

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

An Autonomous Institute Affiliated to SPPU



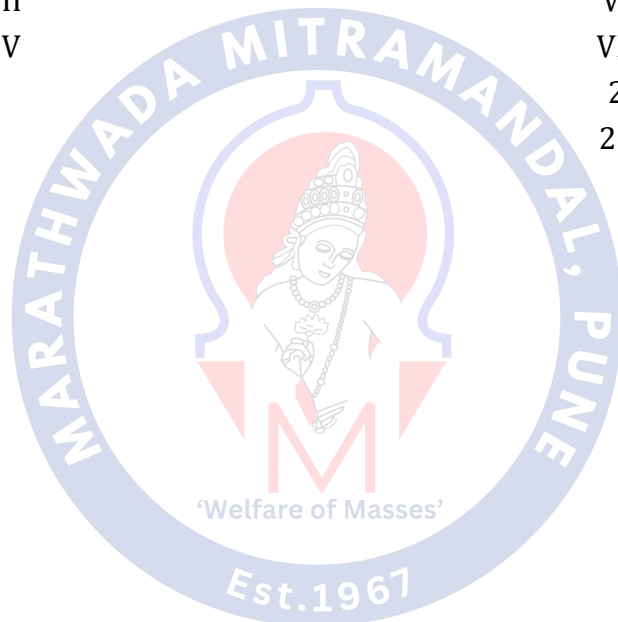
Curriculum for
Second Year B. Tech Information Technology

A.Y. 2026-27

Permanently 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

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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.

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.

Program Outcomes (PO)

- **PO1: 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.
- **PO2: Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
- **PO3: Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
- **PO4: Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
- **PO5: Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
- **PO6: The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
- **PO7: Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
- **PO8: Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
- **PO9: Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
- **PO10: Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
- **PO11: Life-Long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

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.



Abbreviations

BSC:	Basic Science Course
UG:	Undergraduate Programme
ESC:	Engineering Science Course
PCC:	Program Core Courses
PEC:	Program Elective Courses
MDM:	Multidisciplinary Minor Courses
OE:	Open Elective
VSC:	Vocational Skill Course
SEC:	Skill Enhancement Course
AEC:	Ability Enhancement Course
IKS:	Indian Knowledge System
VEC:	Value Education Course
FP:	Field Project
CC:	Co-Curricular Course
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



Curriculum Structure Sem-III

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
IT24MDM204	*(Multidisciplinary Minor Theory)	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
IT24MDM207	*(Multidisciplinary Minor Lab)	MDM	-	2	-	-	-	25	-	-	25	-	1	-	1
IT24CEP208	Community Centered Project	CEP	-	4	-	-	-	50	-	-	50	-	2	-	2
IT24VEC210	Universal Human Values	HSSM-VEC	-	-	2	-	-	50	-	-	50	-	-	2	2
IT24RMD211	Research Methodology and Publications	RMD	-	-	2	-	-	50	-	-	50	-	-	2	2
SH24AEC202	Professional Communication and Personality Development	HSSM-AEC	-	-	2	-	-	50	-	-	50	-	-	2	2
Total			11	10	6	160	240	250	100	-	750	11	5	6	22

*** Refer separate booklet for MDM and OEL**

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

Curriculum Structure Sem-IV

Second Year B.Tech Information Technology SEMESTER IV															
Course Code	Course Name	Course Type	Teaching Scheme(Hrs/w eek)			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
IT24OEL254	*(Open Elective Theory)	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	HSSM-EEM	-	-	2	-	-	50	-	-	50	-	-	2	2
SH24VEC201	Environment Sustainability	HSSM-VE C	-	-	2	-	-	50	-	-	50	-	-	2	2
Total			12	8	4	160	240	150	100	-	650	12	4	4	20

*** Refer separate booklet for MDM and OEL**

Abbreviations:

L- lecture

ETE- End Term Examination

L : 1 Hr.= 1 credit

P- Practical

TW- Term work

P: 2 Hr. = 1 Credit

T- Tutorial

PR- Practical

T: 1 Hr. = 1 Credit

CIE-Continuous Internal Evaluation

OR- Oral

SEMESTER III



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	2	-	-	-	40	60	-	50	-	150	3	1	-	4
Prerequisite: Fundamental knowledge of programming language and basics of algorithms														
Course Objectives:														
- 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:														
C01: Analyze algorithms with respect to time and space complexity.														
C02: Select appropriate searching and/or sorting techniques in the application development.														
C03: Apply the concept of Abstract Data Types to represent and manipulate data structures.														
C04: Apply learned algorithms and data structures to solve the problems.														
C05: Design and implement different hashing functions														
Unit	Contents													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' Sequential organization: Single and multidimensional array and address calculation 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:													8

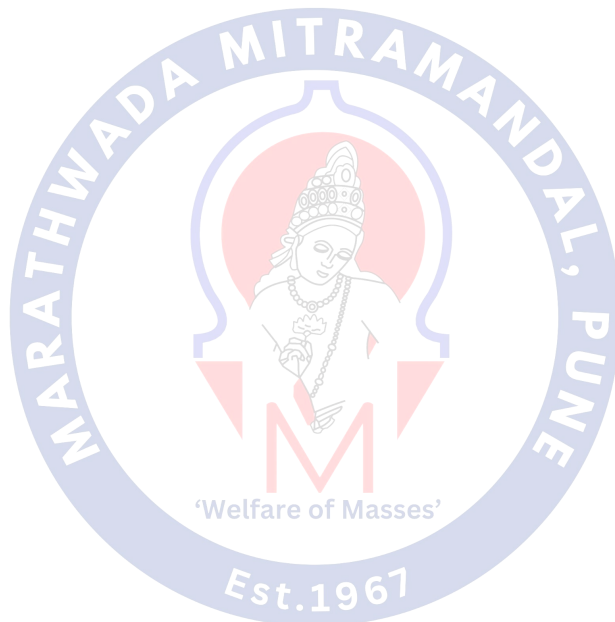
	Bubble, insertion, Quick, Merge Hashing: Hash tables and scattered tables: Basic concepts, hash function, characteristics of good hash function, Different key-to-address transformations techniques, synonyms or collisions, collision resolution techniques- linear probing, quadratic probing, rehashing, chaining with and without replacement	
3	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.	8
4	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, Red and Black Tree Threaded binary Tree: Concept of threaded binary tree (inorder, preorder and postorder). Preorder and In-order traversals of in-order threaded binary tree Applications of Trees: Heap, Huffman	8
5	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.	8
Total Hours		40
Text Books		
1. Gilberg, B. Forouzan, "Data Structures: A pseudocode approach with C", Cengage Learning, 2nd edition. 2. Alfred Aho, John Hopcroft, Jeffrey Ullman, "Data Structures & Algorithms", Pearson Publication 3. Y. Kanetkar, "Data Structures through C," 5th edition BPB Publications, 2023		
Reference Books		
1. Reema Thareja, "Data Structures using C ", Second Edition, Oxford Higher Publication 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

1. NPTEL Course: "Data Structures and Algorithms" ([Link](#))
2. NPTEL Course: "Data Structures and Algorithms Using Java" ([Link](#))
3. Coursera Specialization: "Data Structures and Algorithms Specialization" ([Link](#))



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	-	50	-	100	3	-	-	3
Prerequisite: C Programming														
Course Objectives: - 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 learn 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: C01: Demonstrate the Object-Oriented Programming concept C02: Design and develop programs using classes, constructors, and destructors to represent real-world entities. C03: Apply inheritance to create derived classes from base classes for code reusability C04: Implement file input and output (I/O) operations in C++ C05: Apply built-in algorithms from STL to efficiently solve common problems.														
Unit	Contents										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			

	Polymorphism: Introduction of Polymorphism, Function Overloading, Function Overriding. Operator Overloading: Introduction, syntax, overloading unary and binary operators. Runtime Polymorphism: Pointers to Base class, virtual function and its significance in C++, pure virtual function and virtual table, virtual destructor, abstract base class.	
4	Friend Functions: Friend Function Definition, Friend Classes. 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	8
5	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 Templates & STL: Function and Class templates and using STL like containers, algorithms	8
Total Hours		39
Text Book		
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		
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		
1. NPTEL Course: Prof. D. Janakiram, IIT Madras, "Programming in C++" (Link) 2. NPTEL Course: Prof. Debasis Samanta, IIT Kharagpur, "Programming in Modern C++" (Link) 3. LinkedIn Learning Course: "C++ Standard Template Library (STL)" (Link) 4. LinkedIn Learning Course: "C++ Essential Training" (Link)		

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: - 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.	
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 Requirement Ambiguities, Conflict Identification and Resolution, Requirement Qualities	8
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 Hrs.
List of Activities		
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

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

Reference Books

1. Pankaj Jalote, "Software Engineering: A Precise Approach", Wiley India, ISBN: 9788-1265-2311- 5
2. Rajib Mall, "Fundamentals of Software Engineering", Prentice Hall India, ISBN-13: 9788-1203- 4898-1
3. Soren Lauesen, '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. 3
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

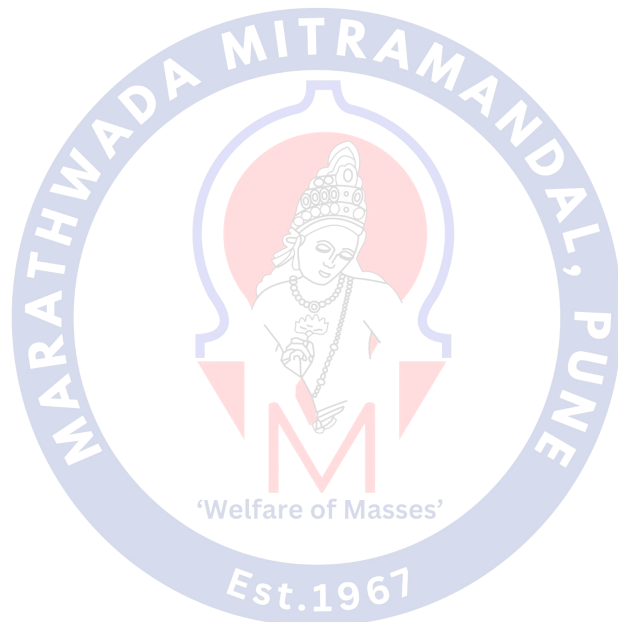
- NPTEL Course : Prof. Rajib Mall, IIT Kharagpur, "Software Engineering" ([Link](#)).

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	TW	PR	OR	TOTAL	L	P	T	TOTAL
-	2	-	-	-	-	-	-	50	-	50	-	1	-	1
Prerequisite: C programming Language, Basics of Algorithms														
Course Objectives: • Significance of Data structures and its use • Problem solving approach using data structures • Linear and Non-linear data structures to solve real world problems • 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														
List of Experiments														
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) • Design a roll call list, arrange list of students according to roll numbers in ascending order (Use Bubble Sort) • Arrange a list of students alphabetically. (Use Insertion sort) • Arrange a list of students to find out first ten toppers from a class. (Use Quick sort) • 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) • 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. • Insertion (Enqueue)												2		

• Deletion (Dequeue) • Display (Note: Handle queue full condition by considering a fixed size of a queue.)	
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: • Insert (Handle insertion of duplicate entry) • Delete • Search • 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 • 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 • Linear probing with and without replacement • Chaining with and without replacement	4
Total Hours	30
Text Books	
1. Gilberg, B. Forouzan, "Data Structures: A pseudocode approach with C", Cengage Learning, 2nd edition. 2. Alfred Aho, John Hopcroft, Jeffrey Ullman, "Data Structures & Algorithms", Pearson Publication 3. Y. Kanetkar, "Data Structures through C," 5th edition BPB Publications, 2023	
Reference Books	
1. Reema Thareja, "Data Structures using C ", Second Edition, Oxford Higher Publication 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

1. NPTEL Course: "Data Structures and Algorithms" ([Link](#))
2. NPTEL Course: "Data Structures and Algorithms Using Java" ([Link](#))
3. Coursera Specialization: "Data Structures and Algorithms Specialization" ([Link](#))



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: - 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: C01: Apply basic C++ concepts like control structures, classes, and arrays to build simple programs C02: Implement object-oriented features such as constructors, destructors, inheritance, and polymorphism. C03: Design and implement complex C++ programs using operator overloading, templates, and exception handling to solve advanced computational problems. C04: Develop file handling systems to efficiently manage, store, and retrieve persistent data in real-world application C05: Apply STL containers and algorithms to perform data manipulation, sorting, and searching on user-defined records.														
List of Experiments														
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	4
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.	4
11	Write a program using STL containers.	2
Total		34

Text Book

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

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

1. NPTEL Course: Prof. D. Janakiram, IIT Madras, "Programming in C++" ([Link](#))
2. NPTEL Course: Prof. Debasis Samanta, IIT Kharagpur, "Programming in Modern C++" ([Link](#))
3. LinkedIn Learning Course: "C++ Standard Template Library (STL)" ([Link](#))
4. LinkedIn Learning Course: "C++ Essential Training" ([Link](#))

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	PR	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: • 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: • 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:

- 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.

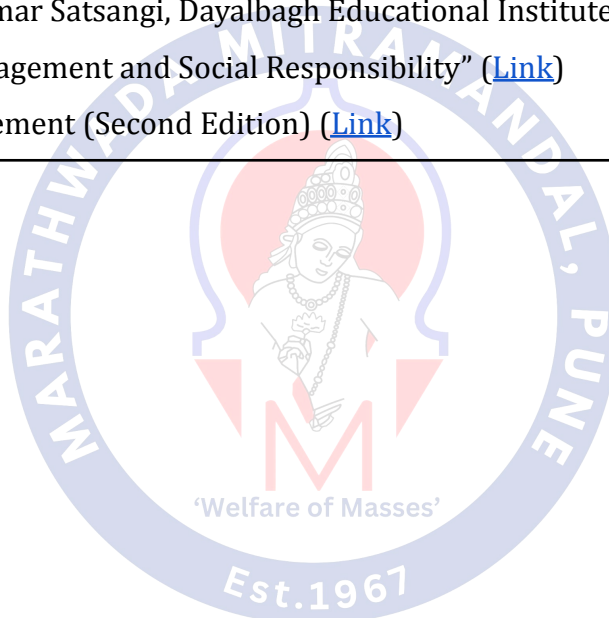
PART A

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):	4

	Analyze the required data in the chosen domain. Identify stakeholders and gather functional as well as non-functional requirements for the proposed project.	
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 - 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.	
2.	Waste Management - 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.	Climate Change - 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.	Career Orientation of Youth - 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.	Traditional & Modern Health Care Methods - 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.	Renewable Energy & Solar Systems - Solar Power Usage Tracker – IoT dashboard monitoring solar panel output vs. household consumption. - Green Energy Awareness App – Game/quiz-based app teaching renewable energy concepts. - 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.	Yoga Awareness & Practice - 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.	Women Education & Empowerment - 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.	Music & Dance - 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		
- NPTEL Course: Prof. Akshay Kumar Satsangi, Dayalbagh Educational Institute, Agra, Uttar Pradesh, "Community Engagement and Social Responsibility" (Link) - Principles of Community Engagement (Second Edition) (Link)		



Second Year B. Tech Information Technology															
Semester-III															
Course Code: IT24VEC210											Course Name: Universal Human Values				
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	
Prerequisite:															
1. Readiness for Self-Exploration															
The course is not about memorizing facts but about a process of dialogue between what you are and what is naturally acceptable to you. You should be prepared to:															
• Verify proposals: Treat course content as "proposals" to be tested against your own Natural Acceptance rather than dogmas to be accepted blindly. • Validate experientially: Be willing to test these values in your daily living to see if they actually lead to harmony and happiness.															
2. Openness to Holistic Thinking															
The syllabus moves from the individual to the family, society, and finally nature. You need an initial willingness to:															
• Look beyond individual success toward mutual fulfillment. • Acknowledge the interconnectedness between yourself and the "four orders" of nature (physical, bio, animal, and human).															
Course Objectives:															
• Development of a holistic perspective based on self- exploration about themselves (human-beings), family, society and nature/existence. • Understanding of the harmony in the human-beings,family, society and nature/existence. • Strengthening of self-reflection. • Development of commitment and courage to act.															
Course Outcomes:															
After the completion of course, the students can:															
C01: Recognize the concept of self-exploration as the process of value education and see they have the potential to explore on their own right.															
C02: Explore the human being as the coexistence of self and body to see their real needs basic aspirations clearly.															
C03: Explain relationship between one self and the other self as the essential part of relationship and harmony in the family															
C04: Interpret the interconnectedness, harmony and mutual fulfilment inherent in the nature and the															

entire existence

Contents		
1	Introduction to Value Education and Harmony in the Human Being i. Understanding Value Education ii. Self-exploration as the Process for Value Education iii. Continuous Happiness and Prosperity- the Basic Human Aspirations and their Fulfilment iv. Right Understanding, Relationship and Physical Facility v. Happiness and Prosperity- Current Scenario vi. Method to Fulfil the Basic Human Aspirations	
2	Harmony in the Human Being : i. Understanding Human being as the Co-existence of the Self and the Body ii. Distinguishing between the Needs of the Self and the Body iii. The Body as an Instrument of the Self iv. Understanding Harmony in the Self v. Harmony of the Self with the Body vi. Programme to Ensure self-regulation and Health	
3	Harmony in the Family, Society and Nature : i. Harmony in the Family- the Basic Unit of Human Interaction "Trust"- the Foundational Value in Relationship ii. 'Respect'- as the Right Evaluation iii. Values in Human-to-Human Relationship iv. Understanding Harmony in the Society v. Vision for the Universal Human Order vi. Understanding Harmony in Nature – Interconnectedness and Mutual Fulfillment	
4	Professional Ethics and Application of Values: i..Competence in Professional Ethics: Ability to Utilize Values in Decision-Making ii. Ethical Human Conduct – The Foundation of Universal Human Order iii. Integration of Human Values with Technical Education	
List of Tutorials		
Sr. No	List of Tutorial	Duration
1	Structured Self-Exploration Reflection Report	4
2	Case Study analysis on Contemporary Life Issues	4
3	Value Identification from Everyday Scenarios	4
4	Reflective Journal – Harmony in Self	2
5	Group Discussion - Topics e.g The Goal of Education (Siksha-Sanskar),Health and Responsibility (Swasthya-Sanyam),Production	2

	and Nature, The Cycle of Nature, Identifying the Root Cause, Defining Conduct	
6	Role Play: Human Relationships	2
7	Debate: Material Growth versus Human Well-Being	2
8	Scenario Evaluation: Right Understanding in Personal Decisions	4
9	Engineering Ethics	2
10	Peer Interaction on Social Responsibility	2
Total Hrs		26

Text Books

1. The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978- 93-87034- 47-1
2. The Teacher's Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G
3. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
4. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press
5. AICTE Model Curriculum for Universal Human Values .

Journals and Articles

1. Dr. SARVESHWARI SHEKHAWAT (May-2025). Universal Human Values and Professional Ethics: A Path to Sustainable Development. INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT, 10(5), 276-287. <https://ijnrd.org/papers/IJNRDD001043.pdf>
2. Rani, S., Beenu, Jindal, H., Gautam, N., & Kumar, S. (2022). Importance of Universal Human Values for Life: A Study. Asian Journal of Science and Applied Technology, 11(1), 36-48.
3. <https://doi.org/10.51983/ajsat-2022.11.1.3204>

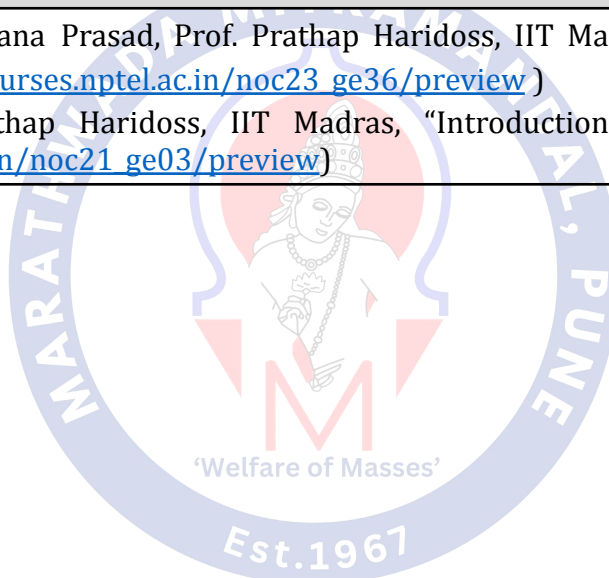
Online References

- NPTEL Course: "Exploring Human Values: Visions of Happiness and Perfect Society" ([Link](#))
- NPTEL Course: "Moral Thinking: An Introduction to Values and Ethics" ([Link](#))
- NPTEL Course: Prof. V. S. Ravi, "Human Values and Ethics" ([Link](#))
- NPTEL Course: Prof. R. R. Gaur, IIT Kanpur, "Human Values" ([Link](#))
- AICTE/UGC Resource: "Value Education Workshop Videos" ([Link](#))
- UGC/SWAYAM Resource: "Human Values Video Lectures" ([Link](#))

Second Year B. Tech Information Technology														
Semester- III														
Course Code:IT24RMD211					Course Name: Research methodology and Publications									
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
Course Objectives: • To introduce undergraduate students to the fundamentals of research and its importance in engineering innovation. • To develop awareness about research publications, patents, IPR, and research ethics. • To inculcate ethical research practices and scientific writing skills.														
Course Outcomes: After learning the course, the students will be able to: CO1: Apply the fundamental concepts of research in engineering to real-world engineering problems and demonstrate their significance. CO2: Apply basic research methodology and technical writing skills. CO3: Explain the process of research publications and intellectual property rights. CO4: Practice ethical standards in research activities.														
Sr. No.		Contents												
1		Introduction and Importance of Research Research definition and meaning, Classification of research: basic, applied, experimental, analytical, and interdisciplinary research, Research in engineering and technology, Importance of research in innovation, sustainability, and societal development, Research problem identification and formulation												
2		Research Methodology and Technical Writing Introduction of Research methodology, steps involved in conducting research, Research design and methods of data collection, Basics of Data analysis and interpretation, Structure of a technical/research paper, Literature survey: purpose, sources, and review process, Use of digital research databases, Abstract writing, keywords, and conclusion writing, Referencing styles and citation tools												

3	Research Publications, Patents, and IPR Research publications: journals, conferences, review papers, and book chapters, Indexing and quality metrics, impact factor, h-index, citation count, Predatory journals and conferences. Intellectual Property Rights (IPR): Introduction, Types of IPR: patents, copyrights, trademarks, industrial designs, Patent process: prior art search, patent filing procedure, overview of patent drafting, Role of patents in engineering and entrepreneurship	
4	Research Ethics and Professional Conduct Research ethics and responsible conduct of research, Plagiarism: types, consequences, and prevention, plagiarism detection tools, acceptable similarity index, falsification, and duplication, authorship ethics and conflict of interest, ethical issues in sponsored and collaborative research, Overview of institutional ethics committees and ethical guidelines	
List of Tutorials		
Sr. No	Name of the tutorial	Duration (Hrs)
1	Identification and formulation of a research problem statement derived from relevant societal challenges, followed by a critical discussion on sustainable and feasible solutions.	4
2	Systematic literature review related to the identified research problem to understand the current state of knowledge, research gaps, and scope for innovation.	2
3	Development of a structured research methodology, including preparation of a detailed flowchart outlining the proposed research approach and experimental/analytical steps.	4
4	Hands-on activity on patent search and analysis, along with an introduction to the patent drafting process aligned with the proposed research methodology.	4
5	Activity on plagiarism detection tools and an in-depth discussion on research ethics, academic integrity, and responsible conduct of research.	4
6	Guided activity on writing a review paper based on the selected research topic, focusing on structure, critical analysis, and scholarly presentation.	4

7	Oral presentation and documentation of the research work, demonstrating the application of the proposed methodology, findings from literature, ethical compliance, and innovation potential.	4
Total Hrs		26
Text Books		
1. Kothari C.R., "Research Methodology: Methods and Techniques", New age International Publications- 2024. 2. Dipankar Deb, Rajeeb Dey, Valentina E. Balas, "Engineering Research Methodology: A Practical Insight for Researchers", Springer Nature Singapore - 2019		
Reference Books		
1. Ranjit Kumar, "Research Methodology: A Step by Step Guide for Beginners", SAGE Publications Pvt. Ltd - 2024		
Online References		
1. NPTEL Course: By Prof. Edamana Prasad, Prof. Prathap Haridoss, IIT Madras, "Research Methodology" (https://onlinecourses.nptel.ac.in/noc23_ge36/preview) 2. NPTEL Course: By Prof. Prathap Haridoss, IIT Madras, "Introduction to Research" (https://onlinecourses.nptel.ac.in/noc21_ge03/preview)		



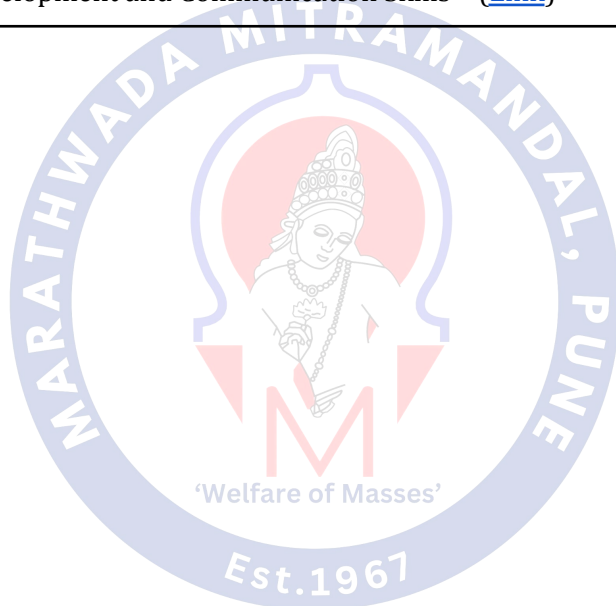
Second Year B. Tech Information Technology														
Semester-III														
Course Code : SH24AEC202					Course Name: Professional Communication and Personality Development									
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	-	2	-	-	-	-	50	-	-	50	-	-	2	2
Prerequisite: Basic understanding of LSRW skills, grammar, and vocabulary of the English Language														
Course Objectives: - To develop students' rhetorical and persuasive abilities for effective oral communication and audience engagement. - To enhance presentation skills through the appropriate use of visual aids, non-verbal communication, and confident handling of audience interactions. - 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: C01: State basic concepts in human values. C02: Explain various key terms from a business and managerial perspective. C03: Applying the legal terms in the context of business. C04: Various provisions of business laws in its functioning. C05: Illustrate and evaluate the use of Acts in business situations and the various facets of basic case laws of each Act from a legal and managerial perspective.														
Sr. No	Name of the tutorial													
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	
Sr. No	Name of the tutorial	Duration
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 Hrs		26
Text Books		
1. Stephen E. Lucas, The Art of Public Speaking, McGraw Hill Publication, ISBN-10: 260914275 ISBN-13: 9781260914276. 2. Jaishri Jethwaney and Sanjay Bhargava, Corporate Communication: Principles and Practices. 3. Dr. Ranjit Singh, Critical Thinking and Problem Solving. 4. Rajendra Pal and J. S. Korlahalli, Essentials of Business Communication, Sultan Chand & Sons, 2011. ISBN: 8180547299, 9788180547294.		
Reference Books		

1. Shiv Khera, You Can Win, Bloomsbury India, ISBN-10: 9382951717 · ISBN-13: 9789832951711.
2. Carmine Gallo, Talk Like TED, Macmillan Business.
3. Garr Reynolds, Presentation Zen: Simple Ideas on Presentation Design and Delivery, New Riders.
4. Peter Facione and Carol Ann Gittens, Think Critically.
5. Lewis Vaughn, The Power of Critical Thinking, Oxford University Press.
6. Emily Post and Peter Post, The Etiquette Advantage in Business: Personal Skills for Professional Success.

Online References

1. NPTEL Course: Technical English for Engineers – ([Link](#))
2. SWAYAM Course: English for Research Paper Writing – ([Link](#))
3. SWAYAM Course: Personality Development and Communication Skills – ([Link](#))



SEMESTER IV



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	TW	OR	PR	TOTAL	L	P	T	TOTAL
3		-	-	-	40	60	-		-	100	3		-	3
Prerequisite: Data Structures and Algorithms														
Course Objectives: - 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: C01: Analyze and design Database Management System using ER model C02: Normalize the database design using normal forms C03: Implement database queries using SQL C04: Apply Transaction Management concepts in real-time situations C05: 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.										9			

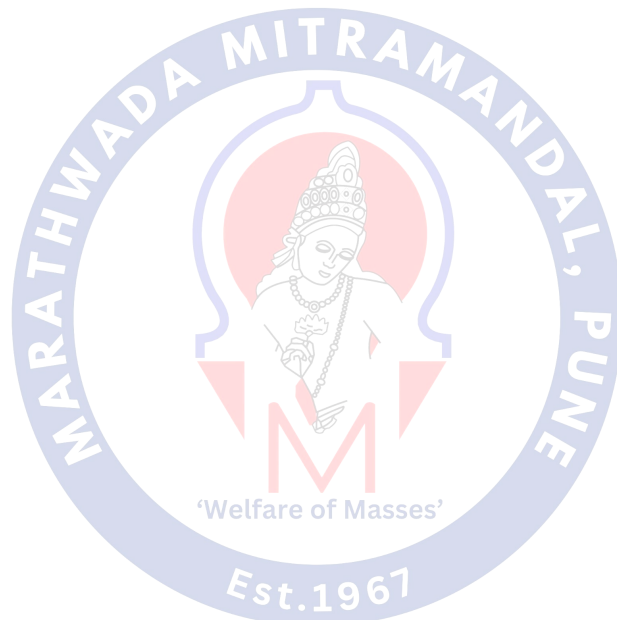
2	Relational Database Design: Relational Model: Basic concepts, Attributes and Domains, CODD's Rules, Relational Integrity: Domain, Referential Integrities, Enterprise Constraints, Database Design: Features of Good Relational Designs, Normalization, Atomic Domains and First Normal Form, 2NF, 3NF, BCNF. Case Study: Convert a Relational Database to different Normal Forms.	9
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.	9
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.	9
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	9
'Welfare of Masses' Total Hours		45
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

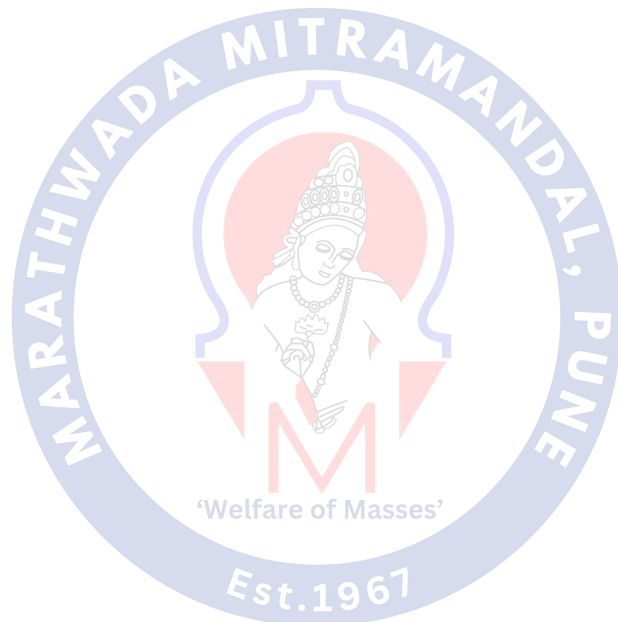
1. NPTEL Course: By Prof. Partha Pratim Das and Prof. Samiran Chattopadhyay, "Database Management Systems" ([Link](#))
2. Coursera Course: "Database Management Essentials" ([Link](#))



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	ETE	TW	PR	OR	TOTAL	L	P	T	TOTAL
3		-	-	-	40	60	-		-	100	3		-	3
Prerequisite: Data Structures and Algorithms														
Course Objectives: - To provide understanding of the concepts like virtualization, concurrency and persistence in operating systems. - To study the design and implementation of scheduling and memory management policies in Operating systems. - To demonstrate the working of concurrency and locking mechanism in operating systems - To provide insights of I/O management in Operating Systems - To make them aware of advanced topics e.g. data protection, distributed systems in Operating Systems. - To provide understanding of xv6 and Linux OS														
Course Outcomes: After completing the course, the students will be able to: C01: Apply the concepts of virtualization, concurrency, persistence, and process in operating system scenarios. C02: Implement and analyze various CPU scheduling algorithms C03: Apply different memory management techniques in an operating system to manage memory efficiently. C04: Apply synchronization mechanisms such as locks, mutexes, and semaphores to ensure mutual exclusion and correct ordering of concurrent processes. C05: Analyze the design and implementation aspects of modern operating systems through case studies of xv6 and Linux operating systems.														
Unit	Contents													Hrs.
1	Introduction to Operating Systems and Process Introduction to operating systems, Virtualizing The CPU, Virtualizing Memory, Concurrency, Persistence, Design Goals The Process: Process abstraction, System calls for Process management, Process Creation: A Little More Detail, Process States, Data Structures, Process execution mechanisms Process API, Process Control and Users, Useful Tools													9

2	Scheduling: Workload Assumptions, Scheduling Metrics, First In, First Out (FIFO), Shortest Job First (SJF), Shortest Time-to-Completion First (STCF), A New Metric: Response Time, Round Robin, Incorporating I/O, The Multi-Level Feedback Queue, The Priority Boost, Attempt, Better Accounting, Multiprocessor Scheduling, Synchronization, Cache Affinity, Single-Queue Scheduling Multi-Queue Scheduling, Linux Multiprocessor Schedulers.	9
3	Address Spaces: Early Systems, Multiprogramming and Time Sharing, The Address Space, Memory API: Types of Memory, The malloc() Call, The free() Call, Segmentation, Fine-grained vs. Coarse-grained Segmentation, Free-Space Management, Paging, A Memory Trace, Faster Translations (TLBs), TLB Basic Algorithm, TLB Issue: Context Switches, Replacement Policy, Hybrid Approach: Paging and Segments, Beyond Physical Memory: Mechanisms, Swap Space, The Page Fault, Page Fault Control Flow.	9
4	Concurrency Shared Data, Uncontrolled Scheduling, The Wish For Atomicity, Thread API : Why Use Threads?, Thread Creation, Thread Completion Locks : The Basic Idea, Pthread Locks, Building A Lock, Evaluating Locks, Controlling Interrupts, Failed Attempt: Just Using Semaphores: A Definition, Binary Semaphores (Locks), Semaphores For Ordering, The Producer/Consumer (Bounded Buffer) Problem, Reader-Writer Locks, , How to Implement Semaphores, Common Concurrency Problems, Deadlock: Necessary Conditions, Methods for Handling Deadlock: Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery Case study: Dining Philosophers problem.	9
5	I/O Devices and Advanced topics in OS System Architecture, A Canonical Device, The Canonical Protocol, Lowering CPU Overhead with Interrupts, More Efficient Data Movement With DMA, Methods Of Device Interaction, Fitting Into The OS: The Device Driver, Case Study: A Simple IDE Disk Driver, Hard Disk Drives, Files and Directories, The Fast File System, File System Implementation, The Checksum, Introduction to Embedded and real time OS.	9
Total Hours		45
Text Books		
1. Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau "Operating Systems: Three Easy Pieces", Arpaci-Dusseau Books, March, 2015 2. Stallings William., "Operating Systems", Fourth Edition, Prentice Hall of India, 2001		

Reference Books	
1.	Silberschatz, A, Galvin, P.B, and Gagne, G., "Operating System Principles", Eight Edition, John Wiley & Sons, 2008.
2.	Bach Maurice J. "The Design of the UNIX Operating System", Second Edition Prentice Hall of India, 2001
Online References	
1.	NPTEL Course: Prof. Rajib Mall IIT Kharagpur "Real Time Operating System" (Link) E-Book: Allen B. Downey" Think OS: A Brief Introduction to Operating Systems" (Link)
2.	SCALAR Course: Srikanth Verma " Operating System Course: Learn Fundamentals of Operating System" (Link)



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: - 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													Hrs.
1	Data Link Layer: Data Link Layer Design issues and Services, Framing: fixed-size framing, variable size framing. Random access: ALOHA, CSMA, CSMA/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.													9
2	Network Layer:													9

	Services, IPv4 Addresses: Classful and Classless Addressing, Special Addresses, NAT, Subnetting, Supernetting, Delivery and Forwarding of IP Packet, Structure of Router, IPv4: Fragmentation, Options, Checksum, ARP: Address Mapping, ARP Protocol, RARP, ICMPv4, Unicast Distance Vector Routing, Link State Routing, Unicast Routing Protocols: RIPv2, 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	9
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.	9
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	9
Total		45 Hrs.
List of Activities		
1. 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		
2. 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

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

Reference Books

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. Cisco Networking Academy Course: [Cisco Networking Academy](#), *Networking Essentials*. This course covers fundamental networking concepts, network devices, IP addressing, wireless networking, and troubleshooting skills.
2. Coursera Course: Google, *The Bits and Bytes of Computer Networking*, Coursera. The course covers TCP/IP, DNS, DHCP, routing, wireless networking, cloud computing, and network troubleshooting.
3. NPTEL Course: Prof. Sujoy Ghosh, Indian Institute of Technology Kharagpur, *Computer Networks*.
4. Online Documentation: [Cisco Networking Academy Learning Resources](#)
5. Online Documentation: [RFC Editor – Internet Standards and Protocols](#)
6. Online Resource: [Wireshark Documentation](#)

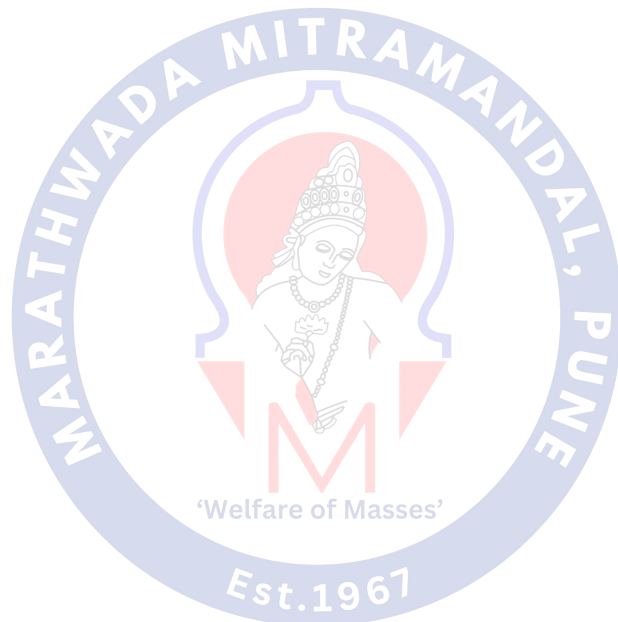
Second Year B.Tech Information Technology														
Semester-IV														
Course Code: IT24PCC255					Course Name: Database Management Systems Lab									
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	2	-	-	-	-	-	-	50	-	50	-	1	-	1
Prerequisite: Data Structures and Algorithms														
Course Objectives: - 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										Duration (Hrs.)			
1	Install and configure client and server of MySQL and PostgreSQL. (Show all commands and necessary steps for installation and configuration)										02			
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.										02			
3	Design and Develop SQL queries for DDL statements for suitable database application.										02			

4	Design SQL queries for suitable database application using SQL DML statements: Insert, Select, Update, delete with operators, functions, Set operators	02
5	Implement arithmetic operators, logical operators, pattern matching, IN and NOT IN predicates, and MySQL built-in functions.	02
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	04
7	Write SQL queries to demonstrate the different SQL concepts like subqueries, performing various join operations, and using set operators in MySQL.	02
8	Implement SQL queries to demonstrate the nested queries in SQL using MySQL.	02
9	a. Write a PL /SQL block to calculate the grade of minimum 10 students. b. Write a PL /SQL block to implement all types of cursors.	02
10	a. Write a PL/SQL for stored procedures and functions. b. Write a database Triggers (row level and statement level)	02
11	Design and Develop MongoDB Queries using CRUD operations. (Use CRUD operations, SAVE method, logical operators etc)	02
12	MongoDB - Aggregation and Indexing: Design and Develop MongoDB Queries using aggregation and indexing with suitable examples using MongoDB.	04
13	MongoDB - Map reduce operations: Implement Map reduces operation with a suitable example using MongoDB.	02
Total Hours		30
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

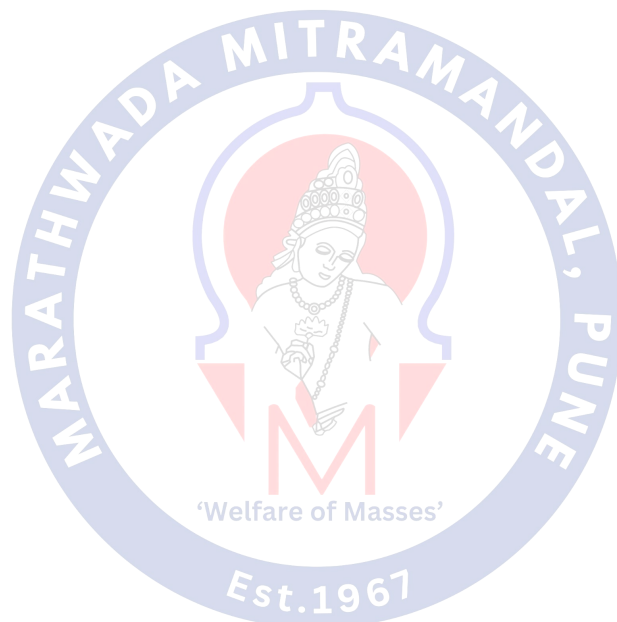
1. MySQL Documentation: "MySQL Reference Manual" ([Link](#))
2. Coursera Course: "Database Management Essentials" ([Link](#))



Second Year B. Tech Information Technology															
Semester III															
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, Data Structure															
Course Objectives:															
- To apply basic Linux commands knowledge to write shell scripts for effective file manipulation, process control, and text processing. - To develop proficiency in system-level programming in C, 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: Apply multithreading, synchronization, and kernel-level concepts to design and analyze concurrent and operating system-level solutions.															
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 the Basic Linux commands and study of shell and shell script													2	

2	Write a shell script to implement an address book with the options given below: a) create address book b) view address book c) Insert Record d) Delete a record e) Modify a record f) Exit	2
3	Process control system calls: The demonstration of fork, execve and wait system calls along with zombie and orphan states.	2
4	Write a program to show the demonstration of Scheduling Algorithms: 1) FCFS 2) SJF 3) Priority Scheduling	4
5	Thread management using pthread library. Implement matrix multiplication using multithreading. Application should have pthread_create, pthread_join, pthread_exit. In the program, every thread must return the value and must be collected in pthread_join in the main function. The final sum of row column multiplication must be done by the main thread (main function).	4
6	Thread synchronization using counting semaphores and mutual exclusion using mutex. Application to demonstrate producer-consumer problem with counting semaphores and mutex.	4
7	Case Study: XV6 Linux Kernel configuration, compilation and rebooting from the newly compiled kernel.	2
8	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
9	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
10	Download and configure XV6 or Linux	2
11	Design and install your own file system in Linux (optional)	2
Total Hrs		30
Text Books		
1. Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau "Operating Systems: Three Easy Pieces", Arpaci-Dusseau Books, March, 2015 2. Stallings William., "Operating Systems", Fourth Edition, Prentice Hall of India, 2001		

Reference Books	
1.	Silberschatz, A, Galvin, P.B, and Gagne, G., "Operating System Principles", Eight Edition, John Wiley & Sons, 2008.
2.	Bach Maurice J. "The Design of the UNIX Operating System", Second Edition Prentice Hall of India, 2001
Online References	
1.	NPTEL Course: Prof. Rajib Mall IIT Kharagpur "Real Time Operating System" (Link)
2.	E-Book: Allen B. Downey" Think OS: A Brief Introduction to Operating Systems" (Link)
3.	SCALAR Course: Srikanth Verma " Operating System Course: Learn Fundamentals of Operating System" (Link)



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	ETE	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: - 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: C01: Understand the fundamental concepts in designing web based applications and apply frontend and backend technologies C02: Apply the client side and server side technologies for web application development C03: Analyze the web technology languages, frameworks and services C04: Create the effective web applications for business functionalities using latest web development platforms														
Contents in Association with Elite Solutions														
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														
List of Lab Activities														
Sr. No	Activities											Duration (Hrs)		
1	Website Planning and Analysis – Study and evaluate a minimum of 7 websites for different client projects. Analyze Website URL, Purpose, Look & Feel, Navigation, Content Representation, Responsiveness, Target Audience, Likes, Dislikes, and Overall Evaluation.											3		
2	Design an Online Food Delivery Website using HTML & CSS – Create an attractive and responsive website for Online FoodShop with pages: Home, About, Menu, and Contact Us.											3		

	Include navigation bar, company logo, responsive layout, and engaging content sections.	
3	Design Survey/Feedback Form and Login Page using HTML & CSS – Develop a feedback form with various input controls and CSS styling. Also design a login page with fields for Name, Mobile Number, Email ID, and Login button.	3
4	JavaScript-Based Online Food Ordering Application – Design the UI using HTML & CSS. Implement JavaScript validation for Name, Mobile Number, and Email ID, use Prompt and Alert boxes, display a Welcome page after successful login, and perform bill calculation/order confirmation.	3
5	Bootstrap Landing Page and Website Hosting Concepts – Design a responsive landing page using Bootstrap. Study website hosting concepts including DNS, ICANN, Domain Ownership, Name Servers, Web Hosting, Types of Hosting (Shared, VPS, Dedicated, Cloud), cPanel, Domain Transfer, and Domain Buying/Selling Process.	3
6	Introduction to Core Java Programming – Install JDK and IDE. Write Java programs using variables, data types, operators, input/output, control statements (if-else, switch), and loops.	3
7	Object-Oriented Programming in Java – Implement classes, objects, constructors, inheritance, polymorphism, encapsulation, methods, arrays, and string handling using food ordering examples.	3
8	Exception Handling, Packages, Collections, and File Handling – Develop programs using exception handling, user-defined packages, ArrayList, HashMap, and file operations to store customer/order details.	3
9	Java Swing GUI Application – Design a desktop-based Online Food Ordering interface using Swing components such as JFrame, JLabel, JTextField, JButton, JComboBox, and event handling.	3
10	JDBC Connectivity and CRUD Operations – Connect Java application with MySQL database and implement Add, Update, Delete, Search, and Display operations for the Online Food Ordering System using JDBC.	3
Total Hours		30 Hrs
Project List (any one can be selected)		
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.		
		Total Hours	28 Hrs
Text Books			
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			
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			

1. HTML, The Complete Reference <http://www.htmlref.com/>
2. <https://www.w3schools.com/bootstrap/>

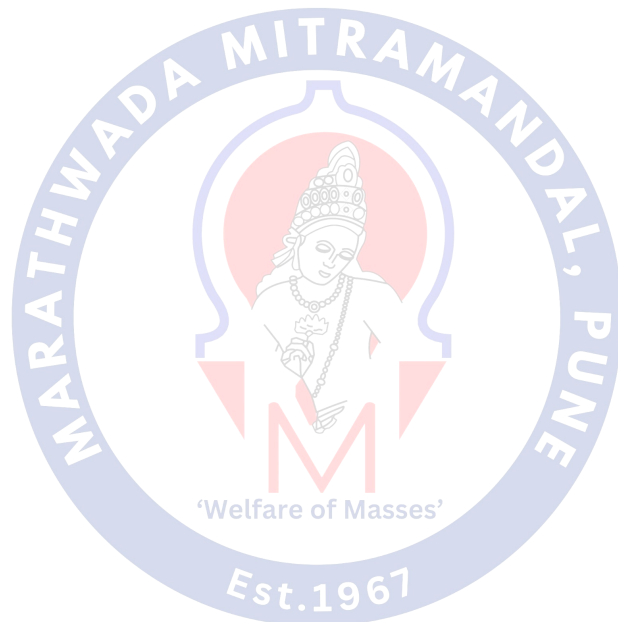
Second Year B. Tech Information Technology															
Semester- III															
Course Code : IT24EEM258					Course Name: Startup Fundamentals and Financing										
Teaching Scheme (Hours/Week)					Examination Scheme						Credits				
L	P	T	OL	ODL	CIE	ETE	TW	PR	OR	TOTAL	L	P	T	TOTAL	
-	-	2	-	-	-	-	50	-		50	-	-	2	2	
Prerequisites: Problem-solving and critical thinking skills, Professional Communication and Personality Development															
Course Objectives: • 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	
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.													6	

2	Product/ Service Proposal: Value Proposition Canvas, problem-solution fit, brainstorming, competition analysis, creating competitive advantage, sustainable differentiation.	6
3	Business model: Types, Lean canvas, Risky assumptions related to product, market, business, and execution capabilities	6
4	Minimum Viable Product (MVP): Create and iterate, testing of MVP, customer feedback, validate risky assumptions, solution-market fit	6
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		30 Hrs.
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

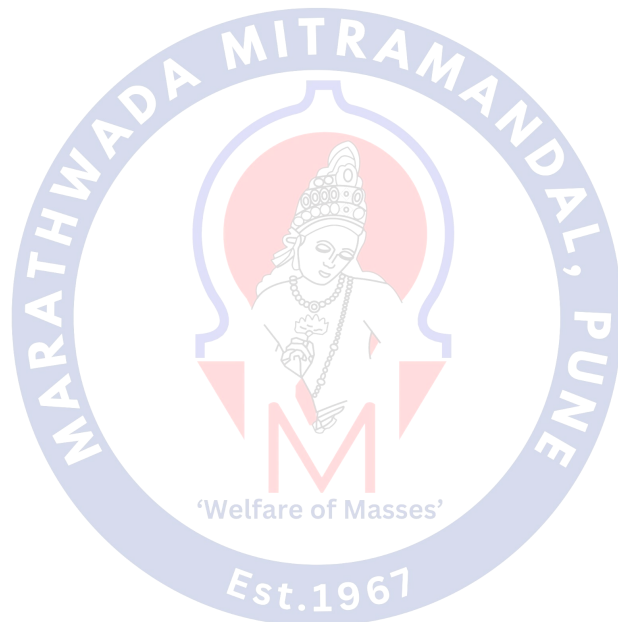
1. Entrepreneur Article: "How to Develop a Go-to-Market Strategy" ([Link](#))
2. Forbes Article: "13 Key Steps to Developing a Go-to-Market Strategy" ([Link](#))
3. Government of India Portal: "Skill India Mission" ([Link](#))
4. StartupTalky Resource: "List of Government Initiatives for Startups in India" ([Link](#))



Second Year B. Tech Information Technology													
Semester- IV													
CCourse Code:SH24VEC201							Course Name: Environmental Sustainability						
Teaching Scheme (Hours/Week)					Examination Scheme						Credits		
L	P	T	OL	ODL	CIE	ETE	TW	OR	PR	TOTAL	L	P	T
-	-	2	-	-	-	-	50	-	-	50	-	-	2
Prerequisites: A basic understanding of environmental science, geography, or social studies													
Course Objectives: - 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: C01: Describe the fundamental ideas of environmental sustainability. C02: Examine sustainability's social, economic, and environmental facets. C03: Analyse how human actions affect Environmental systems. C04: Propose strategies for sustainable development in various sectors.													
Unit	Contents												
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 (Any 08 activities)	Hrs
Total		26 Hrs.
Text Books		

Reference Books
Online References



Second Year B. Tech Information Technology														
Semester - IV														
Course Code:SH24VEC201							Course Name: Environmental 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														
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Unit	Content													
1														
2														
3														
4														

Sr. No	List of Tutorial (Any 08 activities)	Hours
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?	4
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		30
Text Books		
1. Rogers P.P., Jalal K.F., Boyd I.A. (Latest Edition) - An Introduction to Sustainable Development. Earthscan, Publisher : Routledge; Language : English Paperback : 416 pages ISBN-10 : 1844075206 ISBN-13 : 978-1844075201 2. Kalam A.P.J. (Latest Edition) - Target 3 Billion: Innovative Solutions Towards Sustainable Development Penguin Books, ISBN-10 : 9780143417309, ISBN-13 : 978-0143417309 3. Sustainability: A Systems Approach by Tony Clayton and Nicholas Radcliffe 4. Silent Spring by Rachel Carson.		

5. The Sixth Extinction by Elizabeth Kolbert

Journals and Articles

1. Environmental Science & Technology.
2. Journal of Cleaner Production

Online References

1. United Nations Resource: "Sustainable Development Goals (SDGs)" ([Link](#))
2. NASA Resource: "Climate Change" ([Link](#))
3. Springer Journal: "Discover Sustainability" ([Link](#))
4. Inspire Clean Energy Article: "Environmental Sustainability: Definition and Importance" ([Link](#))
5. ScienceDirect Topic: "Environmental Sustainability" ([Link](#))
6. ScienceDirect Journal: "Current Research in Environmental Sustainability" ([Link](#))
7. Clean Energy Ministerial Case Study: "Google Global Energy Management Implementation Case Study" ([Link](#))

