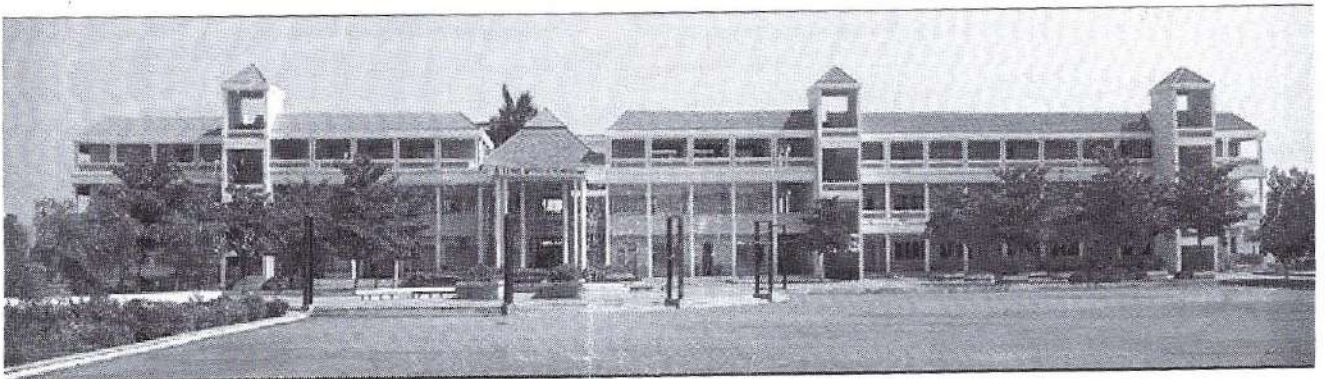Shirpur Education Society's

R. C. Patel Institute of Technology, Shirpur

(An Autonomous Institute)

Course Structure

Second Year B. Tech. (Information Technology)

With effect from Year 2025-26

Shahada Road, Near Nimzari Naka, Shirpur, Maharashtra 425405
Ph: 02563 259 802, Web: www.rcpit.ac.in

Second Year B.Tech Information Technology Semester-III (w.e.f. 2025-26)

Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme L	T	P	CA — TA [A]	Term Test 1 (TT1)	Term Test 2 (TT2)	Average of (TT1 & TT2) [B]	ESE [C]	Total [A+B+C]	Credits	Group
1	PC	RCP24IPC201	Data Structures	3			25	15	15	15	60	100	3	4
	PC	RCP24IPC201L	Data Structures Laboratory			2	25				25	50	1	
2	PC	RCP24IPC202	Database Management System	3			25	15	15	15	60	100	3	4
	PC	RCP24IPC202L	Database Management System Laboratory			2	25				25	50	1	
3	PC	RCP24IPC203L	Web Programming Laboratory			2	25				25	50	1	1
4	MD	RCP24IMD201	Operating System	2			25	15	15	15	60	100	2	2
5	SC	RCP24XSC201P	Semester Project-I			2	25				25	50	1	1
6	HS	RCP24XHS231L	Design Thinking Laboratory			2	25					25	1	1
7	HS	RCP24XHS232	Universal Human Values	3			25	15	15	15	60	100	3	3
8	EL	RCP24XEL201L	Community Engagement Service			2	25					25	1	1
9#	OE	RCP24XOE211	Product Life Cycle Management	3			25	15	15	15	60	100	3	3
		RCP24XOE212	Management Information System	3			25	15	15	15	60	100	3	
		RCP24XOE213	Operations Research	3			25	15	15	15	60	100	3	
		RCP24XOE214	Personal Finance Management	3			25	15	15	15	60	100	3	
		RCP24XOE215	Public Systems and Policies	3			25	15	15	15	60	100	3	
		RCP24XOE216	Fundamentals of Biomedical Instruments	3			25	15	15	15	60	100	3	
		RCP24XOE217	IPR and Patenting	3			25	15	15	15	60	100	3	
		RCP24XOE218	Entrepreneurship and Startup Ecosystem	3			25	15	15	15	60	100	3	
			Total	14	0	12	275			75	400	750		20

Any 1 Open Elective Course

Prepared by:
Ms. J. S. Sonawane

Checked by:
Ms. P. D. Saraf

Prof. Dr. D. R. Patil
BOS Chairman

Prof. S. P. Shukla
C.O.E.

Prof. Dr. P. J. Deore
Dean Academics & Dy. Director

Prof. Dr. J. B. Patil
Director

Second Year B.Tech Information Technology Semester-IV (w.e.f. 2025-26)

Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme L	T	P	CA — TA [A]	Term Test 1 (TT1)	Term Test 2 (TT2)	Average of (TT1 & TT2) [B]	ESE [C]	Total [A+B+C]	Credits
1	PC	RCP24IPC251	Applied Mathematics	4			25	15	15	15	60	100	4
2	PC	RCP24IPC252	Design and Analysis of Algorithm	3			25	15	15	15	60	100	3
	PC	RCP24IPC252L	Design and Analysis of Algorithms Laboratory			2	25				25	50	1
3	PC	RCP24IPC253L	Python Laboratory			2	25				25	50	1
4	PC	RCP24IPC254L	Object Oriented Design Laboratory			2	25				25	50	1
5	MD	RCP24IMD251	Formal Languages and Automata Theory	3			25	15	15	15	60	100	3
6	SC	RCP24XSC251P	Semester Project-II			2	25				25	50	1
7	HS	RCP24XHS281T	Professional and Business Communication Tutorial		2		25					25	2
8	HS	RCP24XHS282	Economics and Financial Management	2			25	15	15	15	60	100	2
9#	OE	RCP24XOE261	Project Management	3			25	15	15	15	60	100	3
		RCP24XOE262	Cyber Security, Policies and Laws	3			25	15	15	15	60	100	3
		RCP24XOE263	Advanced Operations Research	3			25	15	15	15	60	100	3
		RCP24XOE264	Corporate Finance Management	3			25	15	15	15	60	100	3
		RCP24XOE265	Corporate Social Responsibility	3			25	15	15	15	60	100	3
		RCP24XOE266	Bioinformatics	3			25	15	15	15	60	100	3
		RCP24XOE267	Human Resource Management	3			25	15	15	15	60	100	3
		RCP24XOE268	Digital Marketing Management	3			25	15	15	15	60	100	3
		RCP24XOE269	Logistics and Supply Chain Management	3			25	15	15	15	60	100	3
			Total	15	2	08	250		15	75	400	725	21

\# Any 1 Open Elective Course

Prepared by:
Ms. J. S. Sonawane

Checked by:
Ms. P. D. Saraf

Prof. Dr. D. R. Patil
BOS Chairman

Prof. S. P. Shukla
C.O.E.

Prof. Dr. P. J. Deore
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Prof. Dr. J. B. Patil
Director

Program: Information Technology	S.Y. B.Tech.	Semester: III
Data Structures (RCP24IPC201)		
Data Structures Laboratory (RCP24IPC201L)		

Prerequisite: Knowledge of C Programming.

Course Objective(s): The objective of the course is to introduce and familiarize students with linear and non-linear data structures, their use in fundamental algorithms and design & implementation of these data structures. To introduce students to the basics of algorithms and time complexity. To familiarize students with various sorting and searching techniques, and their performance comparison.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze the algorithms based on time and space complexity.	L2	Understand
CO2	Solve the problem using appropriate data structure.	L3	Apply
CO3	Implement appropriate searching algorithm for a given problem.	L4	Analyze
CO4	Implement appropriate sorting algorithm for a given problem.	L4	Analyze

Data Structures (RCP24IPC201)
Course Contents

Unit-I   04 Hrs.

Basics of Algorithms: Algorithms, Characteristics of an Algorithm, Time and Space Complexities, Order of Growth functions, Preliminary Asymptotic Notations. **Data Structures:** Introduction, Need of Data Structures, Types of Data Structures, Abstract Data Types (ADT)

Unit-II   06 Hrs.

Linear Data Structures – LIST: List as an ADT, Array-based implementation, Linked List implementation, Singly linked lists, Circular linked lists, Doubly-linked lists, All operations (Insertion, Deletion, Merge, Traversal, etc.) and their analysis, Applications of linked lists - (Polynomial Addition).

Unit-III   07 Hrs.

Linear Data Structure – STACK: Stack as an ADT, Operations, Array and Linked List representation of Stack, Applications – Reversing data, Conversion of Infix to prefix and postfix expression, Evaluation of postfix and prefix expressions, Balanced parenthesis, etc.

Linear Data Structure – QUEUE: Queue as an ADT, Operations, Implementation of Linear Queue, Circular and Priority Queue using arrays and Linked List, DEQueue.

Applications– Queue Simulation.

Unit-IV   08 Hrs.

Non-Linear Data Structure – TREES: Tree Terminologies, Tree as an ADT, Binary Tree - Operations, Tree Traversals, Binary Search Tree (BST) - Operations, Expression Trees.

Height Balanced Tree- AVL Tree: Creation, insertion and deletion.

Heap- Various Operations on heap and it's applications.

Unit-V   06 Hrs.

Non-Linear Data Structure – GRAPHS: Graph Terminologies, Types of Graphs, Representation of Graph using arrays and Linked List, Breadth-First Search (BFS), Depth–First Search (DFS) **Applications of Graphs -**Topological sorting.

Unit-VI   08 Hrs.

Searching: Searching- Linear Search. Binary Search and Fibonacci search. **Sorting:** Bubble Sort, Selection Sort, Heap Sort, Insertion Sort, Radix Sort, Merge Sort, Quick Sort. Analysis of Searching and Sorting Techniques.

Hashing: Hash Functions, Overflow handling, Collision Collision Resolution Techniques, Linear hashing, hashing with chaining, Separate Chaining, Open Addressing, Rehashing and Extendible hashing.

Data Structures Laboratory (RCP24IPC201L)

List of Laboratory Experiments

Suggested Experiments:(Any 10 to 12)

1. Implementation of Linked List operations.

2. Implementation of different operations on Linked List –copy, concatenate, split, reverse, count no. of nodes etc.

3. Implementation of polynomials operations (addition, subtraction) using Linked List.

4. Implementation of stack.

5. Implementation of Infix to Postfix conversion.

6. Implementation of Prefix and Postfix evaluation using stack.

7. Implementation of parenthesis checker using stack.

8. Implementation of Linear queue.

9. Implementation of Circular queue.

10. Implementation of Double ended queue.

11. Implementation of Priority queue program using array and Linked list.

12. Implementation of Binary Tree.

13. Implementation of Binary Tree Traversal.

14. Implementation of BST using following operations – create, delete, display.

15. Implementation of various operations on tree like – copying tree, mirroring a tree, counting the number of nodes in the tree, counting only leaf nodes in the tree.

16. Implementation of Graph traversal (DFS & BFS).

17. Implementations of Selection and Radix sort.

18. Implementation of Heap & Heap Sort.

19. Implementation of Merge Sort and Quick Sort.

20. Implementation of Bubble Sort.

21. Implementation of searching methods (Index Sequential, Fibonacci search, Binary Search)

22. Implementation of hashing functions with different collision resolution techniques.

23. Implementation of Insert and Delete operation in an array.

24. Implement the program to perform sum of array elements.

25. Implement the program to find maximum of array elements.

26. Implement the program to print all the leaders in the array.

27. Implement the program to find the sub array with the largest sum, and print its sum

28. Implement the program to remove duplicates elements from Linked List

29. Implement the program to Insert the node at the end in Circular Linked List

30. Implement the program to delete the node from Circular Linked List

31. Implement the program to insert the node in Double Linked List

32. Implement the program to delete the node from Double Linked List

33. Implement a stack using arrays to solve a classic problem: converting an integer from decimal to binary using the "divisor-remainder" method.

34. Implement a program to print numbers in a specific pattern using a queue.

35. Implement a program that simulates a to-do list manager using a queue.

36. Implement a program to find whether a given string is palindrome or not using stack.

37. Implement a program to find whether a given string is palindrome or not using queue.

38. Implementation of Adjacency Matrix for Tree

39. Implementation of Adjacency List for Tree

40. Implementation of Depth-First Search (DFS) tree traversal algorithm

41. Implementation of Breadth-First Search (BFS) tree traversal algorithm

42. Implement a program find the number of leaf nodes using DFS algorithm

43. Implement a program to find the height of the tree for undirected connected tree.

44. Implement a program to print all the nodes at the level K from root node in sorted order given undirected connected tree.

45. Implement a program to check if there exists a path from root to any leaf whose sum is equal to targetSum for undirected connected tree.

46. Implement a program to count the number of neighbours of the node v for undirected connected tree.

47. Implement a program to find the subtree sum of each node i for undirected connected tree.

48. Implement a program to find the length of the diameter of the tree for undirected connected tree.

49. Implement a program to find the lowest common ancestor (LCA) for undirected connected tree

50. Implement a program to find the distance between two nodes for undirected connected tree.

51. Implement a program to find the Kth ancestor of the node v for undirected connected tree.

52. Implement a program to find the largest node value at each level for undirected connected tree.

53. Implement a program to determine for each node the number of distinct colours in the subtree of the node for an undirected connected tree with N coloured nodes.

54. Implement a program to determine the minimum time in minutes you have to spend to collect all coins in the tree, starting at root node 1 and coming back to it for an undirected connected tree with N nodes and some of the nodes has gold coins in it.

55. Implement a program to find the height of it given connected binary tree with N nodes.

56. Implement a program to determine binary tree is height-balanced

57. Implement a program to check given two undirected binary trees are the identical or not.

58. Implement a program to print the level order traversal of binary tree nodes.

59. Implement a program to print the zigzag level order traversal of binary tree nodes.

60. Implement a program to print the top view of the binary tree.

61. Implement a program to print binary tree minimum depth

62. Implement a program to construct and return a binary tree using two integer arrays, preorder and inorder.

63. Implement a program to find the sum of leaves at deepest level in a binary tree.

64. Implement a program to check if the second tree T2 exists as a subtree in the first tree T1 in the given two undirected binary trees T1 and T2.

65. Implement a program to find the lowest common ancestor of the three nodes in a given binary tree with three nodes.

66. Implement a program to retrieve all root-to-leaf paths where the sum of the node values along the path equals the given integer target. Print each such path on separate lines for a binary tree and an integer target.

67. Implement a program to search if X exists in the BST or not.

68. Implement a program to print its nodes in sorted order in a binary search tree.

69. Implement a program to find the maximum/largest node in a binary search tree.

70. Implement a program to return the minimum difference between the values of any two different nodes in a binary search tree.

71. Implement a program to check if the given binary tree is a valid Binary Search Tree (BST).

72. Implement a program to find the Kth largest node in BST.

73. Implement a program to determine the inorder predecessor of a given node X in a binary search tree.

74. Implement a program to check if there exist two elements in the BST such that their sum is equal to S.

75. Implement a program to recover the tree without changing its structure for given a binary search tree, where exactly two nodes of the tree were swapped by mistake.

76. Implement a program to find the LCA (lowest common ancestor) of these two nodes using BST.

77. Implementation of Adjacency Matrix for Graph

78. Implementation of Adjacency List for Graph

79. A Cloud Provider's network spans across n locations with m connections between them. Your task is to determine whether Chef can send a message to Chefina. If possible, you need to find the minimum number of servers on such a route.

80. Given an undirected and unweighted graph and two nodes x and y, Implement a program to find the length of the shortest path between the two nodes. If no path exists, return -1.

81. Given a string s1, a character c1, and an integer k, Implement a program to find and print the position of the kth occurrence of the character c1 in the string s1. If the kth occurrence does not exist, print -1.

82. Implement a program to find the smallest and largest elements in an array of integers.

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83. Implement a program to find the element in an array with the smallest absolute difference from a given integer k. If there are multiple elements with the same minimum difference, print the smallest of these elements.

84. Implement a program to find and print all pairs of integers from a list of n pairs where the sum of each pair is divisible by k.

85. Implement a program that reads an integer n followed by n pairs of integers. Given two additional integers left and right, the program should print all pairs whose sum and product fall within the inclusive range [left, right].

86. Implementation a program to find frequency of each element in the array

87. Implementation a program to find frequency of elements using Hashing

88. Implementation a program to Count Beautiful Pairs using Hashing

89. Implementation a Hashing function using Division method.

Any other experiment based on syllabus may be included which would help the learner to understand topic/concept.

Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Text Books:

1. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, "Fundamentals of Data Structures in C", 2nd Edition, W. H. Freeman and Company, 2008.

2. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy", 5th Edition, Careermonk Publications, 2023.

3. Reema Thareja, "Data Structures using C", 2nd Edition, Oxford University Press, 2014.

Reference Books:

1. Mark A. Weiss, "Data Structures and Algorithm Analysis in C", 4th Edition, Pearson, 2014.

2. R. F. Gilberg and B. A. Forouzan, "Data Structures – A Pseudocode Approach with C", 2nd Edition, Cengage Learning, 2005.

3. M. T. Goodritch, R. Tamassia and D. Mount, "Data Structures and Algorithms in C++", 2nd Edition, Wiley, 2011.

4. Kruse, Leung and Tondo, "Data Structures and Program Design in C", 2nd Edition, Pearson Education, 2013.

5. Tenenbaum, Langsam and Augenstein, "Data Structures using C", 2nd Edition, Pearson, 2015.

6. Seymour Lipschutz, "Data Structures", Schaum's Outline Series, 1st Edition, Tata McGraw-Hill, 2014.

Program: Information Technology	S.Y. B.Tech.	Semester: III
Database Management System (RCP24IPC202)		
Database Management System Laboratory (RCP24IPC202L)		

Prerequisite: Computer Basics.

Course Objectives: The course intends to introduce the students to the management of database systems, with an emphasis on how to design, organize, maintain and retrieve information efficiently and effectively from a database.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Design an optimized database	L6	Create
CO2	Construct SQL queries to perform operations on the database.	L6	Create
CO3	Apply appropriate transaction management technique.	L3	Apply
CO4	Use appropriate indexing technique.	L2	Understand

Database Management System (RCP24IPC202) Course Contents

Unit-I Introduction to Database Concepts   04 Hrs.

Introduction, Characteristics of databases, File system v/s Database system, Users of Database system, Schema and Instance, Data Independence, DBMS system architecture, Database Administrator.

Unit-II Relational Data Model   10 Hrs.

The Entity-Relationship (ER) Model: Entity types: Weak and strong entity sets, Entity sets, Types of Attributes, Keys, Relationship constraints: Cardinality and Participation.

Extended Entity-Relationship (EER) Model: Generalization, Specialization and Aggregation.

Relational Model: Introduction to the Relational Model, relational schema and concept of keys, Mapping the ER and EER Model to the Relational Model.

Relational Algebra:Unary and Set operations, Relational Algebra Queries.

Unit-III Structured Query Language (SQL)   10 Hrs.

Overview of SQL, Data Definition Commands, Data Manipulation commands, Integrity constraints - key constraints, Domain Constraints, Referential integrity, check constraints, Data Control commands, Transaction Control Commands, Set and String operations, aggregate function - group by, having, Views in SQL, joins, Nested and complex queries, Triggers, Security and authorization in SQL.

Unit-IV Relational–Database Design   05 Hrs.

Pitfalls in Relational-Database designs, Concept of normalization, Function Dependencies, Normal Forms- 1NF, 2NF, 3NF, BCNF

Unit-V Transaction Management and Recovery   07 Hrs.

Transaction Concept, ACID properties, Transaction States, Implementation of atomicity and durability, Concurrent Executions, Serializability, Concurrency Control Protocols: Lock-based, Timestamp based, Validation Based, Deadlock Handling, Recovery System: Failure classification, Log based recovery, Shadow Paging.

Unit-VI Indexing Mechanism   03 Hrs.

Types of Indexes: Single Level Ordered Indexes, Multilevel Indexes, Overview of B-Trees and B+ Trees.

Database Management Systems Laboratory (RCP24IPC202L)

List of Laboratory Experiments

Suggested Experiments:

1. To draw an ER diagram for a problem statement.

2. Map the ER/EER to relational schema.

3. To implement DDL and DML commands with integrity constraints.

4. To access & modify Data using basic SQL.

5. To implement Joins and Views.

6. To implement Subqueries.

7. To implement triggers.

8. To Study and Implement TCL Commands.

9. Examine the consistency of database using concurrency control technique (Locks).

10. To implement B-trees/B+ trees.

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Text Books:

1. Korth, Silberchatz, Sudarshan, "Database System Concepts", 7th Edition, McGraw Hill, 2021.

2. Elmasri and Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson education, 2021.

3. G Peter Rob and Carlos Coronel, "Database Systems Design, Implementation and Management", 5th Revised Edition, Thomson, 2002

4. G. K. Gupta, "Database Management Systems", 3rd Edition, McGraw Hill, 2018.

Reference Books:

1. Dr. P. S. Deshpande, "SQL and PL/SQL for Oracle 10g", Black Book, Dreamtech Press, 20

2. Sharanam Shah, Vaishali Shah, "Oracle for Professional", 1st Edition, Shroff Publishers & Distributers Private Limited, 2008.

3. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", 3rd Edition, McGraw Hill, 2014.

4. Patrick Dalton, "Microsoft SQL Server Black Book", 11th Edition, Coriolis Group, U.S., 1997.

5. Lynn Beighley, "Head First SQL", 1st Edition, O'Reilly Media Publication, (28 August 2007).

Program: Information Technology	S.Y. B.Tech.	Semester: III
Web Programming Laboratory (RCP24IPC203L)		

Prerequisite: Basics of programming.

Course Objective(s): The course aims to provide students with a comprehensive understanding of web programming fundamentals and the MERN (MongoDB, Express.js, React.js, Node.js) stack. By the end of the course, students will be able to design and develop interactive web applications. Specifically, they will learn the basics of HTML, CSS, and JavaScript for frontend development, gaining expertise in creating dynamic user interfaces with React.js. Through practical experimentation and projects, students will develop problem-solving skills and gain hands-on experience in building modern web applications.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Develop full-stack web application using the MERN stack.	L3	Apply
CO2	Work effectively as a member of a team.	L3	Apply

Web Programming Laboratory (RCP24IPC203L) Course Contents

Unit-I   04 Hrs.

Introduction to Web Development: Overview of web development and its importance, Introduction to HTML: Structure, tags, and attributes, creating a simple webpage using HTML. Basic CSS properties for styling elements.

Unit-II   06 Hrs.

Introduction to JavaScript: Syntax and data types. Variables, operators, and control flow statements. Loops and functions, DOM Manipulation with JavaScript, Introduction to the Document Object Model (DOM), Accessing and manipulating HTML elements with JavaScript, Event handling and listeners.

Unit-III   04 Hrs.

Introduction to React.js: Overview of React.js and its benefits. Setting up React.js development environment. Introduction to JSX syntax. Creating and rendering components in React. Building Single Page Applications (SPAs) with React.js Introduction to React Router for routing in SPAs. Fetching data from a server and rendering in React components. Handling user input with forms and managing state in React.

Unit-IV   04 Hrs.

Backend Development with Node.js and Express.js: Introduction to Node.js: Introduction to Node.js and its features., Installation and setup of Node.js environment, Creating a simple Node.js server. Building RESTful APIs with Node.js and Express.js: Overview of RESTful APIs, setting up Express.js framework for building APIs, creating routes for CRUD operations (GET, POST, PUT, DELETE).

Unit-V   04 Hrs.

Integrating MongoDB with Node.js: Introduction to MongoDB and NoSQL databases, Connecting Node.js with MongoDB using MongoDB native driver or Mongoose, Implementing CRUD operations in Node.js with MongoDB.

Unit-VI   04 Hrs.

Integration and Authentication: Integrating React.js and Node.js: Integrating React.js frontend with Node.js backend, communicating between frontend and backend using APIs. Authentication

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and Authorization: Implementing authentication and authorization using JSON Web Tokens (JWT), OIDC Protocols, Securing routes and resources in the application.

Web Programming Laboratory (RCP24IPC203L)
List of Laboratory Experiments

Use design thinking to work through a real, industry based or societal problem. Develop a design solution that addresses this problem, putting the user first. The result will be a prototype with accompanying design artifacts and a robust presentation to include it in your portfolio.

Suggested Experiments:

1. HTML: Design a website using only HTML/CSS.

2. Design a website using TailWind CSS.

3. Programs based on control flow statements and loops in JavaScript.

4. Develop and demonstrate JavaScript with Accessing HTML elements using JavaScript. Manipulating HTML elements dynamically. Event handling: onclick, onchange, etc.

5. Event Loop using JavaScript Visualizer.

6. Installation and setup of Node.js environment.

7. Create a simple React application that renders a "Hello, World!" message on the webpage.

8. Create a React application. (Counter, TODO List, Temperature Converter etc.)

9. Implement a simple HTTP server that listens on a specified port and responds with "Hello, World!" to incoming requests.

10. Create a RESTful API using Express.js that supports CRUD (Create, Read, Update, Delete) operations on a resource like users, products, or articles.

11. Implement a Node.js program to perform basic CRUD (Create, Read, Update, Delete) operations on MongoDB collections.

12. Mini-project.

Any other experiment based on syllabus may be included which would help the learner to understand topic/concept.

Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Books Recommended:

1. Duckett, J., "HTML and CSS: Design and Build Websites", 2nd Edition, Wiley, 2014.

2. Haverbeke, M, "Eloquent JavaScript: A Modern Introduction to Programming", 3rd Edition, No Starch Press, 2021.

3. Chinnathambi, C., "Learning React: Modern Patterns for Developing React Apps", Packt Publishing, 2023.

4. Casciaro, M., and Lavin, M., "Node.js Design Patterns", 2nd Edition, Packt Publishing, 2022.

5. Wilson, E., Cantelon, E., and Harter, M., "Express.js in Action" Manning Publications, 2016.

6. Chodorow, K., "MongoDB: The Definitive Guide", 3rd Edition, O'Reilly Media, 2018.

7. Ho, A., and Prieto, A., "Fullstack React: The Complete Guide to ReactJS and Friends", 2nd Edition, Fullstack.io, 2020.

List of Open Source Software/Learning Website:

1. Namaste JavaScript Online Available:
   https://www.youtube.com/playlistlist=PLlasXeu85E9cQ32gLCvAvr9vNaUccPVNP

2. JavaScript Visualizer: https://www.jsv9000.app/

Program: Information Technology	S.Y. B.Tech.	Semester: III
Operating System (RCP24IMD201)		

Prerequisite: Foundations of Information Technology.

Course Objective(s): The objective of this course is to familiarize students with the functionality of an Operating System, its basic components interaction among them. The course will also expose students to analyze and evaluate different policies for scheduling, deadlocks, memory management, synchronization and I/O management techniques.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Explore operating system types and functions.	L2	Understand
CO2	Apply appropriate schemes for memory and I/O management.	L3	Apply
CO3	Apply appropriate techniques for concurrency control and process synchronization.	L3	Apply
CO4	Analyze the performance of different process and disk scheduling algorithms.	L4	Analyze
CO5	Handle the deadlock.	L4	Analyze

Operating System (RCP24IMD201)
Course Contents

Unit-I   05 Hrs.

Operating System Overview: Operating System Objectives, basic functions and services, Types of Operating Systems, System Calls, Types of System Calls, Multiprocessor and multicore organization. OS Design Considerations for Multiprocessor and Multicore.

Unit-II   06 Hrs.

Process Management: Process Concept, Process states, Process control, Threads, Uniprocessor Scheduling: Types of scheduling: Pre-emptive, Non pre-emptive, Scheduling algorithms: FCFS, SJF, RR, Priority.

Unit-III   04 Hrs.

Concurrency control Concurrency: Principles of Concurrency, Mutual Exclusion: S/W approaches, H/W Support, Semaphores, Monitors, Classical Problems of Synchronization: Readers-Writers and Producer Consumer problems and solutions.

Unit-IV   05 Hrs.

Memory Management: Memory partitioning: Fixed and Variable Partitioning, Memory Allocation: Allocation Strategies (First Fit, Best Fit, and Worst Fit), Fragmentation, Swapping, Virtual Memory, Paging. Segmentation, Demand paging and Page replacement policies

Unit-V   04 Hrs.

Deadlock: Principles of deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Dining Philosopher problem

Unit-VI   04 Hrs.

Peripheral devices management: I/O transfers – program controlled, interrupt driven and DMA
Input /Output Management and Disk Scheduling: I/O Devices, I/O Buffering, Disk Scheduling algorithm: FCFS, SSTF, SCAN, CSCAN, LOOK, C-LOOK. RAID

Text Books:

1. Hamacher, C. V., Vranesic, Z. G., and Zaky, S. H. "Computer Organization and Architecture." 10th Edition, McGraw-Hill Education, 2019.

2. Abraham Silberschatz, Greg Gagne, Peter Baer Galvin, "Operating System Concepts", 10thth Edition, Wiley, January 2018.

3. Tanenbaum, A. S., and Bos, H., "Modern Operating Systems", 5th Edition, Pearson, 2022.

4. William Stallings, "Operating Systems: Internal and Design Principles", 9th Edition, Pearson, 2021.

5. Mano, M. Morris, and Kime, Charles R., "Digital Logic and Computer Design", 5th Edition, Pearson, 2014.

Reference Books:

1. Hayes, J. "Computer Architecture and Organization", 7th Edition, McGraw-Hill, 2021.

2. Mano, M. Morris, "Computer System Architecture", Pearson, 2017.

3. A. Tannenbaum, "Operating System Design and Implementation", 3rd Edition, Pearson Education, January 2015.

4. Naresh Chauhan, "Principles of Operating Systems", 1st Edition, Oxford University Press, 2014.

5. Anand Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 4th Edition, 2016.

Program: Information Technology	S.Y. B.Tech.	Semester: III
Semester Project-I (RCP24XSC201P)		

Course Objectives:

- Students are expected to design, simulate/implement a project based on the knowledge acquired from current semester subjects.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Conduct a survey of several available literatures in the preferred field of study.	L4	Analyze
CO2	Demonstrate various/alternate approaches to complete a project.	L2	Understand
CO3	Ensure a collaborative project environment by interacting and dividing project work among team members.	L3	Apply
CO4	Present their project work in the form of a technical report / paper and thereby improve the technical communication skill.	L3	Apply
CO5	Demonstrate the ability to work in teams and manage the conduct of the research study.	L2	Understand

Semester Project:

The purpose of introducing semester project at second year level is to provide exposure to students with a variety of projects based on the knowledge acquired from the semester subjects. This activity is supposed to enrich their academic experience and bring enough maturity in student while selecting the project. Students should take this as an opportunity to develop skills in implementation, presentation and discussion of technical ideas/topics. Therefore, proper attention shall be paid to the content of semester project report which is being submitted in partial fulfillment of the requirements of the Second Year and it is imperative that a standard format be prescribed for the report.

Each student shall work on project approved by departmental committee approved by the Head of Department, a group of 03 to 05 students (max allowed: 5 students in extraordinary cases, subject to the approval of the department committee and the Head of the department) shall be allotted for each Semester Project. Each group shall submit at least 3 topics for the Semester Project. The departmental committee shall finalize one topic for every group. Semester Project Title or Theme should be based on knowledge acquired during semester. The project work shall involve sufficient work so that students get acquainted with different aspects of knowledge acquired from semester subjects.

Student is expected to:

- Select appropriate project title based on acquired knowledge from current semester subjects.

- Maintain Log Book of weekly work done(Log Book Format will be as per Table 1).

- Report weekly to the project guide along with log book.

Assessment Criteria:

- At the end of the semester, after confirmation by the project guide, each project group will submit project completion report in prescribed format for assessment to the departmental committee (including project guide).

- Assessment of the project (at the end of the semester) will be done by the departmental committee (including project guide).

Prescribed Project Report Guidelines:

Size of report shall be of minimum 25 pages. Project Report should include appropriate content for:

- Introduction

- Literature Survey

- Related Theory

- Implementation details

- Project Outcomes

- Conclusion

- References

Assessment criteria for the departmental committee (including project guide) for Continuous Assessment:

Guide will monitor weekly progress and marks allocation will be as per Table 2.

Assessment criteria for the departmental committee (including project guide) for End Semester Exam:

Departmental committee (including project guide) will evaluate project as per Table 3.

Table 1: Log Book Format

Sr	Week (Start Date:End Date)	Work Done	Sign of Guide	Sign of Coordinator
1				
2				

Table 2: Continuous Assessment Table

Sr	Exam Seat No	Name of Student	Student Attendance	Log Book Maintenance	Literature Review	Depth of Understanding	Report	Total
			5	5	5	5	5	25

Table 3: Evaluation Table

Sr	Exam Seat No	Name of Student	Project Selection	Design/ Simulation/ Logic	Hardware/ Programming	Result Verification	Presentation	Total
			5	5	5	5	5	25

Program: Information Technology	S.Y. B.Tech.	Semester: III
Design Thinking Laboratory (RCP24XHS231L)		

Prerequisite:

1. Understanding of product / process / software / service development life cycle.

2. Knowledge of agile frameworks (or any similar iterative framework) would be added advantage but will not be mandatory.

Course Objectives:

1. To instill an innovative mindset in students to solve the digital-age business, societal and wicked type of problems using design thinking methods and tools, and its application.

2. To equip students with techniques to empathize with users, and ideate innovative and sustainable solutions for real-world problems through an iterative approach to design.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the importance of a Human-Centric design approach for developing a solution.	L2	Understand
CO2	Generate innovative ideas to design sustainable solutions for real world problems.	L3	Apply
CO3	Apply design thinking principles to solve the real-world problems.	L3	Apply
CO4	Collaborate creatively and effectively in interdisciplinary teams to apply design thinking principles to real world problems.	L3, L4	Apply, Analyze

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Design Thinking Laboratory (RCP24XHS231L)
Course Contents

Unit-I   06 Hrs.

Introduction to Design Thinking :

- Understanding the fundamentals of design thinking.

- Exploring the history and evolution of design thinking.

- The importance of empathy in the design thinking process.

- Conduct market & industry research by observing and contextualizing various macro & micro trends.

- Case Study - Conduct their research on how Design Thinking helped to solve some of the biggest and critical problems of our time.

Unit-II   04 Hrs.

Empathize Phase:

- Techniques for conducting user research and gathering insights.

- Creating user personas and empathy maps.

- Practicing active listening and observation skills.

- To apply various empathizing techniques to the problem statement selected.

- Use walk-a-mile immersion and heuristic reviews to first empathize with end users and then to build an empathy map and customer journey map.

Unit-III   04 Hrs.

Define Phase:

- Defining problem statements and reframing challenges.

- Tools for synthesizing research findings.

- Developing a clear and actionable problem statement.

- Start building from Persona map and conduct interviews/ Gemba walk to plot user's journeys from start to end.

- Define the problem space using the HMW statement. Now highlight areas of opportunities in the journey map and enlist potential channels/touchpoints as well as stakeholders for proposed solution interventions.

Unit-IV   04 Hrs.

Ideate Phase:

- Generating creative ideas through brainstorming sessions.

- Techniques for divergent and convergent thinking.

- Prototyping and experimenting with ideas.
- Apply suitable ideation technique to quickly generate diverse ideas that could be applied to target problem space – either partially or in full.
- Brain Writing – Build on each other's ideas and constructively & creatively develop better ideas using SCAMPER technique.

Unit-V   06 Hrs.

Prototype and Validation:

- Introduction to prototyping tools and techniques.
- Rapid prototyping methods.
- Testing prototypes with users and gathering feedback.
- Refining solutions based on user insights.
- Develop user storyboard to layout solution proposition in visual and easily explainable form. Run a quick peer validation.
- Peer-validated the storyboard.
- Build an interactive digital prototype using any digital rapid prototyping platform and seek user validation.

Unit-VI   02 Hrs.

Design Thinking for Strategic Innovation:

- Types of innovations, strategic innovation.
- Features of strategic innovation.
- Design thinking and strategic innovation.
- Practices of integrating design thinking in strategic innovation

Design Thinking Laboratory (RCP24XHS231L)

List of Laboratory Experiments

- Below is a list of assignments/ activities/ experiments that would be carried out by students as a mini project in groups of size not more than Three students in each group.
- Problem statement for these assignments/ activities/ experiments will be provided by facilitator/ instructor/ faculty to the groups/ teams/ batches within each class.
- This list of experiments will help students to learn various design thinking methods and practice the corresponding tools available.

Suggested Experiments:

1. To conduct market and industry research and analyze case studies demonstrating the app

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of design thinking. (Increased understanding of how design thinking has been applied to solve critical problems in various contexts.)

2. To exercise empathizing techniques to understand the needs and pain points of a target audience.

3. Developing empathy maps and customer journey maps based on collected insights.

4. To exercise different tools and techniques (such as affinity diagrams, journey mapping, and user story mapping) for synthesizing research findings.

5. Develop user personas to represent different user archetypes and their needs concerning the problem at hand.

6. To practice SCAMPRE technique, Brainstorming and brain writing as a collaborative ideation technique to create multiple creative ideas / solution for the problem at hand.

7. Create a mind map to generate a wide range of solutions to a problem at hand.

8. To explore different prototyping tools and platforms, such as Adobe XD, Figma, Sketch, and InVision.

9. To Conduct rapid prototyping sessions to build low fidelity / High fidelity prototype based on the ideas generated in Ideation phase and iterate based on feedback received.

10. Develop a plan for implementing the final solution, considering factors like scalability and feasibility.

11.
    - Conduct usability testing to gather feedback on prototypes.
    - Use A/B testing to compare different versions of a solution and determine which performs better.

A minimum of eight experiments from the above-suggested list (experiments 01 to 07) or any other assignment based on the syllabus will be included, which would help the learner to apply the concept. The mini-project is mandatory.

Text Books:

1. I. Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School",Wiley, 2013.

2. M. Lewrick, P. Link, and L. Leifer, "The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems", Wiley, 2018.

3. T. Lockwood, "Design Thinking: Integrating Innovation, Customer Experience, and Brand Value", Allworth Press, 2010.

4. K. T. Ulrich and S. D. Eppinger, "Product Design and Development", McGraw-Hill Hill Education, 6th Edition, 2016.

5. C. J. Meadows and C. Parikh, "The Design Thinking Workbook: Essential Skills for Creativity and Business Growth", Emerald Publishing, 2022.

Reference Books:

1. T. Kelley and D. Kelley, "Creative Confidence: Unleashing the Creative Potential Within Us All", HarperCollins Publisher, 2013.

2. T. Brown, "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", HarperCollins, 2013.

3. J. Knapp, J. Zeratsky, and B. Kowitz, "Sprint: How to Solve Big Problems and Test New Ideas in Just Five Days", Simon & Schuster, 2016.

4. Chakrabarti, "Engineering Design Synthesis: Understanding, Approaches and Tools", Springer, 2002.

5. K. Otto, and K. Wood, "Product Design", Prentice Hall, 2000.

Online Reference:

- Design and Innovation

    - https://openstax.org/books/entrepreneurship/pages/4-suggested-resources

- Overview of Design Thinking

    - https://www.interaction-design.org/literature/topics/design-thinking

    - 10 Models for Design Thinking. In 2004, business consultants Hasso... | by Libby Hoffman | Medium

    - https://www.tcgen.com/design thinking/What is Design Thinking and How Does it Relate to Product Development

- Understand, observe and define the problem

    - https://www.nngroup.com/articles/empathy-mapping/

    - https://uxdesign.cc/the-purpose-of-a-journey-map-and-how-can-it-galvanize-action-9a628b7ae6e

- Ideation and prototyping

    - https://www.interaction-design.org/literature/topics/prototyping

    - https://www.uxmatters.com/mt/archives/2019/01/prototyping-user-experience.php

- Testing and implementation

- https://www.nngroup.com/articles/usability-testing-101/

- https://www.interaction-design.org/literature/article/test-your-prototypes-how-to-gather-feedback and-maximise-learning

- Design thinking in various sectors

  - https://www.tutorialspoint.com/design_thinking/design_thinking_quick_guide.htm

Web References:

1. Creative Engineering Design (https://nptel.ac.in/courses/107108010)

2. Understanding Creativity and Creative Writing (https://nptel.ac.in/courses/109101017)

3. Understanding Design Thinking & People Centred Design (https://nptel.ac.in/courses/109104109)

4. Design Thinking - A Primer (https://nptel.ac.in/courses/110106124)

5. Product Engineering and Design Thinking (https://nptel.ac.in/courses/112105316)

Program: Information Technology	S.Y. B.Tech.	Semester: III
Universal Human Values (RCP24XHS232)		

Course Objectives:

1. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.

2. To help students initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession.

3. To help students understand the meaning of happiness and prosperity for a human being.

4. To facilitate the students to understand harmony at all the levels of human living and live accordingly.

5. To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society.	L2	Understand
CO2	Distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co existence of Self and Body.	L3	Apply
CO3	Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society.	L2	Understand
CO4	Understand the harmony in nature and existence and work out their mutually fulfilling participation in the nature.	L2	Understand
CO5	Distinguish between ethical and unethical practices and start working out the strategy to actualize a harmonious environment wherever they work.	L3	Apply

Universal Human Values (RCP24XHS232)
Course Contents

Unit-I   04Hrs.

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

Understanding the need, basic guidelines, content and process for Value Education, Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels

Unit-II   05 Hrs.

Understanding Harmony in the Human Being - Harmony in Myself

Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body'. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Self-regulation and health.

Unit-III   09 Hrs.

Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

Understanding harmony in the Family- the basic unit of human interaction, understanding values in human-human relationship; meaning of Justice and program for its fulfillment. Trust and Respect as the foundational values of relationship, Understanding the meaning of Trust; Difference between intention and competence, Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family). Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family!

Unit-IV   04 Hrs.

Understanding Harmony in the Nature and Existence - Whole existence as Co-existence

Understanding the harmony in the Nature, Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all pervasive space. Holistic perception of harmony at all [...]

existence.

Unit-V
<div align="right">04 Hrs.</div>

Implications of the above Holistic Understanding of Harmony on Professional Ethics:
Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, technologies and management models. Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, b) At the level of society: as mutually enriching institutions and organizations.

Text Books:

1. R. R. Gaur, R. Sangal, G. P. Bagaria ,"Human Values and Professional Ethics", Excel Books, New Delhi, 2010

Reference Books:

1. A. Nagaraj, "Jeevan Vidya: EkParichaya" Jeevan Vidya Prakashan, Amarkantak, 1999.

2. A.N. Tripathi, "Human Values," New Age Intl. Publishers, New Delhi, 2004.

3. The Story of Stuff (Book).

4. Mohandas Karamchand Gandhi,"The Story of My Experiments with Truth" .

5. E. F. Schumacher, "Small is Beautiful".

6. Cecile Andrews, "Slow is Beautiful".

7. J C Kumarappa, "Economy of Permanence".

8. Pandit Sunderlal, "Bharat Mein Angreji Raj".

9. Dharampal, "Rediscovering India".

10. Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule".

11. Maulana Abdul Kalam Azad, "India Wins Freedom".

12. Romain Rolland , "Vivekananda".

13. Romain Rolland, "Gandhi".

Program: Information Technology		S.Y. B.Tech.	Semester: III
Community Engagement Service (RCP24XEL201L)			

Prerequisite: Fundamentals of core branch, Communication Skills

Course Objectives:

To sensitise the student / learner into recognising community level problems & challenges and give them an opportunity to engage in activities for solving the same.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Knowledge Application: Apply knowledge understandings acquired from one's academic study/ field/ discipline for community level education, information dissemination by participation and engagement in community welfare activities	L3	Apply
CO2	Commitment for Cause: Identify and experience commitment for community engagement activities that reinforce sense of belongingness and gratitude towards societal cause	L5	Evaluate
CO3	Diversity: Witness diversity in communities and cultures and demonstrate change in approach / attitude as, an evidence of unconditional acceptance.	L3	Apply
CO4	Team: Recognise, experience and value, effectiveness of working in a team, demonstrating co-existence of the roles - sincere worker and effective leader.	L5	Evaluate

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Community Engagement Service (RCP24XEL201L)
Course Contents

Unit-I
Open Activities

- Participation in: blood donation camps organizer / donor, day-long tree plantation or afforestation / seed dispersal / cleanliness (water bodies, surrounding etc.) drives.

- Literacy drives for child / youth / adults. One day hand holding activities in work-shop conduct for under privilege kids in the areas of – basic science, math, technical skill demonstration and building.

Unit-II
Technical (Program core related)

- Cyber-crime, security awareness and vulnerabilities – sensitization, information dissemination and awareness sessions in indicated focus areas.
  Promotion and Sensitization for Sustainable living – focusing on solar power, water recycling, e-waste responsible disposal, waste recycling etc. in indicated focus areas.
  Focus areas: residential societies, schools, under-privileged areas, governments /private offices, and similar other establishments.

<center>OR</center>

- **Field Survey** Reporting on proactively conducted survey in the areas of resource management for – water, vegetables, electricity, crops etc.

Activities to be performed
Among the listed activities students are expected to complete one open activity mandatorily, and one technical (program core) OR field survey activity. The activities mentioned are exemplary in nature and any other additional activity of similar nature too can be undertaken by the learners, provided it is approved and endorsed by the faculty mentor / head of the department.

Suggested Activities
1.Undertaking cyber safety / security awareness sensitization drive / program especially for un-initiated students / individuals in schools / colleges / residential complex / offices etc.
Typical suggested tabulation:

Participant No.	Name	Age	School/College/ Residence/ Office	Email	Contact Number	Awareness Level	Remarks

2. Energy / Power assessment for establishments (societies, schools, colleges, residential complex, shops etc.) involving computing power devices ratings, power consumption over operating period, calculating energy cost from tariff card / rates for every group of appliances / devices or equipment. Typical suggested tabulation pattern:

Device/Appliance Group	Number of appliances / devices	Power Rating (kW)	Operating Hours (h/day)	Energy Consumption (kWh/day)	Tariff Rate (Rs. / kWh)	Energy Cost (Rs.)
Lighting Fixtures						
Ceiling Fans						
Air Conditioner (AC)						
Security Systems						
Water Pump						

3. Traffic light monitoring viz-e-viz average traffic density on road. Analysing the data and commenting on results. Evaluating and comparing impact on road repairs related lane blockage and proportional recommendation for lights timing variations.

Typical suggested tabulation pattern.

Sr.No.	Timestamp	Traffic Density	Traffic Light Status	Road Repair Status	Remarks

4. Help compute green footprint of selected number of household (per member) - say 10 houses of 3+ members. This is for evaluating dependence upon non green energy sources and habits and changes in lifestyle for attempts at their reductions. Learners are encouraged to use typically available online carbon-footprint calculators. The table herewith maybe used for reference calculations.

House No.	Household Name	Number of Members	Energy Usage (kWh)	Water Usage (liters)	Waste Production (kg)	Transportation Habits	Green Footprint

5. Compulsion of having a borewell for non-potable water supply in city residential complexes is a modern day rule. Increased pace of re-development, as well as number of occupants in given area, has resulted in increased number of borewells being dug within and outside city limits.

Reduced yield, quality and quantity of water adds to the recurring maintenance cost of borewells, especially in the city areas. Poor water recharge systems along-with depleting open soil cover area in wake of wall-to-wall of concrete carpet aggravate the problem. Study, analyse and report a residential society's – capacity of water requirement, present day borewells in action, approximate yield, maintenance cost and frequency, borewell flushing iterations in wake of redevelopment in neighborhood. A typical tabulation mechanism for inferences can be as below:

Borewell No.	Location	Depth (ft)	Yield (Liters/Day)	Water Quality	Maintenance Cost (Rs.)	Remarks

6. Detection of Adulteration in food / fruits / vegetables / milk / mava /saffron etc. or contami-

nation of potable drinking water.

Ex. Adulteration in fruits could be apple waxing, injecting chemicals in watermelon, pomegranate etc. to give it a bright red color, artificial ripening of mangos etc.

For a given activity, samples from more than one area, specifically from mofussil /interiors / 'gaothans' etc, may be obtained, to evaluate sample purity or extent of adulteration. Learners are encouraged to use online resources provided by 'Food Safety and Standards Authority of India' *(fssai)*, for handholding in requisite procedures.

YouTube link:

1. Food Safety and Standards Authority of India: goo.gl/Y8Lzbu

2. Ex. 1 Milk Adulteration: https://www.youtube.com/watch?v=pbnmeRUBxKk

3. Ex.2 Watermelon Adulteration: https://www.youtube.com/watch?v=yrLAj7oJies

Product	Adulterant	Testing Method	Result	Remarks

Activity Endorsement Certificate

Date:

Community engagement service is a mandatory course, of one credit, introduced at second year of engineering under the autonomous structure of the institute.

Course objective: To sensitise the student / learner into recognising social problems and challenges and give them an opportunity to engage in activities for solving the same.

Course outcomes:

1. Knowledge application: Applies knowledge understandings acquired from one's academic study/ field/ discipline for community level education, information dissemination by participation and engagement in community welfare activities.

2. Commitment for cause: Identify and experience commitment for community engagement activities that reinforce sense of belongingness and gratitude towards societal cause.

3. Diversity: Witness diversity in communities and cultures and demonstrate change in approach / attitude as an evidence of unconditional acceptance.

4. Team: Recognise, experience and value effectiveness of working in a team, demonstrating co-existence of the roles - sincere worker and effective leader.

This is to certify that Mr./Ms._____ bearing PRN _____ is a student of S.Y. B.Tech., _____ branch of engineering. He / She is a bonafide student of SES's R. C. Patel Institute of Technology, Shirpur. He / She is reliable, sincere, hardworking and capable of conducting _____ _____ activity in your premises. We request you to kindly allow for the conduction of the activity and we also solicit your earnest co-operation in the same.

Signature

Name of Department Head:

Disclaimer

(This form must be read, signed, and submitted prior to the beginning of the community service activity.)

Student Details	Activity Details
Name	
PRN	Date
Program	Time
Class/Div	Address

I, the undersigned _____ accept the following terms and conditions unconditionally:

1. I accept and understand that the community activity identification and selection has been done willingly by me.

2. I undertake to convey that, I am apparently in good health and well-being, and suffer no physical impairment that would or should prevent my participation in the activity.

3. I undertake to bear all related expenses and risk of travel related to the activity and shall not hold any personnel from the institute responsible with regards to claims and / or loss in the process of conduct of activity.

4. I undertake that my parents or legal/local guardians are aware of said activity and agree to above mentioned terms and conditions.

Student's name & Signature: _____

Parent or Guardian's name & signature: _____

Guidelines for Assessment of the work

- The review/progress monitoring committee shall be constituted by the Head of the Department. The progress of selected/assigned activities is to be evaluated on a continuous basis, holding at-least one review in the semester.

- In the continuous assessment, focus shall also be on each individual student's contribution to the team activity, their understanding and involvement as well as responses to the questions being raised at all points in time.

- Each group needs to submit following forms to respective supervisor after conducting both the activities,

  1. Activity Conduction Report

  2. Participant Feedback (online / offline)

  3. Participant Attendance (online / offline)

  4. Survey Report

  5. Participation certification

Forms for Technical Activity:

1. **Activity Conduction Report**

Sr. No.	Name of the Activity	
1	Date of Activity	
2	Activity type Open / Technical	
3	Activity objectives	
4	Place of Activity	
5	PRN and Names of students	
6	Name of the Association	
7	Activity description	
8	No. of participants	
9	Photos (Geo tagged)	

2. Participant feedback (online / offline):

Sr. No.	Indicators	Scale: 1 (Lowest) to 5 (Highest)
1	The objectives of the training were clearly defined.	
2	The content was organized and easy to follow.	
3	This training experience will be useful to me.	
4	The trainer was knowledgeable about the training topics.	
5	The training objectives were met.	

Program: Information Technology		S.Y. B.Tech.	Semester: III
Product Life Cycle Management (RCP24XOE211)			

Prerequisite: Knowledge of basic concepts of Management

Course Objective(s):

1. To familiarize the students with the need, benefits and components of PLM.

2. To acquaint students with Product Data Management & PLM strategies.

3. To give insights into new product development program and guidelines for designing and developing a product.

4. To familiarize the students with Virtual Product Development.

5. To acquaint students with the need of Environmental aspects in PLM & its implementation

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Gain knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation.	L2	Understand
CO2	Illustrate various approaches and techniques for designing and developing products.	L3	Apply
CO3	Acquire knowledge in applying virtual product development tools.	L3	Apply
CO4	Acquire knowledge in implementation of Environmental aspects in PLM.	L2	Understand

Product Life Cycle Management (RCP24XOE211) Course Contents

Unit-I

07 Hrs.

Introduction to Product Lifecycle Management (PLM):

Product Lifecycle Management (PLM), Need for PLM, Product Lifecycle Phases, Opportunities of Globalization, Pre-PLM Environment, PLM Paradigm, Importance & Benefits of PLM, Widespread Impact of PLM, Focus and Application, A PLM Project, Starting the PLM Initiative, PLM Applications.

PLM Strategies: Industrial strategies, Strategy elements, its identification, selection and implementation, Developing PLM Vision and PLM Strategy, Change management for PLM.

Unit-II

07 Hrs.

Product Design and Development:

Product Design and Development Process, Engineering Design, Organization and Decomposition in Product Design, Typologies of Design Process Models, Reference Model, Product Design in the Context of the Product Development Process, Relation with the Development Process Planning Phase, Relation with the Post design Planning Phase.

Unit-III

10 Hrs.

Methodological Evolution of Product Design:

Concurrent Engineering, Characteristic Features of Concurrent Engineering, Concurrent Engineering, Life Cycle Approach, Characteristic Features of Life Cycle Approach.

The Design for X System, Objective Properties and Design for X Tools, Choice of Design for X Tools and Their Use in the Design Process. New Product Development (NPD) and Strategies, Product Configuration and Variant Management.

Integration of Environmental Aspects in Product Design:

Sustainable Development Design for Environment, Need for Life Cycle Environmental Strategies, Useful Life Extension Strategies, End-of-Life Strategies, Introduction of Environmental Strategies into the Design Process, Life Cycle Environmental Strategies and Considerations for Product Design, Tools and techniques for integrated design, Implementation of international standards.

Unit-IV

07 Hrs.

Product Data Management (PDM):

Product and Product Data, PDM systems and importance, Components of PDM, Reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation.

Virtual Product Development Tools:

For components, machines, and manufacturing plants, 3D CAD systems and realistic rendering techniques, Digital mock-up, Model building, Model analysis, Modelling and simulations in Product Design, Examples/Case studies.

Unit-V   08 Hrs.

Engineering Methods for product Duration design & evaluation:

Durability of Products and Components, Design for Fatigue, Infinite Life Approach, Design for Finite Life.

Product Recovery Planning & Analysis:

Approach to the Recovery Problem, Method for Recovery Cycles Planning, Calculation Models for Recovery Cycles Planning, Basic procedure, Determinant Factors for Recovery, Effective Component Reusability, Recovery Fractions, Extension of Useful Life.

Text Books:

1. John Stark, "Product Lifecycle Management: Paradigm for 21st Century Product Realization", Springer-Verlag, 2004, ISBN: 1852338105.

2. Fabio Giudice, Guido La Rosa, Antonino Risitano, "Product Design for the environment-A life cycle approach", Taylor & Francis 2006, ISBN: 0849327229.

Reference Books:

1. Saaksvuori Antti, Immonen Anselmie, "Product Life Cycle Management", Springer, Dreamtech, 2009, ISBN: 3540257314.

2. Michael Grieve, "Product Lifecycle Management: Driving the next generation of lean thinking", Tata McGraw Hill, 2006, ISBN: 0070636265.

3. François Villeneuve, Luc Mathieu, Max Giordano, "Product Life-Cycle Management: Geometric Variations", United Kingdom: Wiley, 2010.

Prerequisite: NIL

Course Objective(s):

1. The course is blend of Management and Technical field.

2. Discuss the roles played by information technology in today's business and define various technology architectures on which information systems are built.

3. Define and analyze typical functional information systems and identify how they meet the needs of the firm to deliver efficiency and competitive advantage.

4. Identify the basic steps in systems development.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain the fundamental concepts of the management information systems used in business.	L2	Understand
CO2	Describe IT infrastructure and its components and its current trends.	L2	Understand
CO3	Use the tools and technologies for accessing information from databases to improve business performance and decision making.	L3	Apply
CO4	Identify and explain the security and ethical challenges in MIS along with the measures to be taken.	L2	Understand
CO5	Select a suitable social computing platform for the given requirements that integrates AI and IoT.	L3	Apply
CO6	Explain the processes involved in the information system within the organization includes information acquisition and enterprise and global management technologies.	L2	Understand

Management Information System (RCP24XOE212) Course Contents

Unit-I

04 Hrs.

Foundation Concepts:

- Definition and scope of Management Information Systems (MIS) in business
- Functional area information system
- The components of information systems
- Impact of IT on organizations and society
- Business Process – BPR and BPI
- Business Pressure, Organizational responses
- Competitive Advantage and Strategic IS's.

Unit-II

05 Hrs.

Information Technology Infrastructure:

- Overview of IT infrastructure
- Hardware and Software
- **Computer Systems:** End User and Enterprise Computing
- **Computer peripherals:** Input, Output, and Storage Technologies
- **Application Software:** End User Applications
- **System Software:** Computer System Management
- **Data Resource Management:** Technical Foundations of Database Management, Managing Data Resources, Big data, Data warehouse and Data Marts, Knowledge Management
- **Networks:** The Networked Enterprise (Wired and wireless), Pervasive computing, Cloud Computing models

Unit-III

10 Hrs.

MIS Tools and applications for Decision making:

- ERP and ERP support of Business
- Business intelligence (BI): Managers and Decision Making

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- **Decision Support System (DSS):** types, components, Data mining

- Executive information system

- Role of AI in decision making

- Role of predictive analytics and data visualization in business

Unit-IV   08 Hrs.

Security and Ethical Challenges

- Information security fundamentals

- Key principles of information security

- Common threats and vulnerabilities in MIS

- Security measures and controls

- Access control mechanisms: authentication, authorization and accounting (AAA)

- Encryption techniques and cryptographic protocols

- Ethical, and societal challenges of IT

- Legal and regulatory framework

- Privacy Policies

Unit-V   06 Hrs.

Social Computing (SC)

- Web 2.0 and 3.0: static and dynamic platform, integration with AI and IoT.

- SC in business-shopping: leveraging social media platforms, Social listening and sentiment analysis.

- Social computing in Customer Relationship Management (CRM)

- Marketing, operational and analytic CRM,

- E-business and E-commerce – B2B B2C, E-commerce platforms and payment gateways

- Mobile commerce: growth trends, mobile wallets, contactless payments, shopping apps and platforms

Unit-VI   06 Hrs.

Information System within Organization

- Acquiring Information Systems and Applications: Various System development life cycle models

- Enterprise and Global Management of Information Technology: Managing Information Technology, Managing Global IT

- Business processes and information systems

Textbooks:

1. A. K. Gupta, "Management Information System", S. Chand Limited, 2010.

2. K. K. Ghosh, Saini Das, and S. Mukherjee, "Management Information System", Management, IIT, Kharagpur, 2021.

Reference Books:

1. James A O'Brien, George M., Ramesh Behl, "Management Information Systems", 11th Edition, Tata McGraw Hill, 2019.

2. Kelly Rainer, Brad Prince, "Management Information Systems", Wiley, 2016.

Web References:

1. Management Information System (https://nptel.ac.in/courses/110105148)

2. Management Information System (https://archive.nptel.ac.in/courses/110/105/110105148/)

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Program: Information Technology	S.Y. B.Tech.	Semester: III
Operations Research (RCP24XOE213)		

Prerequisite: Knowledge of 1. Mathematics, 2. Probability.

Course Objective(s):

1. To formulate a real-world problem as a linear programming problem and able to solve.

2. To understand the optimisation tools that are needed to solve linear programming problems.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Formulate the real-world optimisation problem into a Linear Programming Problem (LPP) and analyse the solution obtained using LPP optimisation models	L4	Analyze
CO2	Solve Linear Programming Problems using transportation and assignment models.	L3	Apply
CO3	Apply Decision Theory to determine the optimal course of action when a number of alternatives are available, and their consequences cannot be forecast with certainty and uncertainty.	L3	Apply
CO4	Apply Game Theory for decision making under conflicting situations where there are one or more opponents (players).	L3	Apply
CO5	To breaking down a large problem into smaller sub problems and solved recursively or iteratively using Dynamic Programming models.	L4	Analyze

Operations Research (RCP24XOE213)
Course Contents

Unit-I   12 Hrs.

Introduction to Operations Research:

Introduction, Structure of the Mathematical Model, Limitations of Operations Research.

Linear Programming:

Introduction, Linear Programming Problem, Requirements of LPP, Mathematical Formulation of LPP, Graphical method, Simplex Method, Penalty Cost Method or Big M-method, Two Phase Method.

Unit-II   08 Hrs.

Transportation Problem:

Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel's approximation method. Optimality test: MODI method.

Assignment Problem:

Introduction, Mathematical Formulation of the Problem, Hungarian Method Algorithm, Processing of n Jobs Through Two Machines and m Machines, Graphical Method of Two Jobs m Machines Problem Routing Problem.

Unit-III   06 Hrs.

Decision Theory: Steps in Decision Theory approach, Decision-making Environment, Decision making under condition of certainty, Decision making under condition of uncertainty, Decision making under condition of risk, Maximum likelihood criterion.

Unit-IV   06 Hrs.

Game Theory: Competitive games, rectangular game, saddle point, minimax/maximin method of optimal strategies, value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point – mixed strategy for 2 X 2 games.

Unit-V   07 Hrs.

Dynamic programming: Characteristics of dynamic programming. Dynamic programming approach for Priority Management employment smoothening, capital budgeting, Stagecoach/Shortest Path, cargo loading and Reliability problems

Text Books:

1. Taha, H. A.,"Operations Research - An Introduction", Pearson Education, 2022.

2. Gupta P. K., Hira D. S.,"Operations Research", S. Chand Limited, 2014.

Reference Books:

1. Boucherie, R. J., Tijms, H. and Braaksma, "A Operations Research: Introduction to Models and Methods", 2021.

2. Hiller, F. S. and Liebermann, G. J, "Introduction to Operations Research", McGraw-Hill Higher Education, 2010.

3. Ravindran, A., Phillips, D. T. and Solberg, J. J, "Operations Research: Principles and Practice", Wiley India Pvt. Limited, 2009.

Program: Information Technology	S.Y. B.Tech.	Semester: III
Personal Finance Management (RCP24XOE214)		

Prerequisite: NIL

Course Objective(s):

1. To create awareness and educate consumers on access to financial services.

2. To make the students understand the basic concepts, definitions and terms related to direct taxation.

3. To help the students compute the Goods and Service Tax (GST) payable by a supplier after considering the eligible input tax credit.

4. To familarise the students with microfinance for accelerating the expansion of local microbusinesses.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the Indian financial system.	L2	Understand
CO2	Use a framework for financial planning to understand the overall role finances play in his/her personal life.	L3	Apply
CO3	Compute income from salaries, house property, business/profession, capital gains and income from other sources.	L3	Apply
CO4	Compute the amount of CGST, SGST and IGST payable after considering the eligible input tax credit.	L3	Apply
CO5	Understand how Microfinance can help in financial inclusion.	L2	Understand

Personal Finance Management (RCP24XOE214) Course Contents

Unit-I   07 Hrs.

Overview of Indian Financial System: Characteristics, Components and Functions of Financial System. Financial Instruments and Financial Markets, Financial inclusion.

Introduction to Personal Finance: Person Financial Planning in Action, Money Management Skills, Taxes in Your Financial Plan, Savings and Payment Services.

Consumer Credit: Advantages, Disadvantages, Sources and Costs.

Unit-II   07 Hrs.

Personal Financial Management:

Loans: Home, Car, Education, Personal, Loan against property and Jewel loan.

Insurance: Types of Insurance – ULIP and Term; Health and Disability Income Insurance, Life Insurance.

Investment: Investing Basics and Evaluating Bonds, Investing in Stocks and Investing in Mutual Funds, Planning.

Unit-III   09 Hrs.

Income Tax:

Income Tax Act Basics: Introduction to Income Tax Act, 1961

Heads of Income and Computation of Total Income and Tax Liability: Heads of Income and Computation of Total Income under various heads, Clubbing Provisions, Set off and Carry forward of Losses, Deductions, Assessment of Income and tax liability of different persons.

Tax Management, Administrative Procedures and ICDS: TDS, TCS and Advance Tax Administrative Procedures, ICDS.

Unit-IV   08 Hrs.

Goods and Services Tax:

GST Constitutional framework of Indirect Taxes before GST (Taxation Powers of Union & State Government); Concept of VAT: Meaning, Variants and Methods; Major Defects in the structure of Indirect Taxes prior to GST; Rationale for GST; Structure of GST (SGST, CGST, UTGST & IGST); GST Council, GST Network, State Compensation Mechanism, Registration.

Levy and Collection of GST: Taxable event- "Supply" of Goods and Services; Place of Supply: Within state, Interstate, Import and Export; Time of supply; Valuation for GST- Valuation rules, tax-ability of reimbursement of expenses; Exemption from GST: Small supplies and Composition Scheme;

Classification of Goods and Services

Unit-V   08 Hrs.

Introduction to Micro – finance:

Micro-Finance: Definitions, Scope & Assumptions, Types of Microfinance, Customers of Micro-finance. Credit Delivery Methodologies, SHG concept, origin, Formation & Operation of Self Help Groups (SHGs).

Models in Microfinance: Joint Liability Groups (JLG), SHG Bank Linkage Model and GRAMEEN Model: Achievements & Challenges

Institutional Mechanism: Current Challenges for Microfinance, Microfinance Institutions (MFIs): Constraints & Governance Issues, Institutional Structure of Microfinance in India: NGO-MFIs, NBFC-MFIs, Co-operatives, Banks, Microfinance Networks and Associations; Demand & Supply of Microfinance Services in India, Impact assessment and social assessments of MFIs.

Reference Books:

1. Asha Singh, M.S. Gupta, "Banking and Financial Sector Reforms in India" , Serials Publication.

2. M.S. Gupta & J.B. Singh,"Indian Banking Sector: Essays and Issues", 1st Edition, Serials Publication.

3. K.M. Bhattacharya O.P. Agarwal,"Basics Of Banking & Finance", Himalaya Publishing House.

4. S. Subba Reddy , P. Raghu Ram, "Agricultural Finance and Management".

5. Dr.Vasant Desai, "The Indian Financial System and Development", 4th Edition, Himalaya Publishing House.

6. Sanjay Kumar Satapathy, "Income Tax Management Simple Way of Tax Management, Tax Planning and Tax Saving".

7. Dr. R. K. Jain, "Direct Tax System Income Tax", SBPD Publications.

8. S K Mishra,"Simplified Approach to GST Goods and Services Tax", Educreation Publishing.

9. Todd A Watkins, "Introduction To Microfinance", World Scientific Publishing Company.

Prerequisite: Basic Knowledge of Social science and Current affairs.

Course Objective(s):

1. To explain public policy and its operations with special focus on policy relating to Government finance.

2. To analyze and evaluate the impact of the public policy on firms and economy at large.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the importance of public systems in a fast-changing environment in the global context.	L2	Understand
CO2	Analyze the transformations in public systems with emphasis on current initiatives and emerging challenges in the field.	L4	Analyze
CO3	Explain public policy and its operations with special focus on policy relating to Government finance.	L2	Understand
CO4	Make policies and know about the happenings in the world, in the nation and those in their locality.	L5	Evaluate
CO5	Analyze and evaluate the impact of the public policy on firms and economy at large and work under various fields as policymakers.	L5	Evaluate

Public Systems and Policies (RCP24XOE215)
Course Contents

Unit-I   10 Hrs.

Introduction and Overview of Public Systems: Ideology of Public Systems; Mechanistic and Organic view of Society and Individuals; The Legal Framework; Federal Government; State and Local Governments, Government growth: The size of Government.

Unit-II   06 Hrs.

Public Sector in the Economics Accounts: Public Sector in the circular flow; Public Sector in the National Income Accounts.

Unit-III   08 Hrs.

Public Choice and Fiscal Politics: Direct Democracy; Representative Democracy; The Allocation Function; The Distribution Function; The Stabilization Function; Coordination of Budget Functions; The Leviathan Hypothesis.

Unit-IV   10 Hrs.

Introduction and Overview of Public Policy: Markets and Government; Social goods and Market failure, Public expenditure and its evaluation; Cost Benefit Analysis, Public policy and Externalities, Taxation Policy and its impact, Income distribution, redistribution and social security issues Fiscal & Budgetary Policy, Fiscal Federalism in India.

Unit-V   05 Hrs.

Case Studies in Expenditure Policy: Public Services

A) National Defense B) Highways C) Outdoor Recreation D) Education

Reference Books:

1. Charles Wheelan, "Introduction to Public Policy", W.W. Norton & Company, New York, 2011.

2. Thomas R. Dye, "Understanding Public Policy", Prentice Hall, 2008.

3. Anderson, James E.,"Public Policy-Making: An Introduction", Boston, 2011.

4. Avasthi & Maheshwari, "Public Administration", Lakshmi Narain Agarwal, 2008.

5. Mohit Bhattacharya, "New Horizons of Public Administration", Jawahar Publishers, New Delhi, 2011.

6. Nicholas Henry, "Public Administration and Public Affairs", Prentice Hall of India, New Delhi, 2017.

7. Harvey S Rosen and Ted Gayer, "Public Finance", 10th Edition, McGraw-Hill Education, 2013.

8. Richard A Musgrave and Peggy B Musgrave, "Public Finance in Theory and Practice", 5th Edition, Mcgraw Hill Book, 2017.

Program: Information Technology	S.Y. B.Tech.	Semester: III
Fundamentals of Biomedical Instruments (RCP24XOE216)		

Prerequisite: Basic knowledge of Human Anatomy, Basic knowledge of Electronics

Course Objective(s):

1. To understand the basic principles and working of various medical instruments .

2. To familiarize the learners with the various medical imaging modalities, their operating principles, instrumentation and clinical applications.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Associate & describe the different physiological processes taking place within the human body.	L2	Understand
CO2	Identify the use of biomaterials and apply principles of various transducers & sensors..	L3	Apply
CO3	Demonstrate the working principle of various medical instruments.	L3	Apply
CO4	Demonstrate principles used in imaging modalities and analysis.	L3	Apply
CO5	Identify different processes used in telemetry and telemedicine.	L2	Understand

Fundamentals of Biomedical Instruments (RCP24XOE216) Course Contents

Unit-I   04 Hrs.

Basic Human Physiology

- **Cell:** Electrical activity of excitable cells (Structure and functions of cell. Polarization and depolarization of cell)

- **Cardiovascular System:** Heart, Conductive tissues of heart, Cardiac cycle, Heart Valves, System and Pulmonary Circulation, Transmission of Cardiac Impulse, Blood Pressure, ECG (Einthoven's Triangle, Various leads and Waveforms).

- **Muscle Physiology:** Muscle physiology and aspects of skin resistance. Generation of EMG

- **Nervous System:** Different parts, their functions. Reflex actions and reflex arc, Function of Sympathetic and Parasympathetic nervous system. Generation of EEG

Unit-II   10 Hrs.

Biomaterial, Transducers and Sensors

- **Biomaterials used in fabrication of biodevices and implants:** Polymeric, Composite biomaterials, Metallic biomaterials, and Ceramic biomaterials.

- **Biopotential electrodes:** Electrode tissue interface, Electrode electrolyte interface Electrodes used for ECG, EEG & EMG.

- **Transducers & sensors:** temperature transducer, pulse sensor, glucose sensor, respiration sensor Introduction of biomaterials, Classification of biomaterials

Unit-III   08 Hrs.

Overview of Medical Instruments

- Classification, application and specifications of diagnostic, therapeutic and clinical laboratory equipment

- Method of operation of these Bio Medical Instruments

- ECG, EEG, EMG.

Unit-IV

09 Hrs.

Imaging Modalities and Analysis

- Radio graphic techniques, Computer Tomography

- MRI, PET, SPECT

- Ultrasonography

- Endoscopy

- Thermography, Retinal Imaging

- Imaging application in Biometric systems

- Analysis of digital images

Unit-V

08 Hrs.

Telemetry & Telemedicine

- Introduction to Biotelemetry

- Physiological parameters compliant to biotelemetry

- Components of Biotelemetry system

- Applications of telemetry in medical field (ECG, EEG & EMG)

Text Books:

1. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice hall of India, New Delhi,2007.

2. M.Arumugam, "Bio-Medical Instrumentation", Anuradha Agencies, 2003.

3. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, New Delhi, 2nd Edition, 2003.

4. John G. Webster, "Medical Instrumentation Application and Design", John Wiley and sons, NewYork, 1998.

5. B.D. Ratner, A.S. Hoffmann, F. J. Schoen, J. E. Lemons, "Biomaterials Science - An Introduction to Materials in Medicine", Academic Press, 1997.

Reference Books:

1. Dr Rajendra Prasad, "Electronic Measurement and Instrumentation".

2. Ed. Joseph D. Bronzino, "The Biomedical Engineering Hand Book", 3rd Edition, Boca Raton, CRC Press LLC, 2006.

3. Curry, T. S., Dowdey, J. E., & Murry, R. C., "Christensen's physics of diagnostic radiology". Lippincott Williams & Wilkins, 1990.

4. Joon Park, R. S. Lakes, "Biomaterials: An Introduction", Springer Science & Business Media.

Prerequisite: NIL

Course Objective(s):

1. To promote the knowledge of intellectual property laws of India and international treaties.

2. To encourage innovation.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Map a given project/ idea to a suitable intellectual property rights.	L3	Apply
CO2	Explain the fundamentals of the patents, copyrights, and design registrations.	L2	Understand
CO3	Draft applications to protect various intellectual property rights.	L6	Create
CO4	Communicate with national and/or international intellectual property organisations.	L4	Analyze

IPR and Patenting (RCP24XOE217)
Course Contents

Unit-I   03 Hrs.

Introduction to Intellectual Property Rights (IPR):

- Concept & meaning of IP and IPR.

- General principles of intellectual property rights.

- Need for intellectual property.

- Categories of IPR instruments - Patents, Trademarks, Copyrights, Industrial. Designs, Plant variety protection, Trade secrets, Geographical Indications etc.

- Ownership, assignment, licenses, infringement, validity period.

- International treaties on IPR.

Unit-II   09 Hrs.

Copyright and Design

- The Indian Copyright Act, 1957.

- Meaning of copyrights and rights of copyrighted works.

- Types of copyright

- Process of filing a copyright application.

- Introduction to Designs Law – Definitions.

- Registration of designs and procedure.

Unit-III   09 Hrs.

Basics of Patents

- The Indian Patent Act and The Indian Patent Rules.

- Conditions of patentability.

- Patentable and non-patentable inventions.

- Types of patent applications and patent specification.

- Inventors and Applicants.

- Category of applicants - natural person, small entity, startup and others.

- Patent databases and prior art search.

- International Patent Classification code.

Unit-IV

09 Hrs.

Patent Application Drafting

Patent application drafting:

- Application.

- Specification.

- Claims drafting:

  - Independent and dependent claims drafting.

  - Process patent and product patent claims.

- Abstract.

- Drawings.

- Declaration as to inventorship.

- Statement and undertaking.

Drafting response to communications from patent office.

- Reading and understanding examination reports.

- Drafting response.

Unit-V

09 Hrs.

Procedure for Filing a Patent Application, Timelines and Fees

- Application for grant of patent.

- Forms and Fees.

- Request for (early) publication and / or (early) examination.

- Patent examination and hearing.

- Pre-grant and post-grant opposition.

Text Books:

1. A Durafe and D Toradmalle, "Intellectual Property Rights", Wiley, 2020.

2. H Rockman, "Intellectual property law for engineers, scientists, and entrepreneurs", Wiley-IEEE Press, 2020.

Reference Books:

1. Bare Act, "The Patents Act, 1970 with The Patents Rules, 2003", Universal, 2023.

2. Bare Act, "The Copyright Act, 1957", Universal and LexisNexis, 2021.

3. Bare Act, "The Designs ACT, 2000", Commercial Law Publishers (India) Pvt. Ltd. 2021.

Online Resources:

1. W. Fisher, "Maps of Intellectual Property" https://cyber.harvard.edu/people/tfisher/IP/IPMaps.htm

2. World Intellectual Property Organisation courses https://www.wipo.int/academy/en/

3. Prof. Feroz Ali, "Patent Drafting for Beginners", https://onlinecourses.nptel.ac.in/noc24_hs59/preview

Program: Information Technology	S.Y. B.Tech.	Semester: III
Entrepreneurship and Startup Ecosystem (RCP24XOE218)		

Prerequisite: NIL

Course Objective(s):

1. To foster an entrepreneurial mindset.

2. To guide participants in building effective Business Models.

3. To educate participants regarding Intellectual property and Fundraising for Innovative Ventures.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Effectively Navigate the Global Startup Landscape.	L3	Apply
CO2	Cultivate an Entrepreneurial Mindset.	L4	Analyze
CO3	Create Effective Business Models.	L6	Create
CO4	Understand the significance of Intellectual Property rights.	L2	Understand
CO5	Master Fundraising Strategies.	L5	Evaluate

Entrepreneurship and Startup Ecosystem (RCP24XOE218)
Course Contents

Unit-I   06 Hrs.

Understanding the Entrepreneurial Ecosystem

- Introduction to Entrepreneurship and Startups

- Role of Entrepreneurship in economy

- Global and Local Entrepreneurial Landscapes

- Role of Incubators and Accelerators

- Case Studies of Successful Startups

Unit-II   08 Hrs.

Developing a Startup Mindset

- Cultivating an Entrepreneurial Mindset

- Market Analysis and Segmentation

- Opportunity Recognition

- Innovation and Idea Generation

- Feasibility Analysis of Business Ideas

- Role of innovation in Entrepreneurship

- Fostering creativity

- Practical Exercises and Workshops on Creative Problem Solving

Unit-III   10 Hrs.

Business Model Development

- Introduction to Business Models

- Lean Startup Methodology

- Prototyping and Minimum Viable Product (MVP)

- Financial Projections and Budgeting

- Various forms of Business Ownership

- Compliance and Legal Regulations

- Operations and Supply Chain Management

- Human Resource Management

- Developing a marketing Strategy

- Managing Growth Challenges

Unit-IV   08 Hrs.

Technological Innovation and Intellectual Property

- Technology and Entrepreneurship

- Intellectual Property Basics (Patents, Trademarks, Copyrights)

- Patent Search and Analysis

- Strategies for Protecting Intellectual Property

- Ethical Considerations in Technology and Innovation

Unit-V   07 Hrs.

Fundraising and Investment Strategies

- Fundraising Options for Startups

- Angel Investors and Venture Capital

- Crowdfunding Platforms

- Financial Modelling for Startups

- Crafting an Effective Pitch

Books Recommended:

1. Alexander Osterwalder and Yves Pigneur, "Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers", John Wiley & Sons, Jul2010.

2. Peter Thiel and Blake Masters, "Zero to One: Notes on Startups, or How to Build the Future", Virgin Books, 2015.

3. Alejandro Cremades, "The Art of Startup Fundraising: Pitching Investors, Negotiating the Deal, and Everything Else Entrepreneurs Need to Know", John Wiley & Sons, Inc., Hoboken New Jersey, 2016.

4. Christensen, Clayton M. "The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail", Boston, MA: Harvard Business School Press, 1997.

5. Brad Feld and Jason Mendelson, "Venture Deals: Be Smarter Than Your Lawyer and Venture Capitalist", Wiley, 4th Edition, 1 October 2019.