and Best Practices		02 Hours
	<ul style="list-style-type: none"> • Introduction to E-Commerce Security • Security Threats and Vulnerabilities in E-Commerce • Cryptographic Tools for E-Commerce Security • Authentication and Authorization Mechanisms • Secure Payment Systems • Network and Application Security Tools • Data Privacy and Protection • Integration of E-Commerce Security with Business Systems • Emerging Trends in E-Commerce Security 	
Exemplars/Case Studies	<ol style="list-style-type: none"> 1) Transaction Security & Authentication: PayPal Security Measures, Two-Factor Authentication (Google), OAuth (Facebook Login), PCI DSS (Stripe), UPI Security (NPCI) 2) Data Breaches & Privacy Regulations: Equifax Data Breach, GDPR Compliance (EU), Apple App Tracking Transparency (ATT) 3) Encryption & Secure Communication: SSL/TLS Certificates (Amazon), PGP Encryption (ProtonMail) 4) Firewall & DDoS Protection: Cloudflare Firewall (Shopify), Web Application Firewall (Netflix), Salesforce Security Integration, ERP Security (Walmart) 5) Advanced Security Technologies: AI-Based Fraud Detection (PayPal), Blockchain for Secure Transactions (IBM Food Trust) 	
Reference Books	<ol style="list-style-type: none"> 1. E-Commerce Security: A Global Status Report <ul style="list-style-type: none"> • Author: ISACA (Institute of Information Systems Audit and Control Association) • Publisher: ISACA 2. E-commerce Security Methods, Protocols & Solutions <ul style="list-style-type: none"> • Author: Prashant Pittalia • Publisher: LAP Lambert Academic Publishing 	

Learning Resources

Unit 1: Introduction to E-Commerce

- 1) E-Commerce Foundations - LinkedIn Learning
<https://www.linkedin.com/learning/ecommerce-foundations>
- 2) Introduction to E-Commerce - Coursera (University of Illinois)
<https://www.coursera.org/learn/ecommerce>
- 3) What is E-Commerce? - Investopedia
<https://www.investopedia.com/terms/e/ecommerce.asp>

Unit 2: Technology Backbone of E-Commerce

- 4) E-Commerce Infrastructure - Tutorialspoint
<https://www.tutorialspoint.com/e-commerce/e-commerce-infrastructure.htm>
- 5) Cloud Computing for E-Commerce - edX
<https://www.edx.org/learn/cloud-computing>

Unit 3: E-Commerce Payment Solutions: An Overview

- 6) Introduction to Payment Systems - Coursera

<p>https://www.coursera.org/learn/payment-systems</p> <p>7) Payment Gateway Explained - PayPal https://www.paypal.com/uk/webapps/mpp/payment-gateway</p> <p>8) Payment Security Basics - PCI Security Standards Council https://www.pcisecuritystandards.org/</p> <p>Unit 4: E-Commerce Marketing & Sales Revolution</p> <p>9) Digital Marketing Specialization - Coursera (University of Illinois) https://www.coursera.org/specializations/digital-marketing</p> <p>10) Inbound Marketing Course - HubSpot Academy https://academy.hubspot.com/courses/inbound-marketing</p> <p>Unit 5: E-Business Fundamentals and Model Development</p> <p>11) E-Business Concepts - OpenLearn https://www.open.edu/openlearn/money-business/leadership-management/e-business/content-section-0</p> <p>12) Business Model Generation - Coursera https://www.coursera.org/learn/business-model-generation</p> <p>Unit 6: E-Commerce Security: Tools and Best Practices</p> <p>13) E-Commerce Security Fundamentals - Pluralsight https://www.pluralsight.com/courses/ecommerce-security-fundamentals</p> <p>14) Cybersecurity for E-Commerce - Coursera https://www.coursera.org/learn/cyber-security</p> <p>15) OWASP Top Ten Security Risks https://owasp.org/www-project-top-ten/</p>	
<p>Text Books</p> <ol style="list-style-type: none"> 1. E-Commerce 2023: Business, Technology, Society by Kenneth C. Laudon, Carol Guercio Traver, Pearson 2. E-Commerce Basics: Technology Foundations and E-Business Applications by Gary P. Schneider, Pearson 3. Electronic Payment Systems for E-Commerce by Donal O'Mahony, Michael A. Hines, Springer 4. e-Business Fundamentals by Peter Eckersley, Paul Jackson, Lisa Harris, Routledge 5. E-Commerce Security Methods, Protocols & Solutions by Prashant Pittalia, LAP Lambert Academic Publishing 	
<p>Reference Books :-</p> <ol style="list-style-type: none"> 1. E-Commerce Basics: Technology Foundations and E-Business Applications by Gary P. Schneider, Pearson 2. E-Commerce Marketing: Strategies for Engaging in E-Business by Henry Chan, Raymond Lee, Wiley 3. Fundamentals of E-Commerce by Ravi Kalakota, Andrew B. Whinston, Pearson Education India 4. E-Commerce Security: Risk Management and Control by Russell S. Dunkle, Wiley 	
<p>e-Books</p> <ol style="list-style-type: none"> 1. Electronic Commerce (12th Edition) by Gary P. Schneider, Cengage Learning 2. E-Commerce: Fundamentals and Applications by Henry Chan, Raymond Lee, Tharam Dillon, Elizabeth Chang, Wiley 3. e-Business Fundamentals by Peter Eckersley, Lisa Harris, Paul Jackson, Routledge 4. Frontiers of Electronic Commerce by Ravi Kalakota, Andrew B. Whinston, Addison-Wesley 5. Advances in Security and Payment Methods for Mobile Commerce by Donal O'Mahony, Michael A. Peirce, Hitesh Tewari, Springer 	
<p>Links to online SWAYAM/NPTEL Courses</p> <ol style="list-style-type: none"> 1. E-Business https://onlinecourses.nptel.ac.in/noc19_mg54/preview 2. E-commerce Technologies https://swayam.gov.in/nd2_cec19_cm01/preview 3. Digital Marketing https://swayam.gov.in/nd2_ugc19_hs26/preview 4. Basics of Digital Marketing https://swayam.gov.in/nd2_cec19_mg23/preview 5. BCOS-184 E-Commerce https://swayam.gov.in/nd2_nou22_cm07/preview 	

Guidelines for Student's Lab Journal	
<ul style="list-style-type: none"> The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, Date of Completion, Objectives, Problem Statement, Software and Hardware requirements, Assessment grade/marks and assessor's sign, Theory- Concept in brief, algorithm, flowchart, test cases, Test Data Set (if applicable), mathematical model (if applicable), conclusion/analysis. Program codes with sample output of all performed assignments are to be submitted as softcopy. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Use of DVD containing students' programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory. 	
Guidelines for Laboratory /Term Work Assessment	
<ul style="list-style-type: none"> Continuous assessment of laboratory work should be based on overall performance of Laboratory assignments by a student. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness. 	
Guidelines for Laboratory Conduction	
<p>The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. The instructor may set multiple sets of assignments without changing its complexity level and distribute among batches of students. Use of open-source software is encouraged. Set of suggested assignment list is provided, instructors may take different case studies with similar complexity level.</p> <p>Operating System Recommended: Linux (Ubuntu, Fedora, Debian, etc.) – 64-bit open-source Linux or its derivative recommended.</p>	
List of Assignments [Any 6 Assignments] Tools are recommended , however staff members may take liberty to make use of suitable /available tools [proprietary/open source]	
<p>Lab Assignment 1: Creating a Simple Static E-Commerce Website Topic: Introduction to E-Commerce Objective: Design a basic online store homepage with HTML/CSS showcasing categories, products, and navigation. Tools: HTML5, CSS3 Reference: Laudon & Traver – Chapter 1</p>	
<p>Lab Assignment 2: Implementing Product Listing and Search Functionality Topic: Technology Backbone of E-Commerce Objective: Develop a dynamic product catalog with search/filter features using JavaScript or PHP. Tools: JavaScript/PHP, MySQL Reference: Schneider – Chapter 4</p>	
<p>Lab Assignment 3: Simulating a Payment Workflow Using Sandbox APIs Topic: E-Commerce Payment Solutions Objective: Integrate PayPal/Stripe Sandbox API to simulate checkout and payment confirmation. Tools: PayPal Sandbox / Stripe Test API Reference: O'Mahony – Chapters 2 & 3</p>	

Lab Assignment 4: Creating a Digital Marketing Campaign (SEO + Email) Topic: Marketing & Sales Objective: Create an SEO-optimized product page and set up a basic email marketing workflow using Mailchimp or Sendinblue. Tools: Google SEO tools, Mailchimp Reference: Laudon & Traver – Chapter 6
Lab Assignment 5: Implementing a Simple Shopping Cart with Session Handling Topic: Tech Backbone of E-Commerce Objective: Create an add-to-cart functionality with session-based quantity tracking and checkout. Tools: PHP/JavaScript, Sessions Reference: Schneider – Chapter 5
Lab Assignment 6: Designing a Business Model Canvas for an E-Commerce Idea Topic: E-Business Model Development Objective: Use the Business Model Canvas (BMC) to outline a business model for a hypothetical E-Commerce startup. Tools: Canva, BMC Templates Reference: Eckersley – Chapter 3
Lab Assignment 7: Implementing Basic Security Features for Login Page Topic: E-Commerce Security Objective: Secure a login system using hashing (bcrypt/MD5), CAPTCHA, and validation. Tools: PHP, bcrypt, reCAPTCHA Reference: Pittalia – Chapter 4
Lab Assignment 8: Log Analysis & Threat Detection Simulation Topic: E-Commerce Security – Best Practices Objective: Parse and analyze sample server logs to identify suspicious activity like repeated failed logins or SQLi attempts. Tools: Python, ELK Stack (optional), Regex Reference: Pittalia – Chapter 6
Mini Project
<p>These are suitable for group mini-projects (3–4 students) and incorporate real-world applications across the course topics. Suggested Statements for reference –</p>
<p>Mini Project 1: End-to-End E-Commerce Web App with Payment Gateway Problem Statement: Develop a fully functional online store (e.g., bookstore or electronics) that allows product browsing, cart management, secure checkout, and dummy payment integration. Topics Covered: Tech Backbone, Payment Solutions, Security Tools: HTML/CSS, PHP/Node.js, MySQL, PayPal Sandbox</p> <p>Mini Project 2: AI-Powered Product Recommendation Engine Problem Statement: Build a recommendation engine that uses customer browsing and purchase data to suggest relevant products. Topics Covered: Marketing & Sales Revolution Tech Used: Python, Flask, Pandas, Scikit-learn (Basic ML)</p> <p>Mini Project 3: E-Commerce Risk & Threat Monitoring Dashboard Problem Statement: Create a dashboard that visually tracks failed login attempts, suspicious requests, and bot detection across an E-Commerce platform.</p>

Topics Covered: Security Best Practices

Tech Used: Python, Log Parser, JavaScript Charts (Chart.js, D3.js)

Mini Project 4: Comparison Tool for E-Payment Options

Problem Statement: Build a web tool that allows comparison between payment modes like UPI, Net Banking, Credit Cards, in terms of fees, transaction speed, and availability.

Topics Covered: Payment Solutions

Tools: PHP/Node.js, APIs (if applicable), Charts

Mini Project 5: Startup Model Planner for E-Commerce Businesses

Problem Statement: Design a web-based platform that helps new startups choose the right E-Commerce business model (e.g., subscription vs. affiliate) based on their goals.

Topics Covered: E-Business Fundamentals

Tools: Web development stack + logic-based recommendation engine

Savitribai Phule Pune University Second Year of Information Technology (2024 Course) Course Code: VEC-251-ITT Course Name: Environmental Studies		
Teaching Scheme	Credits	Examination Scheme
Theory : 2 H/W	2	CCE : 15 ESE : 35
Prerequisite Courses, if any: Biology, Geography, Environmental science		
Companion Course, if any: Basic Science, Indian Knowledge System		
Course Objectives: <ol style="list-style-type: none"> 1. To introduce students with environmental studies, including its elements, sustainability, and interdisciplinary applicability. 2. To examine biotic and abiotic factors within an ecosystem, to identify food chains, webs, as well as energy flow and relationships. 3. To identify and analyze various conservation methods and their effectiveness in relation to renewable and nonrenewable natural resources. 4. To introduce students to biodiversity, its threats, and conservation, with a focus on India's heritage. 5. To be able to assess how humans affect the environment in terms of population, carbon footprint, and ethics. 6. To examine a range of environmental issues in the field, and relate these to scientific theory. 		
Course Outcomes: On completion of the course, learner will be able to– CO1: Demonstrate an integrative approach to environmental issues with a focus on sustainability. CO2: Explain and identify the role of the organism in energy transfers in different ecosystems. CO3: Distinguish between and provide examples of renewable and nonrenewable resources & analyze personal consumption of resources CO4: Identify key threats to biodiversity and develop appropriate policy options for conserving biodiversity in different settings. CO5: Understand environmental pollution and related laws, assess human population impacts on natural resources, and develop scientific skills to analyze and address environmental issues effectively. CO6: Learn skills required to research and analyze environmental issues scientifically and learn how to use those skills in applied situations such as careers that may involve environmental problems and/or issues.		
Course Contents		
Unit No: I	Introduction to Environmental Studies & it's Ecosystems	07 Hours
Definition of environment and components (biotic & abiotic), importance and scope of environmental studies, concept of sustainability and sustainable development, multidisciplinary nature of environmental studies. Definition, structure and function of ecosystems, food chains, food webs, and ecological pyramids, energy flow and ecological succession Case studies: Forest, grassland, desert, and aquatic ecosystems		
Exemplars/Case Studies	-Plastic waste crisis in India, Use of solar rooftops in Gujarat - Sundarbans Mangrove Forests, Water pollution impact on river Yamuna ecosystem	

Unit No: II	Natural Resources: Renewable and Non-renewable Resources	06 Hours
Land Resources: Land use change, soil erosion, land degradation. Deforestation: Impacts of mining and dam projects on forests and biodiversity. Water Resources: Overuse of surface and groundwater; water conflicts. Atmosphere: Air circulation and precipitation basics. Energy Resources: Renewable and non-renewable energy; alternative sources.		
Exemplars/Case Studies	Rainwater Harvesting in Tamil Nadu, Narmada Bachao Andolan – Dam building and displacement	

Unit No: III	Biodiversity and Conservation	06 Hours
Definition of Biodiversity: Levels of biodiversity: genetic, species, ecosystem, India's biogeographic zones and hotspots Value of biodiversity: Ecological, economic, social, ethical, aesthetic, and informational values of biodiversity with examples. Threats to biodiversity: Habitat loss, poaching, invasions. Conservation methods: In-situ and Ex-situ		
Exemplars/Case Studies	Project Tiger – Conservation success, man-animal conflict in Sundarbans	

Unit No: IV	Environmental Pollution and Human Role	05 Hours
Types of pollution & their causes, effects and controls : Air, water, soil, noise, nuclear, Control measures and pollution case studies Global concerns: Climate change, ozone depletion, acid rain. Environmental laws: EPA, Forest Act, Water and Air Act Human impact: Population, carbon footprint, ethics. Environmental movements- Chipko, Silent valley, Bishnios of Rajasthan and public awareness Environmental ethics: Role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).		
Exemplars/Case Studies	Solid Waste Management by Indore Municipal Corporation, Air Pollution in Delhi NCR – Health and Policy Implications	

Learning Resources
Reference Books: <ol style="list-style-type: none"> 1. Carson, R. (2002). <i>Silent Spring</i>. Houghton Mifflin Harcourt. 2. Gadgil, M., & Guha, R. (1993). <i>This Fissured Land: An Ecological History of India</i>. University of California Press. 3. Gleeson, B., & Low, N. (Eds.) (1999). <i>Global Ethics and Environment</i>. Routledge. 4. Gleick, P.H. (1993). <i>Water in Crisis</i>. Oxford University Press. 5. Groom, M.J., Meffe, G.K., & Carroll, C.R. (2006). <i>Principles of Conservation Biology</i>. Sinauer Associates. 6. Grumbine, R.E., & Pandit, M.K. (2013). <i>Threats from India's Himalaya Dams</i>. <i>Science</i>, 339:36-37. 7. McCully, P. (1996). <i>Rivers No More: The Environmental Effects of Dams</i>. Zed Books. 8. McNeil, J.R. (2000). <i>Something New Under the Sun: An Environmental History of the Twentieth Century</i>. Norton.

e-Books:

1. Arunima Sarma , Krishna Gopal Bhattacharya;Comprehensive Environmental Studies
2. Renuka Gupta;Ecosystem structures & functions
3. Dr Sunil Mittal;Biodiversity and conservation

Links to online SWAYAM/NPTEL Courses:

1. https://onlinecourses.swayam2.ac.in/cec25_es01
2. https://onlinecourses.swayam2.ac.in/ugc25_ge17
3. https://onlinecourses.nptel.ac.in/noc25_ge76
4. <https://archive.nptel.ac.in/courses/105/102/105102089>

**SE – Information Technology 2024 Pattern
National Education Policy (NEP)-2020 Compliant Syllabus**

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Chairman

Dr. Sudeep D. Thepade

Chairman– Board of Studies
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