



'येथे बहुतांचे हित'

Marathwada Mitra Mandal's **COLLEGE OF ENGINEERING**

Karvenagar, Pune - 52.

An Autonomous Institute affiliated to SPPU

Accredited with A++ Grade by NAAC
Recipient of Best College award by SPPU | Accredited by NBA
Recognized under 2(f) and 12(B) of UGC Act 1956

www.mmcoe.edu.in

Curriculum Structure and Syllabus Second Year B.Tech. Information Technology



Academic Year 2025-26

**Marathwada Mitra Mandal's College of Engineering
Karvenagar, Pune- 52**

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Department of Information Technology**

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Institute Vision

To be a globally renowned institution through excellence in engineering education for sustainable and holistic development.

Institute Mission

M1: Empower students with cutting-edge technologies and global competencies.

M2: Foster culture of research and entrepreneurial mindset.

M3: Imbibe social and professional values.

M4: Provide an inclusive environment for lifelong learning.

Department Vision

To emerge as a globally competent center in education, research and innovation in Information Technology, fostering sustainable development with a holistic vision.

Department Mission

M1 : To impart IT education that develops globally competent professionals.

M2 : To promote innovation through research and entrepreneurship.

M3 : To encourage lifelong learning and a holistic commitment towards societal development.

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Knowledge and Attitude Profile (WK)

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

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Program Outcomes (PO)

- **P01: Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop the solution of complex engineering problems.
- **P02: Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
- **P03: Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
- **P04: Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
- **P05: Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
- **P06: The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
- **P07: Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
- **P08: Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
- **P09: Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
- **P010: Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
- **P011: Life-Long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Program Educational Objectives (PEO)

The students of Information Technology Department after passing out will :

- Exhibit the capabilities to excel as IT professionals with strong knowledge and innovative thinking.
- Demonstrate leadership in the IT Industry, pursue lifelong learning and contribute through research & collaboration.
- Apply innovations and ethical practices for sustainable technological advancement and societal enrichment.

Program Specific Outcomes (PSOs)

Information Technology graduates will be able to :

- Design and develop information systems using principles of computing to solve real-world problems.
- Integrate emerging IT technologies to innovate and improve technological ecosystems.



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Abbreviations

BSC:	Basic Science Course
UG:	Undergraduate Programme
ESC:	Engineering Science Course
PCC:	Program Core Courses
PEC:	Program Elective Courses
MDM:	Multidisciplinary Minor Courses
OEL:	Open Elective
VSE:	Vocational & Skill Enhancement Course
AEC:	Ability Enhancement Course
EEM:	Entrepreneurship/Economics/Management
IKS:	Indian Knowledge System
VEC:	Value Education Course
RMD:	Research Methodology
CEP/FPR:	Community Engagement Project (CEP)/Field Project (FP)
PRJ:	Project
INT/OJT:	Internship/On-Job Training
CCC:	Co-Curricular Courses
IT:	Internal Tool
ET:	External Tool
ETE:	End -Term Examination
CIE:	Continuous Internal Evaluation
TW:	Term work
OR:	Oral Examination
PR:	Practical Examination
L:	Lecture
P:	Practical
T:	Tutorial
OL:	Online Teaching
ODL:	Open Distance Learning

Assessment Tool Guidelines for Continuous Internal Evaluation (CIE)

AY: 2025-26

Distribution of CIE 40 marks for each subject is as below:

Sr. No.	Unit No.	Weightage	Assessment Tools
1	Unit 1	8 Marks	Class Test
2	Unit 2	8 Marks	
3	Unit 3	8 Marks	Quiz
4	Unit 4	8 Marks	1. Home Assignments 2. Case Study 3. Field work 4. Report writing 5. Presentations/Seminar Topics 6. Mini projects/Course Projects 7. Mind map 8. Poster Presentation 9. Problem Solving and Coding 10. Parametric Study 11. Any other assessment tool with permission of BoS chairperson
5	Unit 5	8 Marks	

1. Above are the suggestive assessment tools for CIE.
2. The class test is a one-time assessment; no retests will be conducted
3. Module coordinators should review and verify the assessment tools implemented for each course.
4. Course coordinators are required to maintain softcopy records of the respective CIE assessment tools used for their classes.

Curriculum Structure Sem-III & IV

Second Year B.Tech Information Technology SEMESTER III															
Course Code	Course Name	Course Type	Teaching Scheme (Hrs/week)			Examination Scheme						Credits			
			L	P	T	CIE	ETE	TW	PR	OR	Total	L	P	T	Total
IT24PCC201	Data Structures and Algorithms	PCC	3	-	-	40	60	-	-	-	100	3	-	-	3
IT24PCC202	Object Oriented Programming	PCC	3	-	-	40	60	-	-	-	100	3	-	-	3
IT24PCC203	Software Engineering and Modelling	PCC	3	-	-	40	60	-	-	-	100	3	-	-	3
*	MDM TH	MDM	2	-	-	40	60	-	-	-	100	2	-	-	2
IT24PCC205	Data Structures and Algorithms Lab	PCC	-	2	-	-	-	-	50	-	50	-	1	-	1
IT24PCC206	Object Oriented Programming Lab	PCC	-	2	-	-	-	-	50	-	50	-	1	-	1
*	MDM Lab	MDM	-	2	-	-	-	25	-	-	25	-	1	-	1
IT24CEP208	Community Centered Project	CEP	-	4	-	-	-	50	-	-	50	-	2	-	2
IT24VEC209	Problem Solving and Analytical Skills	VEC	-	-	2	-	-	50	-	-	50	-	-	2	2
SH24AEC202	Professional Communication and Personality Development	AEC	-	-	2	-	-	50	-	-	50	-	-	2	2
Total			11	10	4	160	240	175	100	-	675	11	5	4	20

Second Year B.Tech Information Technology SEMESTER IV															
Course Code	Course Name	Course Type	Teaching Scheme(Hrs/week)			Examination Scheme						Credits			
			L	P	T	CIE	ETE	TW	PR	OR	Total	L	P	T	Total
IT24PCC251	Database Management Systems	PCC	3	-	-	40	60	-	-	-	100	3	-	-	3
IT24PCC252	Operating Systems	PCC	3	-	-	40	60	-	-	-	100	3	-	-	3
IT24PCC253	Computer Networks	PCC	3	-	-	40	60	-	-	-	100	3	-	-	3
*	Open Elective	OEL	3	-	-	40	60	-	-	-	100	3	-	-	3
IT24PCC255	Database Management Systems Lab	PCC	-	2	-	-	-	-	50	-	50	-	1	-	1
IT24PCC256	Operating Systems Lab	PCC	-	2	-	-	-	-	50	-	50	-	1	-	1
IT24VSE257	Web Development	VSE	-	4	-	-	-	50	-	-	50	-	2	-	2
IT24EEM258	Startup Fundamentals and Financing	EEM	-	-	2	-	-	50	-	-	50	-	-	2	2
SH24VEC201	Environment Sustainability	VEC	-	-	2	-	-	50	-	-	50	-	-	2	2
Total			12	8	4	160	240	150	100	-	650	12	4	4	20

* Refer separate MDM and OEL Booklet

Abbreviations:

L- lecture	P- Practical	T- Tutorial	CIE-Continuous Internal Evaluation
ETE- End Term Examination	TW- Term work	PR- Practical	OR- Oral
L : 1 Hr.= 1 credit	P: 2 Hr. = 1 Credit	T: 1 Hr. = 1 Credit	



Second Year B. Tech Information Technology														
Semester- III														
Course Code: IT24PCC201					Course Name: Data Structures and Algorithms									
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	PR	OR	TOTAL	L	P	T	TOTAL
3	-	-	-	-	40	60	-	-	-	100	3	-	-	3
Prerequisite: Fundamental knowledge of programming language and basics of algorithms														
Course Objectives:														
<ul style="list-style-type: none"> ● To study data structures and their implementations and applications. ● To learn different searching and sorting techniques. ● 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 modelled using tree & graph. ● To learn algorithm development and analysis of algorithms. 														
Course Outcomes:														
After completing the course, the students will be able to:														
CO1: Analyze algorithms with respect to time and space complexity.														
CO2: Select appropriate searching and/or sorting techniques in the application development.														
CO3: Apply the concept of Abstract Data Types to represent and manipulate data structures.														
CO4: Apply learned algorithms and data structures to solve the problems.														
CO5: Design and implement different hashing functions.														
Unit	Contents												Duration (Hrs.)	
1.	Introduction: Introduction to Data Structures: Concept of data, Data object, Data structure, Concept of Primitive and non-primitive, linear and nonlinear, static and dynamic, persistent and ephemeral data structures, Definition of ADT Analysis of algorithms : Frequency count and its importance in analysis of an algorithm, Time complexity and space complexity, Big 'O', 'Ω' and 'θ' Linked organization: Concept of linked organization, Singly Linked List, Doubly Linked List, Circular Linked List (Operations: Create, Display, Search, Insert, Delete)												8	
2.	Searching and Sorting : Searching and Sorting: Need of searching and sorting, Concept of internal and external sorting, sort stability, Searching methods: Linear and binary search algorithms, Sorting methods: Bubble, Insertion, Quick, Merge Hashing: Hash tables and scattered tables: Basic concepts, hash function, characteristics of good hash function, Different key-to-address transformations techniques, synonyms or collisions, collision resolution techniques- linear probing, quadratic probing, rehashing, chaining with and without replacement												8	

3.	<p>Stack and Queues: Stack: Concept of stack, Concept of implicit and explicit stack, stack as an ADT using sequential and linked organization, Applications of stack: recursion, converting expressions from infix to postfix or prefix form, evaluating postfix or prefix form, Queue: Concept of queues as ADT, Implementation of queue using array and linked organization, Concept of circular queue, double ended queue, Applications of queue: priority queue.</p>	8
4.	<p>Trees: Tree: Trees and binary trees-concept and terminology, Expression tree, Binary tree as an ADT, Binary search tree, Recursive and Non recursive algorithms for binary tree traversals ,Binary search tree as ADT(Insert Search Delete, level wise Display), Types of Trees: OBST, AVL Trees Threaded binary Tree: Concept of threaded binary tree (inorder, preorder and postorder). Preorder and In-order traversals of in-order threaded binary tree, Heap- Heap data structure , Min and Max Heap, Heap sort.</p>	8
5.	<p>Graph : Concept and terminologies, Graph as an ADT, Representation of graphs using adjacency matrix and adjacency list, Breadth First Search Traversal, Depth First Search Traversal, Prim's and Kruskal's algorithm for minimum spanning tree, Shortest path using Dijkstra's algorithm, topological sorting.</p>	8
Total Hours		40
Text Books		
<ol style="list-style-type: none"> 1. Reema Thareja, "Data Structures using C ", Second Edition, Oxford Higher Publication 2. Alfred Aho, John Hopcroft, Jeffrey Ullman, "Data Structures & Algorithms", Pearson Publication 3. Gilberg, B. Forouzan, "Data Structures: A pseudocode approach with C", Cengage Learning, 2nd edition. 		
Reference Book		
<ol style="list-style-type: none"> 1. Y. Kanetkar, "Data Structures through C," 5th edition BPB Publications, 2023. 2. E. Horowitz, S. Sahani, "Fundamentals of Data Structures in C", Universities press, 2nd edition. 3. Jean-Paul Tremblay & Paul G. Sorenson, "An Introduction to Data Structures with Applications" Publisher-Tata McGraw Hill, 2nd edition. 4. Data Structures using C & C++-By Tanenbaum Publisher-Prentice-Hall International. 5. Fundamentals of Computer Algorithms by Horowitz , Sahani, Galgotia Pub 2001 ed. 		
Online References		
<ol style="list-style-type: none"> 1. NPTEL Course: Prof. Shankar Balachandran, Prof. Hema A Murthy, "ARICENT: First Mile Foundation Program - Programming and Data Structure and Algorithm", (https://nptel.ac.in/courses/106106133) 2. NPTEL Course: Prof. Naveen Garg, Introduction to Data Structures and Algorithms, (https://nptel.ac.in/courses/106102064) 3. Coursera:Data Structures and Algorithms Specialization https://www.coursera.org/specializations/data-structures-algorithms 		

Second Year B. Tech Information Technology															
Semester-III															
Course Code: IT24PCC202								Course Name: Object Oriented Programming							
Teaching Scheme (Hours/Week)					Examination Scheme						Credits				
L	P	T	OL	ODL	CIE	ETE	TW	PR	OR	TOTAL	L	P	T	TOTAL	
3	-	-	-	-	40	60	-	-	-	100	3	-	-	3	
Prerequisite: C Programming															
Course Objectives:															
<ul style="list-style-type: none"> To Understand the principles of Object-Oriented Programming and the foundational features of C++ TO develop the ability to create and manage classes and objects To explain key concepts like inheritance, polymorphism, and operator overloading. To understand file handling techniques along with error and exception handling methods. To familiarize students with the use of templates and the Standard Template Library for efficient coding. 															
Course Outcomes:															
After completing the course, the students will be able to:															
CO1: Demonstrate the Object-Oriented Programming concept															
CO2: Design and develop programs using classes, constructors, and destructors to represent real-world entities.															
CO3: Apply inheritance to create derived classes from base classes for code reusability															
CO4: Implement file input and output (I/O) operations in C++															
CO5: Apply built-in algorithms from STL to efficiently solve common problems.															
Unit	Contents													Duration (Hrs.)	
1.	Basic of OOP: Principles of Object Oriented Programming (OOP), features of OOP. Basics of C++: Characteristics of C++, Structure of a C++ Program, Writing and Running C++ Programs. C++ Fundamentals: Variables, Data Types, Constants, Operators in C++, Expressions and Statements, Input/output in C++, Control Structures (if, for, while, etc.),function, string.													7	
2.	Class and Object: Creating class and Objects, Member function, array of object, Access Modifiers: public, private, and protected, static variable, inline function. Constructors and Destructors: Introduction to Constructors, Default Constructors and Parameterized Constructors, Destructor Functions, Dynamic Memory Allocation.													8	
3.	Inheritance and Polymorphism: Inheritance: Basic Concepts, types, Constructor and Destructor in Inheritance, Access Control in Inheritance. Ambiguity in Multiple Inheritance, Virtual Base Class, Abstract class.													8	

	<p>Polymorphism: Introduction of Polymorphism, Function Overloading, Function Overriding. Operator Overloading: Introduction, syntax, overloading unary and binary operators.</p> <p>Runtime Polymorphism: Pointers to Base class, virtual function and its significance in C++, pure virtual function and virtual table, virtual destructor, abstract base class.</p>	
4.	<p>Friend Functions: Friend Function Definition, Friend Classes.</p> <p>File Handling: File Input and Output (I/O), File Operations, Reading from and Writing to Files, File Handling Classes in C++: fstream, ifstream, and ofstream classes</p>	8
5.	<p>Exception Handling: Fundamentals, other error handling techniques, simple exception handling- Divide by Zero, Multiple catching, re-throwing an exception, exception specifications, user defined exceptions, processing unexpected exceptions</p> <p>Templates & STL: Function and Class templates and using STL like containers, algorithms</p>	8
Total Hours		39
Text Books		
<ol style="list-style-type: none"> 1. Robert Lafore; 'Object-Oriented Programming in C++', Fourth Edition, Sams Publishing, ISBN:0672323087, 2001. 2. E.Balagurusamy; 'Object-Oriented Programming with C++' 7th edition, Graw-Hill Publication, ISBN 10: 9352607996 ISBN 13: 9789352607990, 2017. 3. Deitel, 'C++ How to Program', 4th Edition, Pearson Education, ISBN:81-297-0276-2, 2002. 		
Reference Book		
<ol style="list-style-type: none"> 1. Bjarne Stroustrup ; 'The C++ Programming Language', Fourth Edition, Addison-Wesley, 2013. 2. Bjarne Stroustrup ; 'A Tour of C++', Second Edition, Addison-Wesley, 2018. 3. Herbert Schildt, 'C++-The complete reference', Eighth Edition, McGraw Hill Professional, 2011, ISBN:978-00-72226805. 4. Matt Weisfeld, 'The Object-Oriented Thought Process', Third Edition, Pearson, 2008, ISBN-13:075-2063330166. 5. Cox Brad, Andrew J. Novobilski, 'Object -Oriented Programming: An Evolutionary Approach, Second Edition, Addison-Wesley, 1991, ISBN:13:978-020-1548341. 		
Online References		
<ol style="list-style-type: none"> 1. NPTEL Course: Prof. Partha Pratim Das, IIT Kharagpur, Programming in C++, (https://onlinecourses.nptel.ac.in/noc21_cs02/preview) 2. NPTEL Course: Prof. Partha Pratim Das, IIT Kharagpur "Programming in Modern C++", (https://onlinecourses.nptel.ac.in/noc22_cs43/preview) 3. LinkedIn: "Complete Guide to C++ Programming Foundations", https://www.linkedin.com/learning/c-plus-plus-standard-template-library 4. LinkedIn: "C++ Essential Training", https://www.linkedin.com/learning/c-plus-plus-essential-training-15106801/ 		

Second Year B. Tech Information Technology														
Semester - III														
Course Code : IT24PCC203					Course Name: Software Engineering and Modeling									
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	PR	OR	TOTAL	L	P	T	TOTAL
3	-	-	-	-	40	60	-	-	-	100	3	-	-	3
Prerequisite: Fundamentals of Problem solving and analytical skills														
Course Objectives: <ul style="list-style-type: none"> To learn the principles of Software Engineering. To gather and define system requirements To create models representing software structure and behavior. To apply design principles to software project development. To understand software quality attributes and testing principles. 														
Course Outcomes: After completing the course, the students will be able to: CO1: Understand fundamental concepts and characteristics of software engineering approaches. CO2: Identify system requirements and create a conceptual model. CO3: Apply UML techniques to model software architecture and behavior. CO4: Apply design principles and patterns to build effective software architectures. CO5: Design quality software using modern tools and engineering practices.														
Unit	Contents													Duration (Hrs.)
1.	Introduction to Software Engineering Approaches: Fundamentals and Characteristics of Software, Core Practices in Software Engineering, Software process, Software Myths, Software development lifecycle, Process Models: A Generic Process Model, Linear Sequential Development Model, Iterative Development Model, The incremental Development Model, Agile Methodology: Landscape of Agile and Planned Methods, Definition - Scrum, Scrum Origins, Scrum Framework, Agile Principles, Sprints, Requirements, User Stories, Product Backlog, Roles: Product Owner, Scrum Master, Development Team, Managers, Scrum Team Structures, Scrum Planning Agile Tools – Jira, Kanban													8
2.	Requirements Specification and Analysis: User and system requirements, Functional and non-functional requirements, requirements engineering (elicitation, specification, validation, negotiation) prioritizing requirements (Kano diagram), requirement traceability matrix (RTM), software requirements Specification document, structure of SRS, writing a SRS, Requirements Characteristics, Eliminating													8

	Requirement Ambiguities, Conflict Identification and Resolution, Requirement Qualities	
3.	Architectural and Behavioral Views in Software Engineering: Introduction to UML diagrams, Analysis Model-Data Modeling, Scenario-Based Modeling, Class-Based Modeling, Flow-Oriented Modeling, Behavioral Modeling, Static Behavior: Use Case, Use Case Diagram, Class Diagram, Component Diagram, Deployment Diagram, Dynamic Behavior: Sequence Diagram, Collaboration Diagram, Activity Diagram, Communication Diagram, Interaction Diagrams.	7
4.	Software Architecture Design and patterns: Design Model, Design Qualities, Characteristics of Design Activities, Design Principles, Cohesion and Coupling, Software Architecture Vs Software Design, Software Reuse, Design Heuristics, Layered Architecture, Client-Server Architecture, Pipe-Filter Architecture, Model-View Controller Architecture, Definition, Describing Design Pattern, Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype Structural Patterns: Adapter, Bridge, Composite, Decorator, Facade, Behavioral Patterns: Chain of Responsibility, Command, Interpreter.	8
5.	Recent Trends and Quality in Software Engineering: Software Configuration Management (SCM), Risk and Defect Management, Technology and Process Evolution, Collaborative and Global Development, Test-Driven Development (TDD), CASE Tools – Types, Components, Environments (Upper, Lower, Integrated), Software Quality – Concepts, Metrics, Challenges, Testing – Principles, Types, Test Plan and Cases, Verification and Validation, Debugging, Bug Reporting.	8
Total Hours		39
List of Activities		
<ol style="list-style-type: none"> 1. Model a mini project (e.g., library management system, Financial Application, food delivery application, System Security Application etc.) using UML diagrams. 2. Design a structured SRS for an online shopping system with prioritized and traceable requirements. 3. Calculate Cyclomatic Complexity and Code Coverage for a Student Record Management module. 4. Create an MVC architecture for a Food Delivery App and explain its components. 5. Write a test plan for a Hotel Booking System and align each test case with verification and validation goals. 6. Conduct a survey to analyze recent trends and quality practices in software engineering, including tools, testing, reuse, and development strategies. 		
Text Books		

1. Roger Pressman, "Software Engineering:A Practitioner's Approach", McGraw Hill, 2009, ISBN 0-07- 337597-7
2. Ian Sommerville, 'Software Engineering',Pearson, 10th Edition, 2017, ISBN-13: 978-9332582699.
3. Kenneth Rubin, 'Essential SCRUM: A Practical Guide To The Most Popular Agile Process', Addison-Wesley, 2012, ISBN-13: 978-0-13-704329-3.
4. Tom Pender, 'UML Bible', John Wiley & Sons, 2003, ISBN - 0764526049.

Reference Books

1. Pankaj Jalote, "Software Engineering: A Precise Approach", Wiley India, 2010, ISBN: 9788-1265-2311- 5.
2. Rajib Mall, "Fundamentals of Software Engineering", 5th Edition, Prentice Hall India, 2018, ISBN-13:9788-1203- 4898-1.
3. SorenLauesen, 'Software Requirements: Styles and Techniques, Addison Wesley, 2002, ISBN 0201745704.
4. Dean Leffingwell, 'Agile Software Requirements', Addison-Wesley, 2011, ISBN-13: 978-0-321-63584-6.
5. Grady Booch, James Rumbaugh, Ivar Jacobson, 'Unified Modeling Language User's Guide', 2nd Edition, Addison- Wesley 2005, ISBN - 032126797
6. Erich Gamma, Richard Helm, Ralph Johnson, 'Design Patterns: Elements of Reusable Object-Oriented Software', Addison-Wesley Professional, 1994, ISBN-13: 978-0201633610.
7. Paul Clements, Felix Bachmann, Len Bass, David Garlan, 'Documenting Software Architectures: Views and Beyond', Addison-Wesley Professional, 2003, ISBN-13: 9780201703726.

Online References

1. NPTEL Course: Prof. Rajib Mall, IIT Kharagpur, "Software Engineering", https://onlinecourses.nptel.ac.in/noc20_cs68/preview
2. Software Engineering: A Practitioner's Approach, Seventh Edition, "<https://intranetssn.github.io/www.ssn.net/twiki/pub/CseIntranet/CseBCS6403/PressmanBook.pdf>"

“येथे बहुतांचे हित”

Second Year B. Tech Information Technology														
Semester-III														
Course Code: IT24PCC205					Course Name: Data Structures and Algorithms Lab									
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	T W	PR	OR	TOTAL	L	P	T	TOTAL
-	2	-	-	-	-	-	-	50	-	50	-	-	1	1
Prerequisite: C programming Language, Basics of Algorithms.														
Course Objective:														
<ul style="list-style-type: none"> ● To study significance of Data structures and its use. ● To learn a problem solving approach using data structures. ● To learn Linear and Non-linear data structures to solve real world problems. ● To learn significance of hashing techniques for efficient retrieval of data. 														
Course Outcomes:														
After completing the course, the students will be able to:														
CO1: Solve a given problem using linear data structures.														
CO2: Solve a given problem using non-linear data structures.														
CO3: Implement searching and sorting techniques.														
CO4: Implement hashing techniques for efficient retrieval of data.														
Sr. No.	List of Experiments													Duration (Hrs.)
1.	Consider a student database of SEIT class (at least 15 records). Database contains different fields of every student like Roll No, Name and SGPA.(array of structure) a) Design a roll call list, arrange list of students according to roll numbers in ascending order (Use Bubble Sort) b) Arrange a list of students alphabetically. (Use Insertion sort) c) Arrange a list of students to find out first ten toppers from a class. (Use Quick sort) d) Search students according to SGPA. If more than one student has the same SGPA, then print a list of all students having the same SGPA. (use Linear Search) e) Search a particular student according to roll number using binary search without recursion.													4
2.	Implement stack as an abstract data type using singly linked list and use this ADT for conversion of Infix expression to postfix expression and postfix expression evaluation OR Infix expression to prefix expression and prefix expression evaluation.													2
3.	Implement Circular Queue using Array. Perform following operations on it. a) Insertion (Enqueue) b) Deletion (Dequeue) c) Display (Note: Handle queue full condition by considering a fixed size of a queue.)													2

4.	Construct an Expression Tree from postfix or prefix expression. Perform recursive and non-recursive In-order, Pre-order and Post-order traversals.	4
5.	Implement binary search tree and perform following operations: a) Insert (Handle insertion of duplicate entry) b) Delete c) Search d) Display tree (Level-wise, print total count of leaf nodes).	4
6.	Implement In-order Threaded Binary Tree and traverse it in In-order and Pre-order.	2
7.	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 <ul style="list-style-type: none"> ● Prim's Algorithm. ● Kruskal's Algorithm. 	4
8.	Represent a graph of the city using an adjacency matrix /adjacency list. Nodes should represent the various landmarks and links should represent the distance between them. Find the shortest path using Dijkstra's algorithm from single source to all destinations.	4
9.	Implementation of Hash table using array and handle collisions using <ol style="list-style-type: none"> a. Linear probing with and without replacement. b. Chaining with and without replacement. 	4
Total Hours		30
Text Books		
<ol style="list-style-type: none"> 1. Reema Thareja, "Data Structures using C ", Second Edition, Oxford Higher Publication 2. Alfred Aho, John Hopcroft, Jeffrey Ullman, "Data Structures & Algorithms", Pearson Publication 3. Gilberg, B. Forouzan, "Data Structures: A pseudocode approach with C", Cengage Learning, 2nd edition. 		
Reference Book		
<ol style="list-style-type: none"> 1. Y. Kanetkar, "Data Structures through C," 5th edition BPB Publications, 2023. 2. E. Horowitz, S. Sahani, "Fundamentals of Data Structures in C", Universities press, 2nd edition. 3. Jean-Paul Tremblay & Paul G. Sorenson, "An Introduction to Data Structures with Applications" Publisher-Tata McGraw Hill, 2nd edition. 4. Data Structures using C & C++-By Tanenbaum Publisher-Prentice-Hall International. 5. Fundamentals of Computer Algorithms by Horowitz , Sahani, Galgotia Pub 2001 ed. 		
Online References		
<ol style="list-style-type: none"> 1. NPTEL Course: Prof. Shankar Balachandran, Prof. Hema A Murthy, "ARICENT: First Mile Foundation Program - Programming and Data Structure and Algorithm", (https://nptel.ac.in/courses/106106133) 2. NPTEL Course: Prof. Naveen Garg, Introduction to Data Structures and Algorithms, (https://nptel.ac.in/courses/106102064) 3. Coursera:Data Structures and Algorithms Specialization https://www.coursera.org/specializations/data-structures-algorithms 		

Second Year B. Tech Information Technology															
Semester-III															
Course Code: IT24PCC206								Course Name: Object Oriented Programming Lab							
Teaching Scheme (Hours/Week)					Examination Scheme						Credits				
L	P	T	OL	ODL	CIE	ETE	TW	PR	OR	TOTAL	L	P	T	TOTAL	
-	2	-	-	-	-	-	-	50	-	50	-	1	-	1	
Prerequisite: C Programming															
Course Objectives: <ul style="list-style-type: none"> To understand basic C++ concepts like control structures and classes. To develop skills in object-oriented programming by implementing constructors, destructors, inheritance, and polymorphism. To use advanced C++ features such as operator overloading, templates, and exception handling. To Acquire skills to perform file operations in c++ To familiarize students with Standard Template Library (STL) for efficient data manipulation, sorting, and searching of user-defined records. 															
Course Outcomes: After completing the course, the students will be able to: CO1: Apply basic C++ concepts like control structures, classes, and arrays to build simple programs. CO2: Implement object-oriented features such as constructors, destructors, inheritance, and polymorphism. CO3: Design and implement complex C++ programs using operator overloading, templates, and exception handling to solve advanced computational problems. CO4: Develop file handling systems to efficiently manage, store, and retrieve persistent data in real-world applications. CO5: Apply STL containers and algorithms to perform data manipulation, sorting, and searching on user-defined records.															
Sr. No.	List of Experiments													Duration (Hrs.)	
1.	Write a program based on basic control structure in C++													2	
2.	Create a simple application with classes. Use array of object and access modifiers													4	
3.	Design and develop the program for a given problem statement. Demonstrate the constructor and destructor in program													4	
4.	Design and develop inheritance concepts for a given case study, identify objects and relationships and implement inheritance wherever applicable.													4	
5.	Design and Develop the program to demonstrate the concept of static and run time polymorphism.													2	
6.	Design and develop the program using the concept of Operator overloading. (at least two Unary and binary operator)													2	
7.	Implement a program for maintaining a database of given case study using Files.													4	

8.	Implement a program using the template for given problem statement	2
9.	Implement a program to demonstrate various types of Exception.	2
10.	Write C++ program using STL for sorting and searching user defined records such as personal records (Name, DOB, Telephone number etc) using vector containers.	2
11.	Write a program using STL containers.	2
Total Hours		30
Text Books		
<ol style="list-style-type: none"> 1. Robert Lafore; 'Object-Oriented Programming in C++', Fourth Edition, Sams Publishing, ISBN:0672323087 2. E.Balagurusamy; 'Object-Oriented Programming with C++' 7th edition, Graw-Hill Publication, ISBN 10: 9352607996 ISBN 13: 9789352607990 3. Deitel, 'C++ How to Program', 4th Edition, Pearson Education, ISBN:81-297-0276-2 		
Reference Book		
<ol style="list-style-type: none"> 1. Bjarne Stroustrup ; 'The C++ Programming Language', Fourth Edition, Addison-Wesley 2. Bjarne Stroustrup ; 'A Tour of C++', Second Edition, Addison-Wesley 3. Herbert Schildt, 'C++-The complete reference', Eighth Edition, McGraw Hill Professional, 2011, ISBN:978-00-72226805 4. Matt Weisfeld, 'The Object-Oriented Thought Process', Third Edition, Pearson ISBN-13:075-2063330166 5. Cox Brad, Andrew J. Novobilski, 'Object -Oriented Programming: An Evolutionary Approach, Second Edition, Addison-Wesley, ISBN:13:978-020-1548341 		
Online References		
<ol style="list-style-type: none"> 1. NPTEL Course: Prof. Partha Pratim Das, IIT Kharagpur, Programming in C++, (https://onlinecourses.nptel.ac.in/noc21_cs02/preview) 2. NPTEL Course: Prof. Partha Pratim Das, IIT Kharagpur "Programming in Modern C++", (https://onlinecourses.nptel.ac.in/noc22_cs43/preview) 3. LinkedIn: "Complete Guide to C++ Programming Foundations", https://www.linkedin.com/learning/c-plus-plus-standard-template-library 4. LinkedIn: "C++ Essential Training", https://www.linkedin.com/learning/c-plus-plus-essential-training-15106801/ 		

Second Year B. Tech Information Technology															
Semester-III															
Course Code: IT24CEP208											Course Name: Community Centered Project				
Teaching Scheme (Hours/Week)					Examination Scheme						Credits				
L	P	T	OL	ODL	CIE	ETE	TW	OR	P R	TOTAL	L	P	T	TOTAL	
-	4	-	-	-	-	-	50	-	-	50	-	2	-	2	
Prerequisite: Foundational knowledge and teamwork skills.															
Preamble: The Community Centered Project aims to equip engineering students with the skills to identify local environmental and societal issues, apply technological solutions, and work collaboratively to develop innovative, community-focused projects. It fosters social responsibility, teamwork, and practical problem-solving through direct interaction with real-world challenges.															
Course Objectives: This course is designed to enable students to: <ul style="list-style-type: none"> Recognize and critically analyze environmental challenges encountered by local communities. Explore and evaluate the role of technology in addressing societal needs. Design and implement innovative solutions grounded in engineering principles to solve real-world problems. Collaborate effectively in teams while contributing individually to the planning and development of projects. 															
Course Outcomes: After completion of the course, student will be able to - CO1: Apply a systematic approach to investigate the problem faced by the community. CO2: Analyze existing literature and collect relevant data. CO3: Design and develop system architecture for the identified problem. CO4: Collaborate effectively in teams, applying problem-solving skills.															
Guidelines for selection and allocation of project work: <ul style="list-style-type: none"> Students are expected to investigate and understand challenges faced by communities. Suggestive list of topics are in Part B. The Coordinator shall assign mentors for continuous guidance to the respective student teams. Students apply a systematic approach to investigate the problem, collect relevant data, analyse the collected data, summarise their findings and compile a detailed report about their study. Field visits are recommended to help students better identify, understand, and relate to the problems they choose to work on. The group of students may be associated with a government official / village authorities/NGOs/local communities etc. The Community Engagement Project should be different from the regular programmes of NSS/NCC/Green Club/Hobby Clubs, Special Interests Groups etc 															
Guidelines for Project Evaluation: <ul style="list-style-type: none"> An activity book has to be maintained by each of the students to record the activities undertaken 															

- and will be countersigned by the concerned mentor.
- An internal evaluation shall also be conducted by a committee constituted by the Project Coordinator/HoD. Evaluation to be done based on the active participation of the student and marks could be awarded by the mentor/committee.
 - Two reviews are to be conducted. Evaluation is as below
 - Review-I: Problem Identification
 - Review II: Solution Development
 - Rubrics for Reviews should be finalized by the Coordinator in consultation with the BoS Chairperson.
 - Project report shall be submitted by each student/group of students.

PART A

Sr. No.	Content	Duration (Hrs.)
1.	Community Centered Project Concepts & Skill Assessment Understand the concept of Community Centered Project . Assess your individual skills (technical, analytical, communication, teamwork, leadership) and document it for identifying strengths and improvement areas.	4
2.	Group Formation & Idea Proposal: Form a diversified and balanced team based on skill assessment. Brainstorm and propose a suitable project idea with justification of problem relevance, expected outcomes.	4
3.	Idea Presentation: Prepare and present the initial project idea covering problem definition, motivation, background study, and Literature review.	4
4.	Requirements Gathering(SRS Writing): Analyze the required data in the chosen domain. Identify stakeholders and gather functional as well as non-functional requirements for the proposed project.	4
5.	Design & Modeling /Partial Implementation: Prepare the design and modeling of the project using suitable diagrams (system architecture, UML, DFD/ER diagrams). Present the design and explain the work done / modules implemented	4
6.	Final Report Writing: Prepare a comprehensive final project report including abstract, objectives, literature review, analysis of data, methodology, design, implementation, results, discussion and future scope.	4
7.	Final Review and Reflection: Present the completed work, Reflect on the overall learning experience, team contributions, challenges, lessons learned, and improvements for future work.	4
Total Hours		28

PART B

(Suggestive list of topics under Community Centered Project)

1.	Health and hygiene of the school going students, home makers and old personals <ul style="list-style-type: none"> ● AI Chatbot for Health & Hygiene Tips – Students can build a simple chatbot with FAQs and awareness content. ● Sleep & Screen Time Analyzer – App that monitors screen usage and gives alerts for better sleep hygiene. 	
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	<ul style="list-style-type: none"> ● Smart Dustbin Monitoring System – IoT-enabled dustbin that reminds when to dispose of waste. ● Gamified Fitness Challenge Platform – Small platform where users (students, homemakers, elderly) can join step challenges. 	
2.	<p>Waste Management</p> <ul style="list-style-type: none"> ● Smart Waste Segregation Assistant – Mobile app that uses image recognition to classify waste into wet/dry/recyclable. ● IoT Dustbin Monitoring System – Sensors track dustbin fill-level and notify the collection team via app/dashboard. ● Waste Collection Route Optimizer – Web app using maps/algorithms to suggest shortest garbage truck routes. ● Gamified Recycling Awareness App – Points and rewards system for students/households reporting recycling habits. 	
3.	<p>Climate Change</p> <ul style="list-style-type: none"> ● Carbon Footprint Calculator – Web/app tool where users log daily activities (travel, electricity use) to estimate CO₂ emissions. ● Climate Awareness Chatbot – AI-powered bot to answer queries on climate change and eco-friendly practices. ● Smart Energy Consumption Dashboard – IoT + software system to monitor home electricity use and suggest savings. ● Gamified Green Challenge App – Users take challenges (plant a tree, cycle instead of car) and earn badges. 	
4.	<p>Career Orientation of Youth</p> <ul style="list-style-type: none"> ● AI-based Career Recommendation System – Web app that suggests career paths based on interests, skills, and aptitude quiz. ● Virtual Mentor Chatbot – AI chatbot trained with FAQs about courses, jobs, and future career options. ● Internship/Opportunity Aggregator – A platform pulling internships/events from multiple sources with filters. ● Gamified Career Skill Tracker – Students log achievements (coding, projects, certificates) and get level-based progress badges. 	
5.	<p>Traditional & Modern Health Care Methods</p> <ul style="list-style-type: none"> ● Digital Ayurveda & Allopathy Knowledge Hub – App showing remedies from both traditional and modern medicine. ● Symptom Checker Chatbot – Suggests whether a condition can be treated with home remedies or needs medical consultation. ● Comparative Health Tracker – Dashboard comparing lifestyle-based outcomes (yoga, herbal diet vs. modern diet). ● IoT-based Herbal Garden Monitor – Smart system to grow medicinal plants with humidity/light tracking. 	
6.	<p>Renewable Energy & Solar Systems</p> <ul style="list-style-type: none"> ● Solar Power Usage Tracker – IoT dashboard monitoring solar panel output vs. household consumption. ● Green Energy Awareness App – Game/quiz-based app teaching renewable 	

	<p>energy concepts.</p> <ul style="list-style-type: none"> ● Solar Feasibility Calculator – Web tool that estimates solar panel requirements based on home size/location. ● IoT-based Smart Streetlight System – Solar-powered streetlights with automatic ON/OFF and fault detection. 	
7.	<p>Yoga Awareness & Practice</p> <ul style="list-style-type: none"> ● AI Pose Detection for Yoga – Mobile/web app using camera to detect yoga poses and give corrections. ● Yoga Habit Tracker App – Tracks daily yoga practice with streaks, reminders, and progress badges. ● Voice-based Meditation Guide – Simple app with guided breathing exercises and stress tracking. ● AR/VR Yoga Experience – Immersive project where users learn yoga in virtual environments (basic VR headset). 	
8.	<p>Women Education & Empowerment</p> <ul style="list-style-type: none"> ● Skill Development Portal for Women – Web platform suggesting free/paid online courses with certifications. ● Women Safety App – SOS alert system with GPS location sharing to emergency contacts. ● AI Mentor Chatbot for Women Careers – Suggests learning paths and resources based on user interest. ● Awareness Dashboard – Data visualization of women's education, literacy, and employment statistics. 	
9.	<p>Music & Dance</p> <ul style="list-style-type: none"> ● Music Mood Analyzer – App that detects user mood (via text/sentiment analysis) and suggests music. ● AI Dance Pose Evaluator – Webcam-based system to evaluate dance steps against a reference. ● Gamified Music Learning App – Simple game to teach notes/instruments interactively. ● Cultural Art Form Preservation Platform – A digital archive where users upload/share traditional music and dance forms. 	
Total Hours for Community Engagement		28
E Resources		
<ol style="list-style-type: none"> 1. NPTEL Course: Prof. Akshay Kumar Satsangi, Dayalbagh Educational Institute, Agra, Uttar Pradesh, "Community Engagement and Social Responsibility" (https://onlinecourses.swayam2.ac.in/ugc23_ge04/preview) 2. Principles of Community Engagement (Second Edition) (https://ictr.iohnshopkins.edu/wp-content/uploads/2015/10/CTSAPrinciplesofCommunityEngagement.pdf) 		

Second Year B. Tech Information Technology															
Semester III															
Course Code: IT24VEC209								Course Name: Problem Solving and Analytical Skills							
Teaching Scheme (Hours/Week)					Examination Scheme						Credits				
L	P	T	OL	ODL	CIE	ETE	TW	PR	OR	TOTAL	L	P	T	TOTAL	
-	-	2	-	-	-	-	50	-	-	50	-	-	2	2	
Prerequisite: Basic concepts of Mathematics.															
Course Objectives:															
<ul style="list-style-type: none"> To develop a strong foundation in basic arithmetic and algebraic operations To apply the fundamental concepts of probability and combinatorics for solving real-world and analytical problems. To build reasoning and logical thinking abilities To enhance data interpretation and analytical decision-making skills 															
Course Outcomes:															
After completing the course, the students will be able to:															
CO1: Understand the basic concepts of arithmetic ability, business computations and data interpretation.															
CO2: Learn to develop strategic approaches to problem solving.															
CO3: Apply mathematical and statistical methods to analyze real-world problems.															
CO4: Develop logical reasoning and thinking ability.															
Unit	Contents														
1.	Arithmetic ability: Algebraic operations BODMAS, Fractions, LCM & GCD(HCF), Probability, Permutations and Combinations Verbal Reasoning: Number Series, Coding & Decoding, Blood relationship, Clocks, Calendars.														
2.	Quantitative aptitude: Averages, Ratio and proportion, Time-distance. Business computations: Percentages, Profit & loss, Simple compound interest, Stocks and Shares.														
3.	Data Interpretation: Tabulation, Bar Graphs, Pie Charts. Logical Venn Diagrams, Tabulation														
4.	Non-verbal reasoning: Series, Analogy, Problems on Cube and Dice, Mirror image, Water image, Rule Detection, Analytical reasoning														
Sr. No.	List of Activities													Duration (Hrs.)	
1.	I. Solve problems that require finding the LCM and GCD of large numbers. II. Group Quiz: Mix arithmetic and reasoning problems for team competitions.													7	
2.	I. Solve basic ratio and proportion problems. II. problems on profit and loss involving cost price, selling price, and profit percentage. III. Solve problems on dividend, face value, and market value of stocks													7	

3.	Case Study: Provide a real-world scenario (e.g., financial data, election results) and ask students to interpret it using tabulation, bar graphs, and pie charts.	7
4.	Create your own figure series using shapes (circle, square, triangle) and ask a peer to find the next figure in your series.	7
5.	Draw your own cube net, label the faces, and fold it into a cube. Share your folded cube with the class and ask your peers to identify opposite and adjacent faces.	
Total Hours		28
Online References		
<ol style="list-style-type: none"> Quantitative Aptitude for Competitive Examination, R S Agrawal, S.Chand publications, "https://eltsindia.com/StudyMaterialFiles/ea007acc-bc55-4e17-8470-0d9e85313252quantitative-aptitude-for-competitive-examinations-by-rs-aggarwal-reprint-2017.pdf" Analytical Skills-I, Dr. Nitin K. Mishra, https://www.lpude.in/SLMs/Master%20of%20Computer%20Applications/Sem_1/DEPEA515_A_NALYTICAL_SKILLS-I.pdf Quantitative Aptitude and Reasoning by R V Praveen, PHI publishers. 		



Second Year B. Tech Information Technology															
Semester III															
Course Code: SH24AEC202					Course Name: Professional Communication and Personality Development										
Teaching Scheme (Hours/Week)					Examination Scheme						Credits				
L	P	T	OL	ODL	CIE	ET E	TW	PR	OR	TOTAL	L	P	T	TOTAL	
-	-	2	-	-	-	-	50	-	-	50	-	-	2	2	
Prerequisite: Basic understanding of LSRW skills, grammar, and vocabulary of the English Language.															
Course Objectives:															
<ul style="list-style-type: none"> • To develop students' rhetorical and persuasive abilities for effective oral communication and audience engagement • To familiarize students with key business and managerial terminologies essential for effective communication and decision-making. • To strengthen analytical and critical thinking skills for constructing logical arguments and making informed decisions • To cultivate professional and technical writing competence, ensuring clarity, accuracy, and etiquette in communication. 															
Course Outcomes:															
After learning the course, the students will be able to:															
CO1: Demonstrate effective rhetoric, persuasive skills, audience engagement, and adaptability in communication.															
CO2: Apply visual aids, body language, voice modulation, and confidently manage audience questions and maintain engagement throughout.															
CO3: Analyze information and construct logical arguments to solve problems and make informed decisions.															
CO4: Exhibit professional and technical writing skills and avoid common pitfalls, ensuring clear, polite, and informative communication.															
Contents															
1.	Public Speaking Using rhetoric and understanding the context in public speaking. Controlling nervousness, building confidence, stage presence, poise, and impact. Employing voice modulation, pace, volume & pitch.														
2.	Presentation Skills Structuring a presentation & using visual aids Understanding audience connection strategies & feedback Handling Q&A session with confidence														
3.	Critical Thinking Working on Case Studies and Situational Analysis Structuring the argument and handling rebuttal. Analyzing logical fallacies and cognitive biases.														
4.	Technical Writing														

	Structuring emails for different purposes (requests, complaints, updates, and follow-ups) Avoiding common mistakes and making the right use of CC, BCC, and reply-all options. Blog/article/ newsletter/survey report format and examples.	
5.	Group Discussion Implementing coherence and cohesion in structuring the argument. Integrating non verbal communication in the conversation. Managing disagreement and aggression in the discussion	
List of Tutorial		
Sr. No.	Activity	Duration (Hrs.)
1.	Ice-breaking Session	2
2.	Storytelling	4
3.	Idea Presentation	4
4.	Advertisement Creation	4
5.	Case Study Analysis	2
6.	Debate	2
7.	Email Writing (Professional & Personal)	2
8.	Blog Writing	2
9.	Survey Reports	2
10.	Group Discussion	2
Total Hours		26
Text Books		
1. Stephen E. Lucas, <i>The Art of Public Speaking</i> , McGraw Hill Publication, ISBN-10: 1260914275 ISBN-13: 9781260914276. 2. Jaishri Jethwaney and Sanjay Bhargava, <i>Corporate Communication: Principles and Practices</i> . 3. Dr. Ranjit Singh, <i>Critical Thinking and Problem Solving</i> . 4. Rajendra Pal and J. S. Korlahalli, <i>Essentials of Business Communication</i> , Sultan Chand & Sons, 2011. ISBN: 8180547299, 9788180547294.		
Reference Books		
1. Shiv Khera, <i>You Can Win</i> , Bloomsbury India, ISBN-10: 9382951717 · ISBN-13: 9789832951711. 2. Carmine Gallo, <i>Talk Like TED</i> , Macmillan Business. 3. Garr Reynolds, <i>Presentation Zen: Simple Ideas on Presentation Design and Delivery</i> , New Riders. 4. Peter Facione and Carol Ann Gittens, <i>Think Critically</i> . 5. Lewis Vaughn, <i>The Power of Critical Thinking</i> , Oxford University Press. 6. Emily Post and Peter Post, <i>The Etiquette Advantage in Business: Personal Skills for Professional Success</i> .		
Online References		
1. NPTEL Course: Prof. Aysha Iqbal, "IIT Madras, "Technical English for Engineers" https://onlinecourses.nptel.ac.in/noc20_hs56/preview 2. NPTEL Course: Dr. Shoba. K. N National Institute Of Technical Teachers Training And Research, Chennai, "English for Research Paper Writing" https://onlinecourses.swayam2.ac.in/ntr24_ed15/preview		

3. NPTEL Course: Dr Sachin Sadashiv Surve | Savitribai Phule Pune University, Pune, "Personality Development and Communication Skills"
https://onlinecourses.swayam2.ac.in/cec22_cm03/preview



SEMESTER IV

“येथे बहुतांचे हित”

Second Year B.Tech Information Technology														
Semester-IV														
Course Code: IT24PCC251					Course Name: Database Management Systems									
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	T W	OR	PR	TOTAL	L	P	T	TOTAL
3	-	-	-	-	40	60	-	-	-	100	3	-	-	3
Prerequisite: Data Structures and Algorithms														
Course Objectives:														
<ul style="list-style-type: none"> To understand Entity-Relationship (ER) modeling techniques to design logical database schemas for real-world scenarios. To acquaint students with database normalization techniques. To develop the ability of formulating and executing SQL queries for various data manipulation and retrieval tasks. To acquire the knowledge of transaction control concepts in realistic database applications. To acquire the skills to use powerful, flexible, and scalable general-purpose databases to handle Big Data. 														
Course Outcomes:														
After completing the course, the students will be able to:														
CO1: Analyze and design Database Management System using ER model														
CO2: Normalize the database design using normal forms														
CO3: Implement database queries using SQL														
CO4: Apply Transaction Management concepts in real-time situations														
CO5: Use NoSQL databases for processing unstructured data														
Unit	Contents													Duration (Hrs.)
1.	Introduction to Database System and ER Modeling: Introduction to Database Management Systems, Purpose of Database Systems, Database-System Applications, View of Data, Database Languages, Database System Structure, Data Models, Database Design and ER Model: Entity, Attributes, Relationships, Constraints, Keys, Design Process, Entity Relationship Model, ER Diagram, Design Issues, Extended E-R Features, converting E-R & EER diagram into tables. Case Study: Design ER Model for any real time application and convert the same into tables on paper.													8
2.	Relational Database Design: Relational Model: Basic concepts, Attributes and Domains, CODD's Rules, Relational Integrity: Domain, Referential Integrities, Enterprise Constraints, Database Design: Features of Good Relational Designs, Normalization, Atomic Domains and First Normal Form, 2NF, 3NF, BCNF. Case Study: Convert a Relational Database to different Normal Forms.													8

3.	SQL: Characteristics and advantages, SQL Data Types, DDL, DML, DCL, TCL, SQL Operators, Views: Creating, Dropping, Updating using Indexes, Set Operations, Predicates and Joins, Set membership, Tuple Variables, Set comparison, Ordering of Tuples, Aggregate Functions, SQL Functions, Nested Queries, Triggers.	8
4.	Database Transaction Management: Transaction concept, Transaction states, ACID properties, Concept of Schedule, Serial Schedule, Serializability: Conflict and View, Cascaded Aborts, Recoverable and Non-recoverable Schedules, Concurrency Control: Lock-based, Time-stamp based Deadlock handling, Recovery methods: Shadow- Paging and Log-Based Recovery.	8
5.	Advances in Databases and Big Data: Introduction to Big Data : 3 V's of Big Data, Solution for Big Data Introduction to NoSQL databases, NoSQL data models and MongoDB, CAP theorem, BASE properties, and comparative study of SQL and NoSQL	7

Total Hours	39
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Text Books

1. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, 7th Edition, 2020 ISBN 978-0-07-802215-9.
2. Ivan Bayross, "SQL, PL/SQL the Programming Language of Oracle", BPB Publications, 2014 ISBN: 9788176569644.
3. Connally T, Begg C., "Database Systems- A Practical Approach to Design, Implementation and Management", Pearson Education, 5th Edition, 2010, ISBN 81-7808-861-4.
4. Pramod J. Sadalage and Martin Fowler, "NoSQL Distilled", Addison Wesley, ISBN 10: 0321826620, 2013, ISBN 13: 978-0321826626.

Reference Books

1. C. J. Date, "An Introduction to Database Systems", Addison-Wesley, 8th Edition, 2004, ISBN 0321189566. S. K. Singh, "Database Systems: Concepts, Design and Application", Pearson Education, 2009, ISBN 9788177585674. Kristina Chodorow, Michael Dierolf, "MongoDB: The Definitive Guide", O'Reilly Publications, 3rd Edition, 2019 ISBN 9781491954461.
2. Kevin Roebuck, "Storing and Managing Big Data - NoSQL, HADOOP and More", Emereo Pty Limited, 2011, ISBN 1743045743, 9781743045749.

Online References

1. MySQL: <https://dev.mysql.com/doc/>
2. Coursera: "Database Management Essentials", <https://www.coursera.org/learn/database-management>

Second Year B. Tech Information Technology															
Semester- IV															
Course Code: IT24PCC252												Course Name: Operating Systems			
Teaching Scheme (Hours/Week)					Examination Scheme						Credits				
L	P	T	OL	ODL	CIE	ET E	TW	PR	OR	TOTAL	L	P	T	TOTAL	
3	-	-	-	-	40	60	-	-	-	100	3	-	-	3	
Prerequisite: Data Structures and Algorithms, Computer Organization															
Course Objectives:															
<ul style="list-style-type: none"> To provide foundational knowledge of operating system concepts, architectures, and essential user interfaces. To develop the ability to manage processes, threads, and CPU scheduling for performance optimization. To impart techniques for ensuring safe concurrent execution and handling deadlocks. To equip students with the skills to manage system resources efficiently and implement protection mechanisms. 															
Course Outcomes:															
After completing the course, the students will be able to:															
C01: Understand the objectives, architecture, and basic commands of operating systems, with a focus on Linux OS and shell scripting.															
C02: Apply process scheduling and synchronization techniques, including thread programming, to optimize CPU utilization and manage concurrency.															
C03: Analyze process synchronization methods and deadlock handling techniques to ensure efficient and deadlock-free operations.															
C04: Evaluate memory management techniques and I/O scheduling methods for effective resource utilization in modern operating systems.															
C05: Design secure operating system environments by implementing protection mechanisms and monitoring system threats.															
Unit	Contents													Duration (Hrs.)	
1.	Overview Of Operating System: Operating System Objectives, The Evolution of Operating System, OS Design Considerations for Multiprocessor and Multicore OS, Architecture of Operating System: Monolithic, Microkernel, Exokernel, Introduction to Linux OS, Basic Shell Commands, Shell Scripting using BASH.													7	
2.	Process Management : Process: Process Concept, Process States, Process Control Block, Process Description Threads: Process and Threads, Basic types of threads, Multithreading, Thread													8	

	Programming using thread library APIs Process Scheduling: Types of Scheduling, Scheduling Criteria, Scheduling Algorithms: First-Come First- Served, Shortest-Job-First, Priority, Round Robin, Case Study - Linux Scheduling	
3.	Process Synchronization : Principles of Concurrency, Critical - Section Problem, Mutual Exclusion: Requirements, Operating System support - Semaphore and Mutex, Classical Synchronization Problems: Reader-Writer Problem, Producer - Consumer Problem, Real Life Problems, Inter-Process Communication: Pipes and Shared Memory Deadlock: Principles of Deadlock, Deadlock Characterization: Necessary Conditions, Resource - Allocation Graph, Methods for Handling Deadlock: Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery, Case Study: Dining Philosopher Problem	8
4.	Memory and I/O Management : Memory Management Requirements, Memory Partitioning: Fixed Partitioning, Dynamic Partitioning, Buddy System, Paging, Segmentation, Virtual Memory: Demand Paging, Page Replacement, Thrashing I/O Management: I/O Devices, Organization of the I/O Function, I/O Buffering, Secondary Storage Management: Disk Structure, Disk Scheduling File Management: Overview-Files and File Systems, File structure. File Organization and Access, File Directories, File Sharing, Case Study: Linux File System, Android File System Case Study: Linux Operating System	9
5.	Protection And Security : Goals of protection, Domain of protection, Access matrix, Implementation of access matrix, Revocation of access rights, Security problems, Authentication, Program threats, System threats, Threat monitoring.	7
Total Hours		39
Text Books		
<ol style="list-style-type: none"> 1. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, 8th Edition, 2014, ISBN-10: 0133805913 • ISBN-13: 9780133805918 2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley & Sons ,Inc., 9th Edition, 2012, ISBN 978-1-118-06333-0 3. Arnold Robbins, Nelson H. F. Beebe, Classic Shell Scripting, O'Reilly Media, Inc., 2005, ISBN 9780596005955 		
Reference Book		
<ol style="list-style-type: none"> 1. Tom Adelstein and Bill Lubanovic, Linux System Administration, O'Reilly Media, ISBN-10: 0596009526, ISBN-13: 978-0596009526. 2. Harvey M. Deitel, Operating Systems, Prentice Hall, ISBN-10: 0131828274, ISBN-13: 978-0131828278. 3. Thomas W. Doeppner, Operating System in depth: Design and Programming, WILEY, ISBN: 978- 0-471-68723-8. 		

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

Online References

1. NPTEL Course: Prof. Rajib Mall, IIT Kharagpur, "Real Time Operating System",
https://onlinecourses.nptel.ac.in/noc25_cs78/preview
2. "Think OS: A Brief Introduction to Operating Systems", Allen B. Downey,
<https://www.e-booksdirectory.com/details.php?ebook=9907>
3. "Operating System Course: Learn Fundamentals of Operating System", Srikanth Varma,
<https://www.scaler.com/topics/course/free-operating-system-course/>



Second Year B. Tech Information Technology														
Semester IV														
Course Code: IT24PCC253										Course Name: Computer Networks				
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	PR	OR	TOTAL	L	P	T	TOTAL
3	-	-	-	-	40	60	-	-	-	100	3	-	-	3
Course Objectives: <ul style="list-style-type: none"> • To understand the Architecture and Layers of TCP/IP • To study key protocols and services offered at different layers of TCP/IP • To analyze addressing and Routing Mechanisms • To understand how the application layer enables end-user communication and supports various network services like email, file transfer, and web browsing. • To understand wireless networks and different wireless standards. 														
Course Outcomes: After completing the course, the students will be able to: C01: Explore concepts and fundamentals of data communication and computer networks. C02: Design the network using IP addressing and subnetting / supernetting schemes C03: Implement client server Program using Sockets C04: Compare protocols at application layer C05: Design wireless network														
Unit	Contents													Duration (Hrs.)
1.	Data Link Layer: Data Link Layer Design issues and Services, Framing: fixed-size framing, variable size framing. Random access: ALOHA, CSMA, CSMS/CD and CSMA/ CA Error Detection and Correction, Linear Block Codes: hamming code, Hamming Distance, parity check code. Cyclic Codes: CRC (Polynomials), Advantages of Cyclic Codes, Other Cyclic Codes (Examples:CHECKSUM: One's Complement, Internet Checksum). Flow control protocols. Noiseless channels: simplest protocol, stop-and-wait protocol, Noisy channels: stop-and-wait Automatic Repeat Request (ARQ), go-back-n ARQ, Selective repeat ARQ, piggybacking.													8
2.	Network Layer: Services, IPv4 Addresses: Classful and Classless Addressing, Special Addresses, NAT, Subnetting, Supernetting, Delivery and Forwarding of IP Packet, Structure of													8

	Router, IPv4: Fragmentation, Options, Checksum, ARP: Address Mapping, ARP Protocol, RARP, ICMPv4, Unicast Distance Vector Routing, Link State Routing, Unicast Routing Protocols: RIP,EIGRP,OSPF,BGP, IPv6 Addressing.	
3.	The Transport Protocols: UDP: Datagram, Services, Applications, TCP: Transport service primitives, Features, Segment, TCP Connection management Handshake, TCP state transition, TCP Timers, Flow control, Congestion Control Algorithms, Leaky Bucket, Sockets: Socket primitives, TCP timers,TCP Flow control (sliding Window), TCP Congestion Control: Slow Start	8
4.	Application Layer Protocols: DHCP, DNS Name Space, Resource Record and Types of Name Server., FTP, TFTP, HTTP, SMTP, POP, IMAP, MIME, Telnet Network Management: SNMP, Telnet.	8
5.	Wireless Networks: IEEE 802.3 Infrastructure Network and Infrastructure-less, MANET: Issues in Adhoc Wireless Network, Adhoc Network MAC Layer: Design Issues, Design Goal, Classification, MACAW Routing: Issues in Designing a Routing Protocol for Ad-hoc Wireless Networks – Classifications of Routing Protocols, DSDV, AODV, DSR, Wireless Sensor Network: Architecture, Design Issues and Challenges Sensor network protocols	7
Total Hours		39

List of Activities

<ol style="list-style-type: none"> Your company has been assigned the network 192.168.10.0/24. It consists of five departments, for each subnet, specify Network address, Subnet mask, First usable IP, Last usable IP, Broadcast address HR: Requires 25 devices. Finance: Requires 50 devices. IT: Requires 60 devices. Sales: Requires 30 devices. R&D: Requires 40 devices You are a network engineer tasked with optimizing the routing configuration of a distributed organization. The organization owns several IP networks that need to be aggregated into a single supernet for simplified routing. Specify the supernet's network address, the subnet mask in dotted decimal notation.The networks to be combined are: 192.168.0.0/24 192.168.1.0/24 192.168.2.0/24 192.168.3.0/24 Conduct an in-depth on-site assessment of the campus network infrastructure to gain first hand insights into its configuration

4. Introduction to server administration and configuration of Web Server.
5. Study of WLAN with static IP addressing and DHCP with MAC security and filters.

Text Books

1. S. Tanenbaum, Computer Networks, 4th edition Pearson Education
2. A. Forouzan, Data Communications and Networking, 5th edition, TMH
3. Siva Ram Murthy, B. S. Manoj, Adhoc Wireless Networks: Architecture and Protocols, Pearson Education, ISBN: 978-81-317-0688-6, 1st Edition.

Reference Book

1. S.Keshav, An Engineering Approach To Computer Networking, Pearson
2. Behrouz A. Forouzan, TCP/IP Protocol Suite, McGraw Hill Education, ISBN: 978-0-07-070652-1, 4th Edition.

Online References

1. Networking Essentials,
(<https://www.netacad.com/courses/networking/networking-essentials>)
2. Coursera: "The Bits and Bytes of Computer Networking",
<https://www.coursera.org/learn/computer-networking>
3. NPTEL Course: Prof. Sujoy Ghosh, IIT Kharagpur, "<https://nptel.ac.in/courses/106105081>"



Second Year B.Tech Information Technology														
Semester-IV														
Course Code: IT24PCC255					Course Name: Database Management Systems Lab									
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	2	-	-	-	-	-	-	-	50	50	-	1	-	1
Prerequisite: Data Structures and Algorithms														
Course Objectives: <ul style="list-style-type: none"> To get familiar with MySQL client-server installation and configuration procedures. To develop an understanding of real-time problem identification and conceptual modeling using ER diagrams and design tools. To strengthen the ability for designing and developing database schemas and queries using DDL and DML SQL statements. To introduce complex SQL queries including subqueries, joins, views, and set operations. To acquaint students with MongoDB CRUD, aggregation, and map-reduce operations for handling unstructured data. 														
Course Outcomes: After learning the course, the students will be able to: CO1: Apply MySQL installation and configuration using client-server settings and commands. CO2: Analyze and convert ER diagrams into normalized schemas CO3: Develop SQL queries using DDL and DML statements. CO4: Implement advanced SQL concepts including joins, nested queries, grouping, and views. CO5: Apply MongoDB CRUD, aggregation, and map-reduce operations for handling unstructured data.														
Sr. No.	Name of the Experiment (Implement below Queries using MySQL or PostgreSQL)										Duration (Hrs.)			
1.	Install and configure client and server of MySQL and PostgreSQL. (Show all commands and necessary steps for installation and configuration)										2			
2.	Decide a real time application and formulate a problem statement for the application to be developed. Propose a Conceptual Design using ER features using tools like ERD plus, ER Win etc. (Identifying entities, relationships between entities, attributes, keys, cardinalities, generalization, specialization etc.) Convert the ER diagram into a table.										2			
3.	Design and Develop SQL queries for DDL statements for suitable database application.										2			
4.	Design SQL queries for suitable database application using SQL DML statements: Insert, Select, Update, delete with operators, functions, Set operators										2			
5.	Implement arithmetic operators, logical operators, pattern matching, IN and NOT IN predicates, and MySQL built-in functions.										4			

6.	Implement SQL queries for different SQL concepts such as grouping data, using the GROUP BY clause, employing the HAVING clause, applying the EXISTS/NOT EXISTS operators, Creating and using Database Views	4
7.	Write SQL queries to demonstrate the different SQL concepts like subqueries, performing various join operations, and using set operators in MySQL.	4
8.	Implement SQL queries to demonstrate the nested queries in SQL using MySql.	2
9.	Design and Develop MongoDB Queries using CRUD operations. (Use CRUD operations, SAVE method, logical operators etc)	2
10.	MongoDB - Aggregation and Indexing: Design and Develop MongoDB Queries using aggregation and indexing with suitable examples using MongoDB.	4
11.	MongoDB - Map reduce operations: Implement Map reduces operation with a suitable example using MongoDB.	2
	Total Hours	30
Text Books		
<ol style="list-style-type: none"> Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, 7th Edition, 2020 ISBN 978-0-07-802215-9. Ivan Bayross, "SQL, PL/SQL the Programming Language of Oracle", BPB Publications, 2014 ISBN: 9788176569644. Connally T, Begg C., "Database Systems- A Practical Approach to Design, Implementation and Management", Pearson Education, 5th Edition, 2010, ISBN 81-7808-861-4. Pramod J. Sadalage and Martin Fowler, "NoSQL Distilled", Addison Wesley, ISBN 10: 0321826620, 2013, ISBN 13: 978-0321826626. 		
Reference Books		
<ol style="list-style-type: none"> C. J. Date, "An Introduction to Database Systems", Addison-Wesley, 8th Edition, 2004, ISBN 0321189566. S. K. Singh, "Database Systems: Concepts, Design and Application", Pearson Education, 2009, ISBN 9788177585674. Kristina Chodorow, Michael Dierolf, "MongoDB: The Definitive Guide", O'Reilly Publications, 3rd Edition, 2019 ISBN 9781491954461. Kevin Roebuck, "Storing and Managing Big Data - NoSQL, HADOOP and More", Emereo Pty Limited, 2011, ISBN 1743045743, 9781743045749. 		
Online References		
<ol style="list-style-type: none"> MySQL: https://dev.mysql.com/doc/ Coursera: "Database Management Essentials", https://www.coursera.org/learn/database-management 		

Second Year B. Tech Information Technology														
Semester-IV														
Course Code: IT24PCC256										Course Name: Operating Systems Lab				
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	PR	OR	TOTAL	L	P	T	TOTAL
-	2	-	-	-	-	-	-	50	-	50	-	1	-	1
Prerequisite: C Programming Language, Computer Organization														
Course Objectives:														
<ul style="list-style-type: none"> ● To learn and execute basic Linux commands and write shell scripts for effective file manipulation, process control, and text processing. ● To develop proficiency in system-level programming, focusing on process creation, synchronization, and inter-process communication using system calls. ● To implement and analyze fundamental CPU scheduling, synchronization, and deadlock handling algorithms to gain practical understanding of operating system concepts. ● To design and implement solutions for classical concurrency problems such as Producer-Consumer, Reader-Writer, and Dining Philosophers using semaphores and mutexes. ● To gain hands-on experience in Linux kernel programming, including adding and demonstrating new system calls by modifying and compiling the kernel. 														
Course Outcomes:														
After completing the course, the students will be able to:														
CO1: Execute and write shell scripts using essential Linux commands (e.g., echo, grep, sed, loops) to automate tasks and process data efficiently.														
CO2: Create and manage processes using fork, wait, and demonstrate process states such as zombie and orphan.														
CO3: Implement and simulate CPU scheduling algorithms and classical synchronization problems using counting semaphores, mutexes, and other synchronization primitives.														
CO4: Write code to handle deadlock avoidance and memory/disk management algorithms, including page replacement and disk scheduling.														
CO5: Modify Linux kernel source code to add new system calls and demonstrate kernel-level programming skills through compilation and user-space interaction.														
Sr.No.	Name of the Experiment													Duration (Hrs.)
1.	Study of Basic Linux Commands: echo, ls, read, cat, touch, test, loops, arithmetic comparison, conditional loops, grep, sed find, diff, tac and Bash scripting													2
2.	Implement the C program in which the main function accepts the integers to be sorted. The main function uses the FORK system call to create a new process called a child process. The parent process sorts the integers using a sorting algorithm and waits for the child process using WAIT system call to sort the integers using any sorting algorithm. Also demonstrate zombie and orphan states													4

3.	Implement the C program to simulate any 2 CPU Scheduling Algorithms (1 preemptive and 1 non- preemptive) with different arrival times.	2
4.	Implement the C program for Producer Consumer problem using counting semaphores and mutex/binary semaphore	2
5.	Implement the C program for Reader-Writer problem with reader priority.	2
6.	Implement the C program for Deadlock Avoidance Algorithm: Bankers Algorithm.	2
7.	Implement the C program for the Dining Philosophers problem.	2
8.	Implement the C program for any one Page Replacement Algorithm with minimum three frames as an input	4
9.	Implement the C program for any one Disk Scheduling Algorithm	2
10.	Implement Full duplex communication between two independent processes. The first process accepts sentences and writes on the first pipe to be read by the second process. The second process counts the number of characters, number of words and number of lines in accepted sentences, and writes the contents on the second pipe to be read by the first process and displays on standard output.	4
11.	Implement a new system call in the kernel space, add this new system call in the Linux kernel by the compilation of this kernel (any kernel source, any architecture and any Linux kernel distribution) and demonstrate the use of this embedded system call using C program in user space.	4
Total Hours		30
Text Books		
<ol style="list-style-type: none"> 1. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, 8th Edition, 2014, ISBN-10: 0133805913 • ISBN-13: 9780133805918 2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley & Sons, Inc., 9th Edition, 2012, ISBN 978-1-118-06333-0 3. Arnold Robbins, Nelson H. F. Beebe, Classic Shell Scripting, O'Reilly Media, Inc., 2005, ISBN 9780596005955 		
Reference Books		
<ol style="list-style-type: none"> 1. Tom Adelstein and Bill Lubanovic, Linux System Administration, O'Reilly Media, ISBN-10: 0596009526, ISBN-13: 978-0596009526. 2. Harvey M. Deitel, Operating Systems, Prentice Hall, ISBN-10: 0131828274, ISBN-13: 978-0131828278. 3. Thomas W. Doepfner, Operating System in depth: Design and Programming, WILEY, ISBN: 978- 0-471-68723-8. 4. Mendel Cooper, Advanced Shell Scripting, Linux Documentation Project. 5. Andrew S. Tanenbaum & Herbert Bos, Modern Operating System, Pearson, ISBN-13: 9780133592221, 4th Edition. 		
Online References		
<ol style="list-style-type: none"> 1. NPTEL Course: Prof. Rajib Mall, IIT Kharagpur, "Real Time Operating System", https://onlinecourses.nptel.ac.in/noc25_cs78/preview 		

2. "Think OS: A Brief Introduction to Operating Systems", Allen B. Downey,
<https://www.e-booksdirectory.com/details.php?ebook=9907>
3. "Operating System Course: Learn Fundamentals of Operating System", Srikanth Varma,
<https://www.scaler.com/topics/course/free-operating-system-course/>



Second Year B.Tech Information Technology														
Semester IV														
Course Code : IT24VSE257										Course Name: Web Development				
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ET E	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	4	-	-	-	-	-	50	-	-	50	-	2	-	2
Pre-requisites: UI/UX design, basics of database management systems.														
Course Objectives:														
<ul style="list-style-type: none"> To familiarize students with Web Programming basic concepts To learn and understand Web scripting languages. To explore the Front end& Back end web programming skills. To understand and learn Web application deployment. 														
Course Outcomes :														
After completing the course, the students will be able to:														
CO1: Understand the fundamental concepts in designing web based applications and apply frontend and backend technologies.														
CO2: Apply the client side and server side technologies for web application development														
CO3: Analyze the web technology languages, frameworks and services.														
CO4: Create effective web applications for business functionalities using the latest web development platforms.														
Contents in Association with Elite Software														
Content related to assignments:														
Website planning, Front End Development (HTML, CSS, Bootstrap, Validation and Design Layout Development.),Responsive Website Development, Introduction of Bootstrap, Bootstrap Components and applying on web pages,JAVA Script, Connectivity using JDBC driver, Website hosting terminologies														
Sr. No.	Activities													Duration (Hrs.)
1.	Website planning: Students should visit different websites (Minimum 7) for the different client projects and note down the evaluation results for these websites. Refer the following points for the same:Website URL,Purpose of Website, Things liked in the website, Things disliked in the website,Look and Feel, Target audience,Navigation, Content Representation,Responsiveness, Overall evaluation of the website													4
2.	Design an attractive web page for an online food delivery system using HTML and CSS, craft a user-friendly interface with navigation, engaging content sections, and responsive design to enhance the overall dining experience. Also add the basic pages "Home," "About," "Menu," and "Contact Us," featuring the													6

	company logo "Online FoodShop".	
3.	Design and Build a Survey/Feedback Form for food delivery systems using HTML and CSS. The form should include various questions for users to answer. Use HTML to design the basic layout of the form, and CSS to enhance the design with elements such as text decoration, text color, background color, text alignment, margin, padding, and more.	6
4.	A] Implement an online food delivery application in Java Script using following: a) Design UI of application using HTML, CSS etc. b) Include Java script validation c) Use of prompt and alert window using Java Script B] Design a Student Grade Calculator using HTML CSS and JavaScript.	8
5.	Design a User login page for online food ordering system with entries for name, mobile number email id and login button and perform following validations. a) Validation for correct names b) Validation for mobile numbers c) Validation for email id d) Validation if no entered any value e) Congratulations and welcome page upon successful entries	6
6.	Write a JDBC Program in JAVA to perform following operations on the online food ordering system database. a) Add record b) Delete record c) Update record d) Display record	8
7.	Create a landing page for a website of your choice using bootstrap.	8
8.	Study and Write the following terminologies for hosting a website: DNS, ICANN, domain ownership, name server, app code, domain transfer process, domain name buying and selling process, What is hosting, types of hosting, difference between shared, VPS, dedicated and Cloud hosting, cpanel, starting your own domain name and hosting service without any investment.	8
Total Hours		54
Sample Project Based Learning (PBL) Topics (Any One)		
P1	Develop a web app that allows users to track their income, expenses, and budget. Users can categorize transactions, set financial goals, and visualize financial health.	
P2	Build a blog platform where you can write and publish articles. Showcase your thoughts, experiences, and expertise. Use HTML, CSS, JavaScript (for dynamic features)	
P3	Build a travel booking platform where users can search for flights, hotels, and tours. Implement features like personalized recommendations, booking management, and payment gateways. Use JDBC connectivity for the same.	

P4	Develop a professional portfolio website for showcasing your skills, projects, and resume. Include sections like an about me page, project showcase, skills, and contact information. Use HTML for content structure, CSS for styling, and consider adding smooth scrolling animations.
P5	Create an end-to-end event management system for organizing conferences, workshops, or festivals. Allow event organizers to create events, manage registrations, and track attendance. Implement features like ticketing, notifications, and analytics.
P6	Develop a fun quiz app with 10 randomly generated questions from different categories to easily play and test your knowledge.
P7	Develop a Weather Forecasting Website. To help people check weather conditions, developers can create a weather forecast website with this web dev project. They can develop different features to check weather conditions, humidity, current temperature, and wind speed.
P8	Develop a web-based dashboard that interacts with various smart home devices. Users should be able to view the status of each device (on/off, temperature, security alerts) and control them directly from the dashboard.
Text Books	
<ol style="list-style-type: none"> 1. Jeffrey C.Jackson, "Web Technologies: A Computer Science Perspective", Second Edition, Pearson Education, 2007, ISBN 978-0131856035 2. DT Editorial Services " HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)" 2Ed , Dreamtech Press. 3. Kogent Learning Solutions Inc, Web Technologies: HTML, JavaScript, PHP, Java, JSP, ASP.NET, XML and Ajax, Black Book 	
Reference Books	
<ol style="list-style-type: none"> 1. Marty Hall, Larry Brown, "Core Web Programming", Second Edition, Pearson Education, 2001, ISBN 978-0130897930. 2. Kathy Sierra, Bert Bates, Trisha Gee, "Head First JAVA", Third Edition, O'Reilly Media, Inc, ISBN: 9781491910771 3. Laura Lemay, Rafe Colburn and Jennifer Kyrnin, "Mastering HTML, CSS & Javascript Web Publishing", SAMS, BPB Publications 	
Online References	
<ol style="list-style-type: none"> 1. HTML, "The Complete Reference", http://www.htmlref.com/ 2. "Online Resource", Online Content Dreamtech Press- Books & Education Solutions 	

Second Year B. Tech Information Technology														
Semester- IV														
Course Code : IT24EEM258					Course Name: Startup Fundamentals and Financing									
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	PR	OR	TOTAL	L	P	T	TOTAL
-	-	2	-	-	-	-	50	-		50	-	-	2	2
Prerequisites: Problem-solving and critical thinking skills, Professional Communication and Personality Development.														
Course Objectives: <ul style="list-style-type: none"> ● To identify business opportunities through market analysis and customer pain points. ● To develop value-driven products using tools like the Value Proposition Canvas. ● To explore startup business models and validate key assumptions. ● To develop and validate Minimum Viable Products based on real customer feedback. ● To apply financial and marketing strategies for startup growth and scalability 														
Course Outcomes: After completing the course, the students will be able to: C01: Analyze the key concepts and frameworks shaping the innovation and start-up ecosystem. C02: Develop expertise in building a startup ecosystem, understanding its key components, managing dynamics, and boosting its overall productivity. C03: Evaluate the contributions of various stakeholders within the ecosystem in promoting and sustaining the growth of start-ups. C04: Demonstrate an understanding of global trends in the startup ecosystem and product development. C05: Analyze and compare various startup ecosystems, and develop performance indicators to evaluate their effectiveness.														
Unit	Contents													Duration (Hrs.)
1.	Start-up Opportunity: Identify business opportunity with problem identification, market size, existing pains for customers, existing alternatives, customer psychology, willingness to pay, customer segments.													5
2.	Product/ Service Proposal: Value Proposition Canvas, problem-solution fit, brainstorming, competition analysis, creating competitive advantage, sustainable differentiation.													5
3.	Business model: Types, Lean canvas, Risky assumptions related to product, market, business, and execution capabilities													5

4.	Minimum Viable Product (MVP): Create and iterate, testing of MVP, customer feedback, validate risky assumptions, solution-market fit	5
5.	Financial Plan and Marketing strategy: Manpower, Sales, Expenses, profitability projections, reality check, Funding plan, Pitch deck, Importance of brand and branding strategy, positioning, market penetration strategy/ plan, digital marketing, use of social media, Customer acquisition Use of technology: for business scalability, effective execution, growth plan	6
Total Hours		26

Text Books

1. Startup and Entrepreneurship - Learn Before Start, Prasanjeet Anand, White Falcon Publishing; 1 edition, 2023.
2. Startup Finance 360° - Founder's Guide to Startup Finance, ZebraLearn Pvt Ltd, ISBN-10-8196373597.
3. Entrepreneurship in Action, Coulter, PHI 2nd Edition.
4. Entrepreneurship Development, E. Gordon & K. Natarajan, Himalaya.
5. Poornima M. Charantimath, Entrepreneurship Development and Small Business Enterprises, 3rd Edition, Pearson Education, 2018.

Reference Book

1. The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company, Steve Blank and Bob Dorf, K & S Ranch ISBN – 978-0984999392.
2. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Eric Ries, Penguin UK ISBN – 978-0670921607.
3. Entrepreneurship Development and Small Business Enterprise, Poornima Charantimath, Pearson Education; ISBN: 978-8131759196.
4. Peter Thiel & Blake Masters, Zero to One: Notes on Startups, or How to Build the Future, Random House, 2014.
5. The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company, Steve Blank and Bob Dorf, K & S Ranch ISBN – 978-0984999392.

Online References

1. <https://www.entrepreneur.com/article/251687>
2. <https://www.forbes.com/sites/forbesbusinessdevelopmentcouncil/2020/09/14/13-key-steps-to-developing-a-go-to-market-strategy/?sh=53023c476fc1>
3. <https://skillindia.gov.in/>
4. <https://startuptalky.com/list-of-government-initiatives-for-startups/>

Second Year B. Tech Information Technology														
Semester - IV														
Course Code: SH24VEC201						Course Name: Environment Sustainability								
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	-	2	-	-	-	-	50	-	-	50	-	-	2	2
Prerequisites: A basic understanding of environmental science, geography, or social studies.														
Course Objectives:														
<ul style="list-style-type: none"> Understand the foundational concepts of sustainability, including its social, environmental, and economic dimensions, and the global need for sustainable development. Gain insights into the 17 United Nations Sustainable Development Goals (SDGs) and the role of technology, international cooperation, and policy in achieving them. Identify and explain different types of pollution (air, water, solid waste), their sources and impacts, and sustainable approaches to waste management including the 3Rs (Reduce, Reuse, Recycle) and zero-waste concepts. Evaluate global and local environmental challenges, including climate change, global warming, ozone depletion, and resource degradation. 														
Course Outcomes:														
After the completion of course, the students can:														
CO1: Describe the fundamental ideas of environmental sustainability.														
CO2: Examine sustainability's social, economic, and environmental facets.														
CO3: Analyse how human actions affect Environmental systems.														
CO4: Propose strategies for sustainable development in various sectors.														
Unit	Content													
1.	Introduction to Environmental Sustainability: Global environmental issues, Foundations of Environmental Sustainability. Sustainability: Challenges, potential; role of technology, policies.													
2.	Environmental Pollution and Waste Management: Air Pollution: Sources and Effects of Air Pollution. Water Pollution: Sources of Water Pollution, Sustainable Wastewater Treatment. Solid Waste zero Waste Concepts (3R Concept).													
3.	Climate Change and Energy: Understanding Climate Change, Science and impacts of climate change Climate modeling and adaptation, Sustainable Energy Solutions, Renewable energy technology, Efficient energy system and conservation													
4.	Sustainable Development Practices: Sustainability in Cities, infrastructure and cities that are sustainable, green buildings and smart cities.													

Sr. No.	List of Tutorial (Select any 08 activities out of 10 contributing to 26 hours)	Duration (Hrs.)
1.	Examine the river pollution in Pune.	4
2.	Prepare a climate change strategy for your town, city, or building.	4
3.	Initiate a campaign to bring emphasis to a sustainability concern.	4
4.	Examine The Current Environmental Issue	2
5.	Examine a successful sustainability attempt from the real world	2
6.	Home energy audit: Have students make a list of all the appliances and light bulbs in their house. How much energy does their house use if all the lights are on for 4 hours per day? If their appliances are on for 2 hours per day? How much energy could they save if they switched to energy-efficient appliances or lightbulbs?	2
7.	Use recycled material in art projects: recycled materials can make beautiful art projects such as jewelry, planters, and birdhouses. Incorporating materials that would otherwise be thrown away into art projects can show your students how to find new uses for these items.	2
8.	Life cycle: One way to show students what happens when you put something in the trash versus recycling or reusing the object is to do a life cycle analysis. This is a flowchart that shows the environmental impacts of an object, from extracting the raw materials to decomposition and everything in between. When something is put in the trash instead of being reused or recycled, the life cycle assessment will show a bigger environmental impact. When something is reused or recycled, the environmental impact is less because raw materials don't need to be extracted to create something new.	4
9.	Go on a field trip: Visit your local landfill, recycling center, or a nearby composting facility where the students can see firsthand what is happening to waste and learn about the lifecycle of waste and its effect on the environment.	2
10.	Compare carbon footprints of different materials used in construction or manufacturing in India.	2
Total Hours for 08 Activities		26

Text Books

1. Sharma, "P.D. Ecology and Environment", Rastogi Publications, 2020.
2. Kaushik, C.P., Kaushik, Anubha, "Perspectives in Environmental Studies New Age", International Publishers, 2021.
3. Agarwal, S.K. "Environmental Management", APH Publishing Corporation, 2005.

Journals and Articles

1. Kalam, A.P.J. Abdul, Srijan Pal Singh, "Target 3 Billion Innovative Solutions Towards Sustainable Development", Penguin Books, 2011.
2. Kolbert, Elizabeth, "The Sixth Extinction: An Unnatural History", Henry Holt and Co., 2014.

Online References

1. NPTEL Course : Prof. Trupti Mishra, IIT Bombay "Business and Sustainable Development"
[<https://nptel.ac.in/courses/110101153>]
2. NPTEL Course :By Prof. Brajesh Kumar Dubey , IIT Kharagpur "Sustainable Engineering Concepts And Life Cycle Analysis" [https://onlinecourses.nptel.ac.in/noc23_ce90/preview]



AICTE Approved Programmes

Branch	Intake			Career Options
	B.Tech.	M.Tech.	Working Professional Direct Second Year	
Computer Engineering	180	Computer Engineering:18	---	Data Science, Artificial Intelligence (AI), Big Data Analytics, High Performance Computing (HPC), Machine Learning, Database Engineering, Computer Networks, Cyber Security, IOT
Electrical Engineering	60	Power Electronics & Drives: 06	30	Public Sector, Power Sector, Software Development, Maintenance Engineering, Contractor & Supervisor, Energy Auditor, Internet of Things (IoT), Robotics and Automation, Industry 4.0, Chartered Engineer, Electric Vehicles,
Electronics & Telecommunications Engineering	180	VLSI and Embedded System: 06	---	Internet of Things (IoT), Robotics and Automation, Industry 4.0, Wireless Communication 4G, 5G, 6G, Artificial Intelligence, VLSI, Embedded Systems, Satellite Communication, Data Science, Power Electronics, Computer Networking, Blockchain Technology, Signal Processing, Electronic Design
Information Technology	180	Data Science: 06	---	Software Development & Testing, Cyber Security, Cloud Computing, Big Data Analytics, IoT, Machine Learning, Artificial Intelligence, Blockchain, Database Management, Data Engineer, Data Science
Mechanical Engineering	120	Design Engineering: 06	30	Machine Design, System Modeling, Simulation, Robotics, Mechatronics, Rapid Prototyping, 3D Printing, Composite Materials, Automotive & Electrical Vehicles, Manufacturing Sector, HVAC Systems, Energy Engineering and Process Industry, Robotics, Data Science, Public Sector, Power Sector, Software Development, Mechanical Design Engineer, Design Quality Assurance Manager, Engineering, Service, Teaching, Designing Machines & Tools
Artificial Intelligence and Data Science	180	---	---	Cyber Security Analyst, Software Development Expert, Artificial Intelligence Engineer, Data Scientist, Data Analysis, Machine Learning Engineer, Machine Learning Architect, Product Analyst, Software Architect, Data Warehouse Engineer, Product Manager, Front-end Developer, Full Stack Developer
Ph.D Research Center in Computer Engineering.				

Industry Connect through Professional Bodies / Students' Chapters

- ◆ CII
- ◆ ISHRAE
- ◆ ACM
- ◆ ISRD
- ◆ GDSC
- ◆ IE(I)
- ◆ TATA
- ◆ ASHRAE
- ◆ IETE
- ◆ DICCI
- ◆ IEEE
- ◆ ISACA
- ◆ MCCIA
- ◆ SAEINDIA
- ◆ CSI
- ◆ ISTE
- ◆ STP

OUR PROMINENT RECRUITERS

