



Shirpur Education Society's

**R. C. Patel Institute of Technology, Shirpur**  
(An Autonomous Institute)

## Course Structure

**Second Year B. Tech. (Computer Engineering)**

With effect from Year 2025-26



Shahada Road, Near Nimzari Naka, Shirpur, Maharashtra 425405  
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# Second Year B.Tech Computer Engineering Semester-III (w.e.f. 2025-26)

Second Year B.Tech Computer Engineering Semester-III (w.e.f. 2025-26)													
Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total	Credits
							Continuous Assessment (CA)						
							TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Average of (TT1 & TT2)			
											ESE		
1	PC	RCP23CPC201	Data Structures	L	T	P	[A]			[B]	[C]	[A+B+C]	
				3			25	15	15	15	60	100	3
	PC	RCP23CPC201L	Data Structures Laboratory				25				25	50	1
				2									
2	PC	RCP23CPC202	Database Management System	3			25	15	15	15	60	100	3
	PC	RCP23CPC202L	Databasc Management System Laboratory			2	25				25	50	1
3	PC	RCP23CPC203	Computer Networks	2			25	15	15	15	60	100	2
4	PC	RCP23CPC203L	Python Programming Laboratory			2	25				25	50	1
6#	OE	RCP23CMD201	Computational Mathematics	3			25	15	15	15	60	100	3
		RCP23XOE211	Product Life Cycle Management	3			25	15	15	15	60	100	3
		RCP23XOE212	Management Information System	3			25	15	15	15	60	100	3
		RCP23XOE213	Operations Research	3			25	15	15	15	60	100	3
		RCP23XOE214	Personal Finance Management	3			25	15	15	15	60	100	3
		RCP23XOE215	Public Systems and Policies	3			25	15	15	15	60	100	3
		RCP23XOE216	Fundamentals of Biomedical Instruments	3			25	15	15	15	60	100	3
		RCP23XOE217	IPR and Patenting	3			25	15	15	15	60	100	3
7	SC	RCP23XOE218	Entrepreneurship and Startup Ecosystem	3			25	15	15	15	60	100	3
		RCP23XSC201P	Semester Project-I			2	25				25	50	1
		RCP23XHS231L	Design Thinking Laboratory			2	25					25	1
		RCP23XHS232	Universal Human Values	3			25	15	15	15	60	100	3
10	EL	RCP23XEL201L	Community Engagement Service			2	25				25	1	
Total				17	0	12	300			90	460	850	23

# Any 1 Open Elective Course

Prepared by: *Sonawane*

Ms. J. S. Sonawane

Cheked by: *Sonawane*

Dr. S. M. Pardeshi

Prof. Dr. R. B. Wagh

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 Computer Engineering Semester-IV (w.e.f. 2025-26)

Second Year B.Tech Computer Engineering Semester-IV (w.e.f. 2025-26)														
Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total	Credits	
				L	T	P	Continuous Assessment (CA)							
							TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Average of (TT1 & TT2)				
											ESE			
1	PC	RCP23CPC251	Operating Systems	3			[A]	25	15	15	[B]	[C]	[A+B+C]	
	PC	RCP23CPC251L	Operating Systems Laboratory					25			15	60	100	3
2	PC	RCP23CPC252	Analysis of Algorithms	3		2		25				25	50	1
	PC	RCP23CPC252L	Analysis of Algorithms Laboratory					25	15	15	15	60	100	3
3	PC	RCP23CPC253	Artificial Intelligence			2		25				25	50	1
	PC	RCP23CPC253L	Artificial Intelligence Laboratory	3				25	15	15	15	60	100	3
4	MD	RCP23CMD251	Algebraic Number Theory			2		25				25	50	1
		RCP23XOE261	Project Management	2				25	15	15	15	60	100	2
		RCP23XOE262	Cyber Security, Policies and Laws	3				25	15	15	15	60	100	2
5#	OE	RCP23XOE263	Advanced Operations Research	3				25	15	15	15	60	100	3
		RCP23XOE264	Corporate Finance Management	3				25	15	15	15	60	100	3
		RCP23XOE265	Corporate Social Responsibility	3				25	15	15	15	60	100	3
		RCP23XOE266	Bioinformatics	3				25	15	15	15	60	100	3
		RCP23XOE267	Human Resource Management	3				25	15	15	15	60	100	3
		RCP23XOE268	Digital Marketing Management	3				25	15	15	15	60	100	3
		RCP23XOE269	Logistics and Supply Chain Management	3				25	15	15	15	60	100	3
6	SC	RCP23XSC251P	Semester Project-II			2		25				25	50	1
7	HS	RCP23XHS281T	Professional and Business Communication Tutorial		2			25					25	2
8	HS	RCP23XHS282	Economics and Financial Management	2				25	15	15	15	60	100	2
Total				16	2	08		275			90	460	825	22

# Any 1 Open Elective Course

Prepared by: Sonawane

Ms. J. S. Sonawane

Checked by: Dr. S. M. Pardeshi

Dr. S. M. Pardeshi

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Dean Academics & Dy. Director

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Director



## Semester - III



Program: Computer Engineering	S.Y. B.Tech.	Semester: III
Data Structures (RCP23CPC201)		
Data Structures Laboratory (RCP23CPC201L)		

**Prerequisite:** C Programming.

### Course Objective(s):

1. To introduce and familiarize students with linear and non-linear data structures, their use in fundamental algorithms and design & implementation of these data structures.
2. To introduce students to the basics of algorithms and time complexity.
3. To familiarize students with various sorting and searching techniques, and their comparison.

### Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Assimilate the concept of various linear and non-linear data structures.	L2	Understand
CO2	Solve the problem using appropriate data structure.	L3	Apply
CO3	Implement appropriate searching and sorting algorithms for a given problem.	L4	Analyze



# Data Structures (RCP23CPC201)

## Course Contents

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### Unit-I

02 Hrs.

**Data Structures:** Introduction, Need of Data Structures, Types of Data Structures, Abstract Data Types (ADT), Algorithms and Asymptotic notations.

### Unit-II

08 Hrs.

**Linear Data Structures – LIST:** List as an ADT, Array-based Implementation, Linked List Implementation, Singly Linked Lists, Circularly Linked Lists, Doubly-Linked Lists, All Operations (Insertion, Deletion, Merge, Traversal, etc.) and their Analysis, Applications of Linked Lists - (Polynomial Addition).

### Unit-III

08 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

10 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:** Creation of AVL Tree.

**Heap-** Operations on Heap, Heap Sort

**Applications -**Huffman Coding.

**Introduction to B tree** -Insertion, Deletion.

### Unit-V

03 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:** Linear Search, Binary Search and Fibonacci Search.

**Sorting:** Selection Sort, Insertion Sort, Radix Sort, Merge Sort, Quick Sort.





**Hashing:** Hash Functions, Overflow handling, Collision & Collision Resolution Techniques, Linear hashing, Hashing with chaining, Separate Chaining, Open Addressing.

## **Data Structures Laboratory (RCP23CPC201L)**

### **List of Laboratory Experiments**

#### **Suggested Experiments:(Any 10)**

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.





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. Reema Thareja, "Data Structures using C", 3<sup>rd</sup> Edition, Oxford, 2023.
2. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, "Fundamentals of Data Structures in C", 2<sup>nd</sup> Edition, W. H. Freeman and Company, 2008.
3. R. F. Gilberg and B. A. Forouzan, "Data Structures – A Pseudocode Approach with C", 2<sup>nd</sup> Edition, Cengage Learning, 2007.

### **Reference Books:**

1. Tanenbaum, Langsam, Augenstein, "Data Structures using C", Pearson, 2<sup>nd</sup> Edition, 2015.
2. Kruse, Leung, Tondo, "Data Structures and Program Design in C", 2<sup>nd</sup> Edition, Pearson Education, 2013.
3. Aho, Hopcroft, Ullman, "Data Structures and Algorithms", Addison-Wesley, 1<sup>st</sup> Edition, 2010.



Program: Computer Engineering	S.Y. B.Tech.	Semester: III
Database Management System (RCP23CPC202)		
Database Management System Laboratory (RCP23CPC202L)		

**Prerequisites:** Computer Basics, Foundation of Computing Technologies.

### Course Objective(s):

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:

On completion of the course, the learner will be able to:

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	Demonstrate appropriate transaction management and recovery techniques for a given problem	L3	Apply
CO4	Understand indexing mechanisms and non-relational databases	L2	Understand





# Database Management System (RCP23CPC202) Course Contents

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## Unit-I

06 Hrs.

**Introduction to DBMS: The Entity-Relationship (ER) Model:** 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-II

09 Hrs.

**Structured Query Language (SQL):** 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-III

08 Hrs.

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

## Unit-IV

06 Hrs.

**Transaction Management and Recovery:** Transaction Concept, ACID properties, Transaction States, Implementation of atomicity and durability, Concurrent Executions, Serializability, Concurrency Control Protocols: Lock-based, Deadlock Handling.

**Recovery System:** Failure classification, log-based recovery, Shadow paging

## Unit-V

04 Hrs.

**Indexing Mechanism:** Hashing techniques, Types of Indexes: Single Level Ordered Indexes, Multilevel Indexes, Overview of B-Trees and B+ Trees.

## Unit-VI

06 Hrs.

**NoSQL Databases:** Introduction to unstructured data, Overview of NoSQL databases – Key-value store, Document database, Column-oriented database, Graph database, Overview of MongoDB.



# Database Management System Laboratory (RCP23CPC202L)

## List of Laboratory Experiments

### Suggested Experiments:(Any 10)

1. Identify the case study and detail statement of problem. Design an Entity-Relationship (ER) /Extended Entity-Relationship (EER) Model.
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. Examine the consistency of database using concurrency control technique (Locks)
9. To implement B-trees/B+ trees.
10. Perform CRUD operations in MongoDB

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", 7<sup>th</sup> Edition, McGraw Hill, 2019.
2. Elmasri and Navathe, "Fundamentals of Database Systems", 7<sup>th</sup> Edition, Pearson education, 2016.
3. Carlos Coronel, Steven Morris, Peter Rob, "Database Systems Design, Implementation and Management", 9<sup>th</sup> Edition, Cengage Learning, 2011.
4. G. K. Gupta, "Database Management Systems", 3<sup>rd</sup> Edition, McGraw Hill, 2018.
5. Andreas Meier, Michael Kaufmann, "SQL & NoSQL Databases", Springer, 2019.
6. Xun (Brian) Wu, Sudarshan Kadambi, Devram Kandhare, Aaron Ploetz — Seven NoSQL Databases in a Week, Packt Publishing Limited, 2018.



7. NoSQL with MongoDB in 24 Hours, Sams Teach Yourself, Pearson Education, 2015.

## Reference Books:

1. Dr. P. S. Deshpande, "SQL and PL/SQL for Oracle 10g", Black Book, Dreamtech Press, 2012.
2. Sharaman Shah, "Oracle for Professional", Shroff Publishers & Distributers Private Limited, 1<sup>st</sup> Edition, 2008.
3. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", 3<sup>rd</sup> Edition, McGraw Hill, 2014.
4. Patrick Dalton, "Microsoft SQL Server Black Book", Coriolis Group Publication, U.S., 11<sup>th</sup> Edition, 1997.
5. Lynn Beighley, "Head First SQL", O'Reilly Media Publication, 1<sup>st</sup> Edition, 2007.
6. Gaurav Vaish —Getting started with NoSQL, Packt Publishing Limited, 2013.
7. Kyle Banker, Peter Bakkum, Shaun Verch, Douglas Garrett, "MongoDB in Action", 2<sup>nd</sup> Edition Covers MongoDB Version 3.0, Harper Business, 2016.





Program: Computer Engineering	S.Y. B.Tech.	Semester: III
Computer Networks (RCP23CPC203)		

**Prerequisite:** Digital Logic.

### Course Objective(s):

1. To get familiar with contemporary issues and challenges of various protocol designing in layered architecture and performance analysis of routing and transport layer protocols for various applications.

### Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze OSI and TCP/IP reference models for network architecture design.	L4	Analyze
CO2	Classify physical layer transmission media based on communication requirements.	L2	Understand.
CO3	Apply data link layer error control and flow control protocols for reliable data transmission.	L3	Apply
CO4	Apply IP addressing schemes and routing algorithms for network implementation.	L3	Apply
CO5	Compare transport layer protocols and congestion control mechanisms for performance optimization.	L4	Analyze
CO6	Examine WSN and SDN networking paradigms including their architecture and applications.	L2	Understand



# Computer Networks (RCP23CPC203)

## Course Contents

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### Unit-I

03 Hrs.

**Introduction to Networking:** Introduction to computer network, network application, network software and hardware components, Network topology, design issues for the layers. Reference models: Layer details of OSI, TCP/IP models.

### Unit-II

03 Hrs.

**Physical Layer:** Frequency Spectrum, Guided Transmission Media: Twisted pair, Coaxial, Fiber optics. Unguided media: Bluetooth (Piconet, Scatternet and Protocol stack), Infra, Radio Waves, Microwaves.

### Unit-III

06 Hrs.

**Data Link Layer:** Design Issues: Framing, Error Control: Error Detection and Correction (Hamming Code, CRC, Checksum), Flow Control: Stop and Wait, Sliding Window (Go Back N, Selective Repeat), Medium Access Control Sublayer: Channel Allocation problem, Multiple Access Protocol (Aloha, Carrier Sense Multiple Access (CSMA/CA, CSMA/CD).

### Unit-IV

07 Hrs.

**Network Layer:** Network Layer design issues, Communication Primitives: Unicast, Multicast, Broadcast. IPv4 Addressing (Classful and Classless), IPv4 Protocol, IPv6 Protocol Network Address Translation (NAT) Routing algorithms : Link state routing, Distance Vector Routing Protocols - ARP, RARP, ICMP, IGMP Congestion control algorithms: Open loop congestion control, Closed loop congestion control, Token & Leaky bucket algorithms.

### Unit-V

04 Hrs.

**Transport Layer:** The Transport Service, Port Addressing, Transport service primitives, Berkeley Sockets, Connection management (Handshake, Teardown), UDP, TCP, TCP Congestion Control: Slow Start.

**Application Layer-** DNS, HTTPS, SMTP, Telnet, FTP.

### Unit-VI

03 Hrs.

**Introduction to Modern Networking Paradigms:** Introduction to WSN, WSN Architecture, Types of WSN, Challenges in WSN.

Introduction to SDN, SDN Architecture, Key Concepts in SDN (Introduction to flow-based forwarding and an overview of the OpenFlow protocol).



## Text Books:

1. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks", 6<sup>th</sup> Edition, Pearson Education, 2021.
2. Behrouz A. Forouzan, "Data Communications and Networking", 5<sup>th</sup> Edition, TMH, 2017.
3. Oliver C. Ibe, "Fundamentals of Data Communication Networks", 1<sup>st</sup> Edition, Wiley Publications, 2017.
4. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", 6<sup>th</sup> Edition, Pearson Education, 2017.

## Reference Books:

1. S. Keshav, "An Engineering Approach to Computer Networking", 3<sup>rd</sup> Edition, Pearson Education, 2010.
2. Natalia Olifer and Victor Olifer, "Computer Networks: Principles, Technologies & Protocols for Network Design", Wiley India, 2011.
3. Larry L. Peterson and Bruce S. Davie, "Computer Networks: A Systems Approach", 2<sup>nd</sup> Edition, Morgan Kaufmann, 2012.
4. Anna Hac, "Wireless Sensor Network Designs", John Wiley & Sons, December 2003, 391 pages.
5. Paul Goransson and Chuck Black, "Software Defined Networks: A Comprehensive Approach", Morgan Kaufmann, 2014.





Program: Computer Engineering	S.Y. B.Tech.	Semester: III
Python Programming Laboratory (RCP23CPC203L)		

**Prerequisite:** C Programming.

### Course Objective(s):

1. To learn the basic and OOP concepts of Python
2. To study various advanced python concepts like inheritance, exception handling, modules etc.
3. Learn to develop GUI based standalone and web application

### Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand basic and object-oriented concepts, data structure implementation in python.	L2	Understand
CO2	Apply file, directory handling and text processing concepts in python	L3	Apply
CO3	Apply database connectivity using python.	L3	Apply
CO4	Develop python-based application using Tkinter.	L6	Create



# Python Programming Laboratory (RCP23CPC203L) Course Contents

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## Unit-I

04 Hrs.

### Python Basics, Control Structures and Data Structures

Introduction to Python, Types of IDE (Anaconda/PyCharm) Identifiers, Variables, Operators, Data Types, Conditions, Loops.

### Data Structures in Python

- Strings: Introduction, functions, and operations on Strings, Application Programs on Strings.
- Arrays: Application Programs on Arrays.
- List: Introduction, functions and operations on List, Application Programs on Lists
- Tuple: Introduction, functions, and operations on Tuple
- Dictionaries: Introduction, functions and operations on Dictionaries, Application Programs on Dictionaries.
- Sets: Introduction, functions, and operations on Sets, Applications on Sets

## Unit-II

06 Hrs.

### Functions, Modules and Collections

- Functions: Defining and Invoking functions, Scope, Parameter types Recursive functions, Built in Functions such as enumeration, zip, sorted, map, filter and Applications
- Modules in Python, creating custom modules and calling them
- Lambda functions
- Collections, Iterators, Generators, Decorators, OrderedDict, defaultdict etc.
- Recursion and Memoization
- Functional Libraries (functools, itertools)

## Unit-III

06 Hrs.

### • Working with Text and Databases File I/O operations

Reading and Writing data from various formats

- **Regular Expressions** Identifiers, Quantifiers. Application Programs on Regular Expressions
- **Working with Databases** Databases and Data Science, SQLite database and Insert, Update, Delete, Retrieve operations
- **Exception Handling** Need for Exception handling, Raising exceptions
- Network Programming with Sockets



## Unit-IV

02 Hrs.

### Object Oriented Programming using Python

- Need for Static members, Static functions
- Need for Encapsulation and Abstraction, Private Attributes
- Getter, and Setter Methods- Python Implementation
- Inheritance: Need for Inheritance, Kinds of Inheritance
- Polymorphism Abstract methods, Overloading and Overriding

## Unit-V

04 Hrs.

### Web Development with Python

- Web Frameworks (Flask, Django)
- RESTful API Development
- Authentication and Authorization
- Asynchronous Programming with Python

## Unit-VI

04 Hrs.

### Exploratory Data Analysis and Visualization

- Data Manipulation and Exploratory Data Analysis with Numpy, Pandas
- Matplotlib and Seaborn libraries for Visualization
- Machine Learning with scikit-learn
- Data Scraping with BeautifulSoup and Scrapy
- GUI programming using Tkinter

## Python Programming Laboratory (RCP23CPC203L)

### List of Laboratory Experiments

#### Suggested Experiments:(Any 10)

1. Write python programs to understand Expressions, Variables, Quotes, Basic Math operations.
2. Write python programs to demonstrate applications of different decision-making statements.
3. Write a Python program to implement Basic String Operations & String Methods.
4. Write a Python program to implement functions of List, Tuples, and Dictionaries.
5. Write a Python program to implement Arrays (1D, 2D) applications.
6. Write a Python program to implement Functions and Recursion.
7. Write a Python program to implement Programs based on Lambda, Map, and Reduce Functions





8. Write a Python program to implement program to implement concept of Function decorators.
9. Write python programs to implement Classes & objects, Constructors.
10. Write python programs to implement Inheritance & Polymorphism.
11. Write python programs to implement Exception handling.
12. Write python programs to understand different File handling operations with exception handling.
13. Write python programs to implement database connectivity and DDL and DML commands in Python using SQLite.
14. Write python programs to understand GUI designing (Programs based on GUI designing using Tkinter).
15. Implement different Machine learning packages like numpy, pandas and matplotlib.
16. Build a simple web application using Flask or Django framework.
17. Implement a RESTful API for a specific use case (e.g., a blog API).

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. Dr. R. Nageswara Rao, "Core Python Programming", 3<sup>rd</sup> Edition, Dreamtech Press, 2021.
2. Mark Lutz, "Learning Python", 5<sup>th</sup> Edition, Oreilly Publication, 2013.
3. E Balagurusamy, "Introduction to computing and problem-solving using Python", McGraw Hill Education, 2018.
4. Reema Thareja, "Python Programming: Using Problem Solving Approach", 2<sup>nd</sup> Edition, Oxford, 2017

### Reference Books:

1. Martin C Brown, "Python: The Complete Reference", 1<sup>st</sup> Edition, Mc Graw Hill, 2018.
2. Zed A. Shaw, "Learn Python the Hard Way", 3<sup>rd</sup> Edition Edition, Addison-Wesley Publication, 2014.
3. Laura Cassell, Alan Gauld, "Python Projects", Wrox Publication, 2015.



## Online Resources:

1. The Joy of Computing, [https://onlinecourses.nptel.ac.in/noc24\\_cs57/](https://onlinecourses.nptel.ac.in/noc24_cs57/)
2. Programming in Python, [https://onlinecourses.swayam2.ac.in/cec22\\_cs20/](https://onlinecourses.swayam2.ac.in/cec22_cs20/)



Program: Computer Engineering	S.Y. B.Tech.	Semester: III
Computational Mathematics (RCP23CMD201)		

**Prerequisites:** Knowledge of

1. Calculus
2. Descriptive Statistics
3. Basics of probability

**Course Objective(s):**

1. To introduce students to the concepts of Eigenvalues and Eigenvectors of Matrices.
2. To introduce students to the concepts of probability, and test of hypothesis.
3. familiarizes students with different methods of solving Linear Programming problems.

**Course Outcomes:**

On completion of the course, the learner will be able to:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Apply the concepts of eigenvalue, eigenvectors, and diagonalization to engineering problems.	L3	Apply
CO2	Apply the concept of probability distribution to engineering problems	L3	Apply
CO3	Draw conclusions on population based on large and small samples taken and hence apply it to understand data science problems.	L3	Apply
CO4	Apply nonparametric test and perform Analysis of Variance on the population to analyze data	L3	Apply
CO5	Apply the concept of Optimization to the engineering problems.	L3	Apply





# Computational Mathematics (RCP23CMD201)

## Course Contents

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### Unit-I :

08 Hrs.

#### Matrices:

- 1.1 Eigen values and Eigen vectors, Cayley-Hamilton theorem (without proof).
- 1.2 Similar matrices, diagonalizable of matrix.
- 1.3 Functions of square matrix.
- 1.4 Matrix decomposition, Singular Value Decomposition of a matrix (SVD).

### Unit-II

08 Hrs.

#### Probability:

- 2.1 Random Variables: Discrete & Continuous random variables, expectation, Variance.
- 2.2 Probability Density Function & Cumulative Density Function.
- 2.3 Moments, Moment Generating Function.
- 2.4 Probability distribution: Binomial distribution, Poisson distribution and Normal distribution.

### Unit-III

07 Hrs.

#### Sampling Theory:

##### Test of Hypothesis- Large Sample Test:

- 3.1 Test of Hypothesis, Level of significance, Critical region, One Tailed and Two Tailed test, Interval Estimation of population parameters.
- 3.2 Test of significant for Large Samples: Test for significance of the difference between sample mean and population means, Test for significance of the difference between the means of two samples.

##### Test of Hypothesis- Small Sample Test:

- 3.3 Test of significant for small samples: Student's t-distribution and its properties.
- 3.4 Test for significance of the difference between sample mean and population mean, Test for significance of the difference between the means of two samples, paired t-test

### Unit-IV

05 Hrs.

#### Test of Hypothesis- Chi square Distribution and ANOVA:

- 4.1 Test of goodness of fit.
- 4.2 Test of independence of attributes-Contingency table.
- 4.3 Association of attributes and Yate's correction.
- 4.4 Analysis of Variance(F-Test): One way classification, Two-way classification (short-cut method).



## Unit-V

11 Hrs.

### Optimization Techniques::

- 5.1 Types of solution, Standard and Canonical form of LPP, Basic and feasible solutions.
- 5.2 Simplex method, Big -M method (method of penalty).
- 5.3 Duality of Linear Programming Problem.
- 5.4 Dual simplex method
- 5.5 Non-Linear Programming: -Problems with equality constraints and inequality constraints (No formulation, No Graphical method).

### Text Books:

- 1. Matrices, by A. R. Vasishtha, Krishna Prakashan, Edition 2023.
- 2. Fundamentals of Mathematical Statistics by S. C. Gupta, V. K. Kapoor, Sultan Chand & Sons 12<sup>th</sup> Edition, 2020.
- 3. Probability, Statistics and Random Processes by T. Veerarajan, Mc Graw Hill publication, 3<sup>rd</sup> Edition Edition, 2020.
- 4. Operation Research by Hira Gupta, S Chand.

### Reference Books:

- 1. Higher Engineering Mathematics by Dr. B. S. Grewal, Khanna Publication, 42<sup>nd</sup> Edition Edition.
- 2. Probability and Statistics for Engineering, Dr. J Ravichandran, Wiley-India, Edition 2019.
- 3. Probability & Statistics with reliability by Kishor s. Trivedi, Wiley India, 2016.
- 4. Operations Research by S.D. Sharma KedarNath, Ram Nath Co. Meerat.
- 5. Engineering optimization (Theory and Practice) by Singiresu S. Rao, New Age International publication.



Program: Computer Engineering	S.Y. B.Tech.	Semester: III
Product Life Cycle Management (RCP23XOE211)		

**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:

On completion of the course, the learner will be able to:

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 (RCP23XOE211) Course Contents

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## 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 21<sup>st</sup> 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.



Program: Computer Engineering	S.Y. B.Tech.	Semester: III
Management Information System (RCP23XOE212)		

**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:

On completion of the course, the learner will be able to:

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 (RCP23XOE212) Course Contents

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## 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
- 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", 11<sup>th</sup> 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/>)





Program: Computer Engineering	S.Y. B.Tech.	Semester: III
Operations Research (RCP23XOE213)		

**Prerequisites:** 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:

On completion of the course, the learner will be able to:

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 (RCP23XOE213)

## Course Contents

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### 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 – North-west 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 in 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  $2 \times 2$  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: Computer Engineering	S.Y. B.Tech.	Semester: III
Personal Finance Management (RCP23XOE214)		

**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 familiarise the students with microfinance for accelerating the expansion of local microbusinesses.

### Course Outcomes:

On completion of the course, the learner will be able to:

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 (RCP23XOE214) Course Contents

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## 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:** Personal 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, taxability of reimbursement of expenses; Exemption from GST: Small supplies and Composition Scheme:



## 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", 1<sup>st</sup> 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", 4<sup>th</sup> 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.





Program: Computer Engineering	S.Y. B.Tech.	Semester: III
Public Systems and Policies (RCP23XOE215)		

**Prerequisites:** 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:

On completion of the course, the learner will be able to:

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 (RCP23XOE215)

## Course Contents

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### 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", 10<sup>th</sup> Edition, McGraw-Hill Education, 2013.
8. Richard A Musgrave and Peggy B Musgrave, "Public Finance in Theory and Practice", 5<sup>th</sup> Edition, McGraw Hill Book, 2017.





Program: Computer Engineering	S.Y. B.Tech.	Semester: III
Fundamentals of Biomedical Instruments (RCP23XOE216)		

**Prerequisites:** 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:

On completion of the course, the learner will be able to:

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 (RCP23XOE216) Course Contents

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## 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, 2<sup>nd</sup> 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", 3<sup>rd</sup> 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.



Program: Computer Engineering	S.Y. B.Tech.	Semester: III
IPR and Patenting (RCP23XOE217)		

**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:**

On completion of the course, the learner will be able to:

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 (RCP23XOE217)

## Course Contents

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### 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](https://onlinecourses.nptel.ac.in/noc24_hs59/preview)



Program: Computer Engineering	S.Y. B.Tech.	Semester: III
Entrepreneurship and Startup Ecosystem (RCP23XOE218)		

**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:

On completion of the course, the learner will be able to:

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 (RCP23XOE218) Course Contents

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## 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, 4<sup>th</sup> Edition, 1 October 2019.





<b>Program: Computer Engineering</b>	<b>S.Y. B.Tech.</b>	<b>Semester: III</b>
<b>Semester Project-I (RCP23XSC201P)</b>		

### Course Objective(s):

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

### Course Outcomes:

On completion of the course, the learner will be able to:

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





<b>Program: Computer Engineering</b>	<b>S.Y. B.Tech.</b>	<b>Semester: III</b>
<b>Design Thinking Laboratory (RCP23XHS231L)</b>		

### Prerequisites:

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 Objective(s):

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:

On completion of the course, the learner will be able to:

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

# Design Thinking Laboratory (RCP23XHS231L) Course Contents

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## 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 solve some of the biggest and most 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 (RCP23XHS231L)

### 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 consisting of 3-4 students.
- 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 learn various design thinking methods and practice the corresponding tools available.

1. To conduct market and industry research and analyze case studies demonstrating the application 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 five experiments from the above-suggested list 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.

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

### 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, 6<sup>th</sup> 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](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](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: Computer Engineering	S.Y. B.Tech.	Semester: III
Universal Human Values (RCP23XHS232)		

### Course Objective(s):

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:

On completion of the course, the learner will be able to:





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 (RCP23XHS232)

## Course Contents

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### Unit-I

04 Hrs.

#### 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 fulfillment 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 levels of



## Unit-V

04 Hrs.

### 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. PanditSunderlal, "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: Computer Engineering	S.Y. B.Tech.	Semester: III
Community Engagement Service (RCP23XEL201L)		

**Prerequisites:** Fundamentals of core branch, Communication Skills.

### Course Objective(s):

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

### Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	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	L3	Apply
CO2	Identify and experience commitment for community engagement activities that reinforce sense of belongingness and gratitude towards societal cause	L5	Evaluate
CO3	Witness diversity in communities and cultures and demonstrate change in approach / attitude as, an evidence of unconditional acceptance.	L3	Apply
CO4	Recognise, experience and value, effectiveness of working in a team, demonstrating co-existence of the roles - sincere worker and effective leader.	L5	Evaluate





# Community Engagement Service (RCP23XEL201L) Course Contents

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## 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.

OR

**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/ Of- fice	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						
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 select 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 Foot-print

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 contamination 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](https://www.youtube.com/watch?v=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

**Certificates and Formats:**





# 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,
  - Activity Conduction Report
  - Participant Feedback (online / offline)
  - Participant Attendance (online / offline)
  - Survey Report
  - 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.	

**Evaluation Scheme:**

**Continuous Assessment (A):**

Term Work:- 25 marks, distribution as herewith:

1. Rubric for Open Ended Activity (10 marks)

- Participation certificate/proof

2. Rubric for Technical Activity (15 marks)

Sr.No.	Performance Indicators (Maximum marks per indicator are given in bracket)	Marks
1	Pre-requisite documents (permission letter, presentation material etc.) [05 marks]	
2	Participant Feedback [05 marks]	
3	Participant attendance [05 marks]	
	<b>TOTAL</b>	

OR





3. Rubric for Field Survey Activity:

Sr.No.	Performance Indicators (Maximum 03 marks per indicator)	Marks
1	Topic selection	
2	Survey preparation	
3	Field work	
4	Analysis	
5	Report writing	
	<b>TOTAL</b>	

## Semester - IV



Program: Computer Engineering	S.Y. B.Tech.	Semester: IV
Operating System (RCP23CPC251)		
Operating System Laboratory (RCP23CPC251L)		

**Prerequisites:** Digital Electronics, Foundation of Computing Technologies

### Course Objective(s):

1. To familiarize students with the functionality of an Operating System, its basic components & interaction among them.
2. To analyze and evaluate different policies for scheduling, deadlocks, memory management, synchronization, file management & I/O and implement these policies using a suitable programming language.

### Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the basic functionalities of an Operating System.	L2	Understand
CO2	Understand process management principles and apply methods for process scheduling, concurrency control, and deadlock management.	L3	Apply
CO3	Understand memory management principles and apply them to optimize memory utilization.	L3	Apply
CO4	Apply and analyze different techniques of file and I/O management	L4	Analyze
CO5	Understand the functionalities of advanced operating systems.	L2	Understand



# Operating System (RCP23CPC251)

## Course Contents

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### Unit-I

03 Hrs.

**Overview of Operating System:** Operating System Objectives, basic functions and services, Evolution of operating system, Operating System structures (monolithic, microkernel), System calls.

### Unit-II

10 Hrs.

**Process Management and Synchronization:** Concept of a Process, Process States, Process Control Block, Threads: Definition and Types, Concept of Multithreading, Scheduling: Types of Scheduling: Preemptive and Non-preemptive, Scheduling algorithms and their performance evaluation: FCFS, SJF, SRTF, Priority based, Round Robin.

Concurrency: Principles of Concurrency, Inter-Process Communication, Process/Thread Synchronization. Mutual Exclusion: Requirements, Hardware and Software Support, Semaphores and Mutex, Monitors, Classical synchronization problems: Producer and Consumer problem, Readers/Writers Problem.

### Unit-III

07 Hrs.

**Deadlock:** Principles of Deadlock, Conditions for deadlock, Resource Allocation Graph, Deadlock Prevention, Deadlock Avoidance: Banker's Algorithm for Single & Multiple Resources, Deadlock Detection and Recovery. Dining Philosophers Problem.

### Unit-IV

07 Hrs.

**Memory Management:** Memory Management Requirements, Memory Partitioning: Fixed Partitioning, Dynamic Partitioning, Memory Allocation Strategies: Best-Fit, First Fit, Worst Fit, Next Fit, Relocation, Paging, Segmentation. Virtual Memory: Demand Paging, Structure of Page Tables, Page Replacement Strategies: FIFO, Optimal, LRU, LFU, Thrashing.

### Unit-V

08 Hrs.

**File System and I/O Management:** File Management: Overview, File Organization and Access, Secondary Storage Management: File Allocation Methods Input /Output Management I/O Management and Disk Scheduling: I/O Devices, I/O Buffering, Disk Scheduling algorithm: FCFS, SSTF, SCAN, CSCAN, LOOK, C-LOOK.

### Unit-VI

04 Hrs.

**Advanced Operating Systems::** Overview of NOS, DOS, Multiprocessor OS, RTOS, Mobile OS: Architecture, design issues, Application development using Android.





# Operating System Laboratory (RCP23CPC251L)

## List of Laboratory Experiments

### Suggested Experiments:(Any 10)

1. Explore the internal commands of linux and Write shell scripts to do the following:  
Display top 10 processes in descending order.  
Display processes with highest memory usage.  
Display current logged in user and logname.  
Display current shell, home directory, operating system type, current path setting, current working directory.  
Display OS version, release number, kernel version.  
Illustrate the use of sort, grep, awk, etc.

2. System calls for file manipulation.

3. CPU scheduling algorithms like FCFS, SJF, Round Robin etc.

4. There is a service counter which has a limited waiting queue outside it. It works as follows:

- The counter remains open till the waiting queue is not empty.
- If the queue is already full, the new customer simply leaves.
- If the queue becomes empty, the outlet doors will be closed (service personnel sleep).
- Whenever a customer arrives at the closed outlet, he/she needs to wake the person at the counter with a wake-up call.

Implement the above-described problem using semaphores or mutexes along with threads. Also show how it works, if there are 2 service personnel, and a single queue. Try to simulate all possible events that can take place, in the above scenario.

5. Implement Banker's Algorithm for deadlock avoidance.
6. Implement Placement algorithms (Best, First, Worst fit).
7. Implement various page replacement policies (LRU, FIFO, Optimal).
8. Implement File allocation techniques (Sequential, Indexed, Linked).
9. Implement disk scheduling algorithm FCFS, SSTF, SCAN, CSCAN etc.
10. Using the CPU-OS simulator analyze and synthesize the following:
  - Process Scheduling algorithms.



- Thread creation and synchronization.
  - Deadlock prevention and avoidance.
11. Building a scheduler in XV6.
  12. Application development using Android

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. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, 10<sup>th</sup> Edition, John Wiley & Sons, Inc., 2021.
2. Tannenbaum, “Modern Operating System”, 4<sup>th</sup> Edition, Pearson Education, 2014.
3. William Stallings, “Operating System: Internals and Design Principles”, 9<sup>th</sup> Edition, Prentice Hall, 2018.
4. Randal. K. Michael, “Mastering Shell Scripting”, 2<sup>nd</sup> Edition, Wiley Publication, 2008.

### Reference Books:

1. Andrew Tannenbaum, “Operating System Design and Implementation”, 3<sup>rd</sup> Edition, Pearson Education, January 2015.
2. Phillip A. Laplante, Seppo J. Ovaska, “Real Time Systems Design and Analysis”, 4<sup>th</sup> Edition, Wiley-IEEE Press, Dec 2011.
3. Naresh Chauhan, “Principles of Operating Systems”, 1<sup>st</sup> Edition, Oxford University Press, 2014.



<b>Program: Computer Engineering</b>	<b>S.Y. B.Tech.</b>	<b>Semester: IV</b>
<b>Analysis of Algorithms (RCP23CPC252)</b>		
<b>Analysis of Algorithms Laboratory (RCP23CPC252L)</b>		

**Prerequisites:** Data structure, Programming in C

### Course Objective(s):

- The objective of the course is to introduce important algorithmic design paradigms and approaches for effective problem solving.
- To analyze the algorithm for its efficiency to show its effectiveness over the others. In addition, the concepts of tractable and intractable problems and the classes P, NP and NP-complete problems will be introduced.

### Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze the performance of algorithms using asymptotic analysis.	L4	Analyze
CO2	Solve the problem using appropriate algorithmic design techniques.	L3	Apply
CO3	Able to prove that certain problems are NP-Complete.	L3	Apply





# Analysis of Algorithms (RCP23CPC252)

## Course Contents

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### Unit-I

08 Hrs.

**Introduction to analysis of algorithms:** Introduction, Asymptotic notations (Big-Oh, small-oh, Big Omega, Theta notations). Analysis of Selection Sort, Insertion Sort.

**Recurrences:** Recursion Tree Method, Substitution method, Master's theorem.

**Problem Solving using divide and conquer algorithm:** Max-Min problem, Strassen's Matrix Multiplication.

### Unit-II

06 Hrs.

**Greedy Method:** Introduction, control abstraction Problem solving using - fractional knapsack problem, job sequencing with deadline.

**Minimum Spanning trees:** (Kruskal's algorithm, Prim's algorithm).

**Graphs:** Single source shortest path (Dijkstra's algorithm).

### Unit-III

10 Hrs.

**Dynamic Programming:** Introduction, principle of optimality, Components of dynamic programming, characteristics of dynamic programming, Fibonacci problem, Coin Changing problem, 0/1 knapsack (table and set method), Multistage graphs, All pairs shortest paths (Floyd Warshall Algorithm), Single source shortest path (Bellman-Ford Algorithm), Matrix Chain Multiplication, Travelling salesperson problem, Longest Common Subsequence (LCS).

### Unit-IV

05 Hrs.

**Backtracking:** Introduction, basics of backtracking, N-queen problem, sum of subsets, graph coloring, Hamiltonian cycles generating permutation, analysis of all algorithms.

### Unit-V

05 Hrs.

**String Matching Algorithms:** Introduction, The naive string-matching algorithm, The Rabin Karp algorithm, String matching with finite automata, The Knuth Morris Pratt algorithm.

### Unit-VI Basics of Computational Complexity

05 Hrs.

**Basics of Computational Complexity:** Complexity classes: class P and NP, polynomial reduction, NP completeness problem, NP-Hard problems, NP completeness problem using travelling salesman problem (TSP), approximation algorithm using TSP.





# Analysis of Algorithms Laboratory (RCP23CPC252L)

## List of Laboratory Experiments

### Suggested Experiments:(Any 10)

1. Implementation of Min Max algorithm.
2. Implementation of Strassen's Matrix Multiplication.
3. Fractional Knapsack implementation using greedy approach.
4. Implementation of job sequencing with deadline using greedy approach.
5. Implementation of Kruskal's/ Prim's algorithm using greedy approach.
6. Implementation of Single source shortest path (Dijkstra's algorithm).
7. Implementation of Bellman Ford algorithm using Dynamic programming.
8. Implementation of Longest Common Subsequence algorithm using Dynamic programming.
9. Implementation of Travelling Salesperson problem using Dynamic programming.
10. Implementation of multistage graphs/ all pair shortest path using dynamic programming.
11. Implementation of N-queen problem using Backtracking.
12. Implementation of Knuth Morris Pratt string matching algorithm.
13. Implementation of sum of subset problem using Backtracking.
14. Implementation of Naive String Matching Algorithm string matching algorithm.
15. Implementation of Selection Sort.
16. Implementation of Bubble Sort.
17. Implement a program to merge two sorted arrays.
18. Implementation of Merge sort algorithm.
19. Implementation of Inversion Count: You have an array A of length N Count the number of pair of indexes (I, j) such that  $i < j$  and  $A_i > A_j$  Output the number of pairs, modulo modulo  $10^9 + 7$ .
20. Implementation of quick sort algorithm.
21. Implementation of Randomised quick sort algorithm.
22. Implementation of Sequential Search method.



23. Implementation of Binary Search method.
24. Average Flex: There are  $N$  students in a class, where the  $i$ -th student has a score of  $A_i$ . The  $i$ -th student will boast if and only if the number of students scoring less than or equal  $A_i$  is greater than the number of students scoring greater than  $A_i$ . Find the number of students who will boast.
25. Implement a program for Divide and Conquer Multiplication of two arrays.
26. Implement a program to perform Multiplication of Two Matrices.
27. Implementation of Huffman Algorithm.
28. Implement a program to solve 0/1 Knapsack implementation.
29. Implement a program to find Longest Palindromic Subsequence.
30. Implementation of Optimal Binary Search Trees: You are building a Binary Search Tree consisting of values  $1, 2, \dots, N$  that would require the minimum number of operations. You are already provided queries given as an array  $F$  of length  $N$  -  $F_i$  stores the number of search queries asked for value  $i$ . Output the minimum number of comparisons that would be required to process all the queries.
31. Consider a weighted, undirected and connected graph with  $N$  nodes, numbered 1 to  $N$ , and  $M$  edges. Implement a program to find the minimum cost of any walk from node  $S$  to node  $T$ , via node  $V$  (visiting node  $V$  is compulsory), where cost of a walk is the sum of weights of distinct edges occurring in the walk.
32. You are given an array  $A_1, A_2, \dots, A_N$  of length  $N$  that may contain duplicates. Implement a program to find all possible unique permutations of  $A$ .
33. Given  $N$  pairs of parentheses. Implement a program to find all valid parentheses string of length  $2N$ .
34. You are given a string  $S$  consisting of lowercase english characters. Partition  $S$  such that every substring of the partition is a palindrome. Implement a program find all possible unique palindrome partitioning of  $S$ .

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. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, "Introduction to algorithms", 4<sup>th</sup> Edition, The MIT Press, 2022.
2. Ellis Horowitz , Sartaj Sahni, S. Rajsekaran. "Fundamentals of computer algorithms" University Press, 2008.

### Reference Books:

1. Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, "Algorithms", Tata McGraw- Hill Edition, 2023.
2. John Kleinberg, Eva Tardos, "Algorithm Design", 1<sup>st</sup> Edition, Pearson, 2005.
3. Michael T. Goodrich, Roberto Tamassia, "Algorithm Design and Applications", 1<sup>st</sup> Edition, Wiley Publication, 2014.



<b>Program: Computer Engineering</b>	<b>S.Y. B.Tech.</b>	<b>Semester: IV</b>
<b>Artificial Intelligence (RCP23CPC253)</b>		
<b>Artificial Intelligence Laboratory (RCP23CPC253L)</b>		

**Prerequisites:** Knowledge of Programming Language and Algorithms.

### Course Objective(s):

1. To provide the basic ideas and techniques underlying the design of intelligent systems.
2. To impart the knowledge of various search techniques for problem solving.
3. To learn knowledge representation, planning and provide the knowledge to deal with uncertain and incomplete information.

### Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Provide the basic ideas and techniques underlying the design of intelligent systems.	L2	Understand
CO2	Impart the knowledge of various search techniques for problem solving.	L3	Apply
CO3	Learn knowledge representation, planning and provide the knowledge to deal with uncertain and incomplete information.	L4	Analyze





# Artificial Intelligence (RCP23CPC253)

## Course Contents

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### Unit-I

05 Hrs.

**Introduction to Artificial Intelligence:** Introduction, History of Artificial Intelligence, Intelligent Systems: Categorization of Intelligent System, Components of AI Program, Foundations of AI.

**Agents and Environments:** Concept of rationality, Nature of environment, Structure of Agents, Types of Agents, PEAS representation for an Agent.

### Unit-II

12 Hrs.

**Problem Solving:** Problem Solving Agent, Formulating Problems, Example Problems.

**Search Methods: Uninformed Search:** Breadth First Search (BFS), Depth First Search (DFS), Depth Limited Search, Depth First Iterative Deepening (DFID).

**Informed Search:** Greedy Best First Search, A\* Search, Memory bounded heuristic Search.

**Local Search Algorithms and Optimization Problems:** Hill Climbing search, Simulated Annealing, Genetic algorithms, Ant Colony Optimization.

**Adversarial Search:** Game Playing, The Minimax algorithm, Alpha-Beta Pruning.

### Unit-III

07 Hrs.

**Knowledge Representation and Reasoning:** Knowledge based Agents, The Wumpus World, Propositional Logic, First Order Logic, Inference in FOL, Conjunctive Normal Form, Forward Chaining, Backward Chaining, Unification, Resolution, Logic Programming (PROLOG), Semantic networks.

**Uncertain Knowledge and Reasoning:** Representing knowledge in an uncertain domain, The semantics of Bayesian Belief Network, Inference in Belief Network.

### Unit-IV

04 Hrs.

**Planning:** The planning problem, Planning with state space search, Planning graphs, Partial order planning, Hierarchical planning.

### Unit-V

07 Hrs.

**Learning:** Types of Learning, Inductive Learning.

### Unit-VI

04 Hrs.

**Expert System:** Introduction, Phases in building Expert Systems, ES Architecture, Case Study on MYCIN Rule based system.

**Advanced topic:** Introduction to Generative AI, Explainable AI.



# Artificial Intelligence Laboratory (RCP23CPC201L)

## List of Laboratory Experiments

### Suggested Experiments:(Any 08)

1. Select a problem statement relevant to AI.  
i) Identify the problem ii) PEAS Description iii) Problem formulation
2. Identify and analyze Uninformed Search Algorithm to solve the problem. Implement BFS/DFS search algorithms to reach goal state.
3. Implement DFID search algorithms to reach goal state.
4. Identify and analyze Informed Search Algorithm to solve the problem. Implement A\* search algorithm to reach goal state.
5. Program to implement Local Search algorithm: Hill Climbing search.
6. Program on Genetic Algorithm to solve a optimization problem in AI.
7. Program to implement learning: Perceptron Learning / Backpropagation Algorithm.
8. The laboratory will emphasize the use of PROLOG.  
(For example, Program to implement Family Tree in Prolog)
9. Implementation on any AI game: Wumpus world, Tic-tac-toe, 8-Queens Problem.
10. Case study of an AI Application.

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. Stuart J. Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach" 3rd Edition, Pearson Education, 2010.
2. George F Luger, "Artificial Intelligence" 6th Edition, Pearson Education, 2021.
3. Deepak Khemani, "A First Course in Artificial Intelligence", 6th Reprint, McGraw Hill Education, 2018.
4. Saroj Kaushik, "Artificial Intelligence", 1st Edition, Cengage Learning, 2010.



## Reference Books:

1. AP Engelbrecht, "Computational Intelligence", 3rd Edition, Wiley-Blackwell, 2021.
2. Elaine Rich and Kevin Knight, "Artificial Intelligence" 3rd Edition, McGraw Hill Education, 2017.
3. Ivan Bratko, "PROLOG Programming for Artificial Intelligence", 4th Edition, Addison- Wesley, 2011.
4. Hagan, Demuth, Beale, "Neural Network Design", 2nd Edition, Martin Hagan, 2014.
5. Ronald J. Martin, "The Age of Artificial Intelligence", Independently Published, 2023.



Program: Computer Engineering	S.Y. B.Tech.	Semester: IV
Algebraic Number Theory (RCP23CMD251)		

**Prerequisite:** Computational Mathematics.

### Course Objective(s):

1. To provide a foundation in sets, logic, proof techniques, relations, functions, and combinatorics for applications in computer science and formal systems.
2. To develop an understanding of number theory, group theory, rings, fields, and Boolean algebra for computational algorithms
3. To apply graph theory and automata theory in the context of secure communication and computational modeling.

### Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze and apply set theory, logic, relations, and functions to construct formal mathematical arguments and solve discrete problems	L4	Analyze
CO2	Apply number theory and modular arithmetic techniques in advanced computational algorithms	L3	Apply
CO3	Understand different algebraic structures and its applications in various security systems.	L2	Understand
CO4	Understand graph theory and apply these concepts to solve real world problems.	L2	Understand





# Algebraic Number Theory (RCP23CMD251)

## Course Contents

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### Unit-I

04 Hrs.

#### Set Theory and Mathematical Logic:

Sets and Operations: Union, Intersection, Difference, Complement, Power Sets, Cartesian Product, Inclusion-Exclusion Principle

Propositional Logic: Syntax, Semantics, Truth Tables, Logical Equivalence

Predicate Logic: Quantifiers, Validity, Rules of Inference and Logical Arguments, Proof by Mathematical Induction

### Unit-II

05 Hrs.

#### Relations, Lattices and Functions:

Relations: Reflexive, Symmetric, Transitive, Equivalence Relations, Partial Orders, Hasse Diagrams, Lattice, Types of Lattice Functions: Injective, Surjective, Bijective, Inverses, Composition of Functions, Pigeonhole Principle.

### Unit-III

06 Hrs.

#### Number Theory and Modular Arithmetic:

Number Theory: Divisibility, Prime Numbers, Greatest Common Divisor (GCD), Least Common Multiple (LCM), Euclidean Algorithm, Extended Euclidean Algorithm, Modular Arithmetic: Modular Operations, Modular Exponentiation, Modular Inverse, Fermat's Little Theorem, Euler's Theorem, Euler's Totient Function, Chinese Remainder Theorem. Primality Testing and Primitive Roots

### Unit-IV

06 Hrs.

#### Algebraic Structures:

Algebraic Structures: Semigroups, Monoids, Groups, Binary Operations, Group codes, Cyclic Groups, Abelian Groups, Group Homomorphisms, Group Isomorphisms. Rings and Fields: Commutative Rings, Integral Domains, Finite Fields: Galois Fields ( $GF(p)$ ,  $GF(2)$ ), Polynomial Rings, Polynomial Irreducibility

### Unit-V

05 Hrs.

#### Graph Theory and Automata:

Graph Theory: Graphs, Degrees, Paths, Cycles, Connected Components, Graph Representations: Adjacency Matrices, Incidence Matrices, Euler's and Hamiltonian Graphs.



## Text Books:

1. Eric Lehman, F. Thomson Leighton, and Albert R. Meyer, "Mathematics for Computer Science", Pearson, 2<sup>nd</sup> Edition, 2021.
2. Kenneth H. Rosen, "Discrete Mathematics and Its Applications", McGraw-Hill, 9<sup>th</sup> Edition, 2021.
3. Niven, Zuckerman, and Montgomery, "An Introduction to the Theory of Numbers", John Wiley & Sons, 7<sup>th</sup> Edition, 2020.
4. David S. Dummit and Richard M. Foote, "Abstract Algebra", Wiley, 4<sup>th</sup> Edition, 2021.
5. Richard J. Trudeau, "Introduction to Graph Theory", Dover Publications, 2<sup>nd</sup> Edition, 2021.

## Reference Books:

1. G. V. Kumbhojkar, "Discrete Structures and Graph Theory", 2<sup>nd</sup> Edition, P. Jamnadas LLP, 2021.
2. Johannes A. Buchmann, "Introduction to Cryptography: Principles and Applications", Springer, 3<sup>rd</sup> Edition, 2021.
3. William Stallings, "Cryptography and Network Security: Principles and Practice", Pearson, 9<sup>th</sup> Edition, 2021.
4. John M. Harris, Jeffry L. Hirst, and Michael J. Mossinghoff, "Combinatorics and Graph Theory", Springer, 2<sup>nd</sup> Edition, 2021.
5. Michael Artin, "Algebra", Pearson, 4<sup>th</sup> Edition, 2021.
6. Michael Sipser, "Introduction to the Theory of Computation", Cengage Learning, 4<sup>th</sup> Edition, 2021.



<b>Program: Computer Engineering</b>	<b>S.Y. B.Tech.</b>	<b>Semester: IV</b>
<b>Project Management (RCP23XOE261)</b>		

**Prerequisite:** Basic concepts of Management.

### Course Objective(s):

1. To familiarize the students with the use of a structured methodology/approach for every unique project undertaken, utilizing project management concepts, tools and techniques.
2. To appraise the students with the project management life cycle and make them knowledgeable about the various phases from project initiation through closure.

### Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain project management life cycle and the various project phases as well as the role of project manager.	L2	Understand
CO2	Apply selection criteria and select an appropriate project from different options.	L3	Apply
CO3	Create a work break down structure for a project and develop a schedule based on it. Manage project risk strategically.	L6	Create
CO4	Use Earned value technique and determine & predict status of the project. Capture lessons learned during project phases and document them for future reference.	L6	Create
CO5	Differentiate between traditional waterfall approach and agile scrum methodology for software development projects	L4	Analyze





# Project Management (RCP23XOE261)

## Course Contents

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### Unit-I

07 Hrs.

**Project Management Foundation:** Definition of a project, Project Vs Operations, Necessity of project management, Triple constraints, Project life cycles (typical & atypical). Project phases and stage gate process. Role of project manager, Negotiations and resolving conflicts, Introduction to project leadership, ethics in projects, Multicultural and virtual projects, Project management in various organization structures, PM knowledge areas as per Project Management Institute (PMI).

### Unit-II

08 Hrs.

**Initiating Projects:** How to get a project started, selecting project strategically, Project selection models (Numeric /Scoring Models and Non-numeric models), Project portfolio process, Project sponsor and creating charter, Effective project team, Stages of team development & growth (forming, storming, norming & performing), team dynamics.

### Unit-III

08 Hrs.

**Project Planning:** Work Breakdown structure (WBS) and linear responsibility chart, Project cost estimation and budgeting, Top down and bottoms up budgeting, Networking and Scheduling techniques, PERT, CPM. Crashing project time & Resource loading and levelling (Only Theory), Project Stakeholders and Communication plan.

**Risk Management in projects:** Risk management planning, Risk identification and risk register, Qualitative and quantitative risk assessment, Probability, and impact matrix. Risk response strategies for positive and negative risks.

### Unit-IV

08 Hrs.

**Monitoring and Controlling Projects:** Planning monitoring and controlling cycle, Information needs and reporting, engaging with all stakeholders of the projects, communication and project meetings. Earned Value Management techniques for measuring value of work completed, using milestones for measurement, change requests and scope creep, Project audit, Project Contracting: Project procurement management, contracting and outsourcing.

**Closing the Project:** Customer acceptance, Reasons of project termination, Various types of project terminations (Extinction, Addition, Integration, Starvation), Process of project termination, completing a final report, doing a lessons learned analysis, acknowledging successes and failures.

### Unit-V

**Agile project management::** Agile principle, Agile Manifesto, Agile process framework





teristics of Agile Approaches and Scrum, Benefits of Agile project management, Implementing Agile project management.

**Agile Project Planning:** Comparison of Agile Project Management with Traditional Waterfall Approach, Project Planning with Scrum, Scrum Artifacts Supporting Project Planning , Scrum Events for Project Planning. Scheduling with scrum, Techniques for scrum scheduling- Poker estimation.

**Agile Tools for Tracking Project Progress:** Task Boards, Burnup and Burndown Charts.

### Text Books:

1. Jack Meredith & Samuel Mantel, "Project Management: A managerial approach", 11<sup>th</sup> Edition, Wiley India.
2. Erik Larson, Clifford Gray, "Project Management: The Managerial Process", 8<sup>th</sup> Edition, McGraw Hill Education.
3. Jim Highsmith, Pearson Education, "Agile Project Management", Low Price Edition, India.

### Reference Books:

1. A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 7<sup>th</sup> Edition, Project Management Institute PA, USA.
2. Gido Clements, "Project Management", Cengage Learning.
3. Gopalan, "Project Management", Wiley India.
4. Dennis Lock, "Project Management", 9<sup>th</sup> Edition, Gower Publishing England.
5. Kalpesh Ashar, "Agile Essentials You Always Wanted to Know", Vibrant Publishers U.S.A.



Program: Computer Engineering	S.Y. B.Tech.	Semester: IV
Cyber Security, Policies and Laws (RCP23XOE262)		

**Prerequisite:** Fundamentals of Computers.

### Course Objective(s):

1. Familiarize with the provisions and implications of the Digital Personal and Data Protection Act, the obligations of data fiduciaries, the rights and duties of data principals, and mechanisms for resolving breaches.
2. Equip individuals and organizations with the knowledge and tools to create secure cyber ecosystems, strengthen regulatory frameworks, and develop incident response plans.

### Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand and describe the major types of cybercrime and navigate legal frameworks and regulations concerning digital personal and data protection.	L2	Understand
CO2	Implement strategies for cybersecurity outlined in the National Cyber Security Policy.	L3	Apply
CO3	Apply appropriate law enforcement strategies to both, prevent and control cybercrime.	L3	Apply
CO4	Comprehend regulations and strategies pertaining to AI (Artificial Intelligence) and large language models.	L2	Understand



# Cyber Security, Policies and Laws (RCP23XOE262) Course Contents

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## Unit-I

08 Hrs.

**Cyber Crime:** Definition and Origin of the Word, Cyber Crime and Information Security, who are Cyber Criminals, Classification of Cybercrimes, E-mail Spoofing, Spamming, Cyber Defamation, Internet Time Theft, Salami Attack, Salami technique Data Diddling, Forgery, Newsgroup Spam, Online Frauds, Pornographic Offenders, Email Bombing, Password Sniffing, Credit Card Frauds.

## Unit-II

08 Hrs.

**Cyber Offenses:** How Criminals plan them, Categories of Cyber Crimes, How Criminal Plans the Attack: Active Attacks, Passive Attacks, Social Engineering, Classification of Social Engineering, Cyber Stalking: types of Stalkers, Cyber Cafe and Cyber Crimes, Botnets, Attack Vectors, Cyber Crime and Cloud Computing.

## Unit-III

08 Hrs.

**Indian IT Act:** Cyber Crime and Criminal Justice, Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments Security aspect in Cyber-Law, The Contract Aspects in Cyber Law, The Security Aspect of Cyber Law, Security Standards: SOX, GLBA, HIPAA, NIST Cyber Security Framework (CSF).

## Unit-IV

07 Hrs.

**India's Digital Personal and Data Protection Act (2023):** Preliminary, Obligations of Data Fiduciary, Rights and Duties of Data Principal, Special Provisions, Data Protection Board of India, Powers, Functions and Procedure to Be Followed by Board, Appeal and Alternate Dispute Resolution, Penalties and Adjudication.

## Unit-V

08 Hrs.

**India's AI Regulation and Strategy:** Privacy, Security and Artificial Intelligence, Differential Privacy, Security in AI. National Artificial Intelligence Strategy, Principles for Responsible AI, Information Technology (Intermediary Guidelines and Digital Media Ethics Code-2021), Draft National Data Governance Framework Policy (NDGFP), Rules against Deepfakes, Due diligence advisory for AI, AI regulations framework (June 2024).



### Text Books:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole, Sunit Belapur, Wiley-2011.
2. Understanding Cybersecurity Management in Decentralized Finance: Challenges, Strategies, and Trends by Gurdip Kaur, Springer-2023.

### Reference Books:

1. The Information Technology Act, 2000; Bare Act- Professional Book Publishers, New Delhi.
2. Izzat Alsmadi , The NICE Cyber Security Framework: Cyber Security Intelligence and Analytics, Springer-2023.

### References (Web Resources):

1. Digital Personal Data Protection Act 2023.pdf (meity.gov.in)
2. National Cyber Security Policy (draft v1 (meity.gov.in)
3. CISO\_Roles\_Responsibilities.pdf
4. Standards(bis.gov.in)
5. AI, Machine Learning & Big Data Laws & Regulations — India (globallegalinsights.com)





Program: Computer Engineering	S.Y. B.Tech.	Semester: IV
Advanced Operations Research (RCP23XOE263)		

**Prerequisites:** 1. Operation Research 2. Mathematics (Calculus)

### Course Objective(s):

1. To develop an ability to analyse the structure and mathematical model of various complex system occurring in manufacturing system, service system, and business applications.
2. To develop knowledge of the mathematical structure of linear and nonlinear optimization models.
3. To develop an understanding of the techniques used to solve linear and nonlinear optimization models using their mathematical structure.
4. To develop an understanding of the use of modelling languages for expressing and solving optimization models.

### Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Apply Duality theory to solve linear programming problem and analyse optimum solution.	L3	Apply
CO2	Construct linear integer programming models and apply the O.R. algorithms and techniques to solve linear integer programming problems.	L3	Apply
CO3	Determine best satisfying solution under a varying quantity of resources and priorities of the goals.	L5	Evaluate
CO4	Set up decision models and solve nonlinear programming- unconstrained optimization problems.	L3	Apply
CO5	Set up decision models and solve nonlinear programming- constrained optimization problems.	L3	Apply



# Advanced Operations Research (RCP23XOE263) Course Contents

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## Unit-I

06 Hrs.

**Dual Linear Programs:** Primal, dual, and duality theory - The dual simplex method -The primal-dual algorithm-Duality applications. Post optimization problems: Sensitivity analysis.

## Unit-II

06 Hrs.

**Integer Programming:** Pure and mixed integer programming problems, Solution of Integer programming problems – Gomory's all integer cutting plane method and mixed integer method, branch and bound method, Zero-one programming.

## Unit-III

05 Hrs.

**Goal Programming :** Concept of Goal Programming, GP model formulations, Graphical method of GP, The simplex method of GP, Application areas of GP.

## Unit-IV

11 Hrs.

**Nonlinear Programming- Unconstrained optimization :**Minimization and maximization of convex functions- Local Global optimum- Convergence-Speed of convergence. one-dimensional unconstrained optimization – Newton's method – Golden-section search method , multidimensional unconstrained optimization –Gradient method — steepest ascent (descent) method – Newton's method.

## Unit-V

11Hrs.

**Nonlinear Programming- Constrained optimization :** Constrained optimization with equality and inequality constraints. Constrained optimization: Lagrangian method - Sufficiency conditions - Kuhn-Tucker optimality conditions Rate of convergence - Engineering Applications Quadratic programming problems-convex programming problems.

## Text Books:

1. Gupta, P. K. and Hira, D. S., Operations Research, S. Chand Publications, 2014.
2. Srinivasan, G., Operations research: Principles and applications, Prentice Hall of India, 2007.
3. Nita H. Shah, Poonam Prakash Mishra, Non-Linear Programming-A Basic Introduction, CRC Press, 2020.



## Reference Books:

1. Frederick S. Hillier & Gerald J. Lieberman, Introduction to Operations Research, McGraw-Hill: Boston MA; 8<sup>th</sup>(International) Edition, 2005.
2. Ravindran, Philips and Soleberg, Operations Research – Principle and Practice, Second Edition, John Wiley and Sons, 2007.
3. Taha, H. A., Operations Research - An Introduction, Pearson Education, 2022.
4. Paul A. Jensen, Jonathan F. Bard, Operations Research: models and methods, Wiley Publications, 2003.
5. C. B Gupta, I.K., Optimization Techniques in Operation Research, International Publishing House Pvt. Limited, 2008.



<b>Program: Computer Engineering</b>	<b>S.Y. B.Tech.</b>	<b>Semester: IV</b>
<b>Corporate Finance Management (RCP23XOE264)</b>		

**Prerequisite:** Nil.

### **Course Objective(s):**

1. Overview of Indian financial system, instruments and market.
2. Basic concepts of value of money, returns and risks, corporate finance, working capital and its management.
3. Knowledge about sources of finance, capital structure, dividend policy.

### **Course Outcomes:**

On completion of the course, the learner will be able to:

<b>CO</b>	<b>Course Outcomes</b>	<b>Blooms Level</b>	<b>Blooms Description</b>
CO1	Understand Indian finance system	L2	Understand
CO2	Apply concepts of time value money and risk returns to product, services and business.	L3	Apply
CO3	Understand corporate finance and working capital management.	L2	Understand
CO4	Take Investment and finance decisions.	L3	Apply
CO5	Take dividend decisions.	L3	Apply





# Corporate Finance Management (RCP23XOE264) Course Contents

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## Unit-I

08 Hrs.

**Overview of Indian Financial System:** Characteristics, Components and Functions of Financial System. Financial Instruments: Meaning, Characteristics and Classification of Basic Financial Instruments — Equity Shares, Preference Shares, Bonds-Debentures, Certificates of Deposit, and Treasury Bills. Financial Markets: Meaning, Characteristics and Classification of Financial Markets — Capital Market, Money Market and Foreign Currency Market. Financial Institutions: Meaning, Characteristics and Classification of Financial Institutions — Commercial Banks, Investment-Merchant Banks and Stock Exchanges.

## Unit-II

08 Hrs.

**Concepts of Returns and Risks:** Measurement of Historical Returns and Expected Returns of a Single Security and a Two-security Portfolio; Measurement of Historical Risk and Expected Risk of a Single Security and a Two-security Portfolio.

**Time Value of Money:** Future Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Present Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Continuous Compounding and Continuous Discounting.

## Unit-III

07 Hrs.

**Overview of Corporate Finance:** Objectives of Corporate Finance; Functions of Corporate Finance—investment Decision, Financing Decision, and Dividend Decision.

**Working Capital Management:** Concepts of Meaning Working Capital; Importance of Working Capital Management; Factors Affecting an Entity's Working Capital Needs; Estimation of Working Capital Requirements; Management of Inventories; Management of Receivables; and Management of Cash and Marketable Securities.

## Unit-IV

08 Hrs.

**Capital Budgeting:** Meaning and Importance of Capital Budgeting; Inputs for Capital Budgeting Decisions; Investment Appraisal Criterion—Accounting Rate of Return, Payback Period, Discounted Payback Period, Net Present Value (NPV), Profitability Index, Internal Rate of Return (IRR), and Modified Internal Rate of Return (MIRR)

## Unit-V

**Capital Structure:** Factors Affecting an Entity's Capital Structure; Overview of Capital Structure



Theories and Approaches — Net Income Approach, Net Operating Income Approach; Traditional Approach, and Modigliani-Miller Approach. Relation between Capital Structure and Corporate Value; Concept of Optimal Capital Structure.

**Dividend Policy:** Meaning and Importance of Dividend Policy; Factors Affecting an Entity's Dividend Decision; Overview of Dividend Policy Theories and Approaches — Gordon's Approach, Walter's Approach, and Modigliani-Miller Approach

### Text Books:

1. Financial Management, Theory

Practice 8<sup>th</sup> Edition (2011), by Prasanna Chandra: Tata McGraw Hill Education Private Limited, New Delhi.

2. Indian Financial System, 9<sup>th</sup> Edition (2015) by M. Y. Khan; Publisher: McGraw Hill Education, New Delhi.

3. Financial Management, 11<sup>th</sup> Edition (2015) by I. M. Pandey; Publisher: S. Chand (G/L) & Company Limited, New Delhi.

### Reference Books:

1. Fundamentals of Financial Management, 13<sup>th</sup> Edition (2015) by Eugene F. Brigham and Joel F. Houston; Publisher: Cengage Publications, New Delhi.
2. Analysis for Financial Management, 10<sup>th</sup> Edition (2013) by Robert C. Higgins; Publishers: McGraw Hill Education, New Delhi.



Program: Computer Engineering	S.Y. B.Tech.	Semester: IV
Corporate Social Responsibility (RCP23XOE265)		

**Prerequisite:** Nil.

### Course Objective(s):

1. To make students understand the concept, theories and application of CSR for the Development of the Society.

### Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	To analyse and critique the ethical dimensions of Corporate Social Responsibility initiatives, demonstrating a comprehensive understanding of CSR principles and their ethical underpinnings	L4	Analyze
CO2	To understand the legislative frameworks shaping Corporate Social Responsibility both in India and globally, alongside recognizing the key drivers fostering CSR practices within the Indian context.	L2	Understand
CO3	To identify and discuss the significance of social responsibility and community engagement initiatives, demonstrating an understanding of their impact on both businesses and society.	L2	Understand





# Corporate Social Responsibility (RCP23XOE265) Course Contents

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## Unit-I

07 Hrs.

**Introduction to Corporate Social Responsibility (CSR):** Understanding the concept of CSR ,Historical evolution and development of CSR,Importance and benefits of CSR for businesses and society ,Stakeholder theory and its relevance to CSR .

## Unit-II

08 Hrs.

**Ethical Foundations of CSR:** Ethical theories relevant to CSR (Utilitarianism, Deontology, Virtue Ethics), Ethical decision-making frameworks in business, Corporate governance and ethics, Ethical issues in supply chain management.

## Unit-III

08 Hrs.

**CSR-Legislation in India and the World:** Section 135 of Companies Act 2013.Scope for CSR Activities under Schedule VII, Appointment of Independent Directors on the Board, and Computation of Net Profit's Implementing Process in India.

## Unit-IV

08 Hrs.

**The Drivers of CSR in India:** Market based pressure and incentives, civil society pressure, the regulatory environment in India Counter trends, Review of current trends and opportunities in CSR, Review of successful corporate initiatives and challenges of CSR. Case Studies of Major CSR Initiatives Corporate Social Responsibility and Public-Private Partnership (PPP).

## Unit-V

08 Hrs.

**Social Responsibility and Community Engagement:** Social issues and challenges in contemporary society, Corporate philanthropy and community development initiatives, Stakeholder engagement strategies, Corporate volunteering and employee engagement programs, CSR as a strategic business tool vital for sustainable development.





### Text Books:

1. Andrew Crane, Dirk Matten, "Corporate Social Responsibility: Definition, Core Issues, and Recent Developments" Oxford University Press.
2. O. C. Ferrell, John Fraedrich, Linda Ferrell, "Business Ethics: Ethical Decision Making Cases", Cengage Learning.
3. Corporate Social Responsibility in India, Sanjay K Agarwal, Sage Publications, 2008.
4. Corporate Social Responsibility in India, Bidyut Chakrabarty, Routledge, New Delhi, 2015.

### Reference Books:

1. Corporate Social Responsibility: An Ethical Approach, Mark S. Schwartz, Broadview Press, 2011.
2. Attaining Sustainable Growth through Corporate Social Responsibility, George Pohle and Jeff Hittner, IBA Global Business Services, 2008.
3. Strategic Corporate Social Responsibility: Stakeholders in a Global Environment, William B. Werther Jr. and David Chandler, 2<sup>nd</sup> Edition, Sage Publications, 2011.



<b>Program: Computer Engineering</b>	<b>S.Y. B.Tech.</b>	<b>Semester: IV</b>
<b>Bioinformatics (RCP23XOE266)</b>		

**Prerequisite:** Nil

### **Course Objective(s):**

1. To provide an overview of bioinformatics and its significance in modern biological research.
2. To enable students to apply bioinformatics methods in practical scenarios for biological data analysis and interpretation.

### **Course Outcomes:**

On completion of the course, the learner will be able to:

<b>CO</b>	<b>Course Outcomes</b>	<b>Blooms Level</b>	<b>Blooms Description</b>
CO1	Understand the structure and function of cells, organelles, and biomolecules	L2	Understand
CO2	Understand the types of data stored in bioinformatics databases and their relevance to biological research.	L2	Understand
CO3	Explore genomic databases and understand the structure and content of protein databases.	L2	Understand
CO4	Understand system biology concepts and molecular evolution	L2	Understand
CO5	Apply knowledge of cellular and molecular biology concepts to analyze a biological problem.	L3	Apply



# Bioinformatics (RCP23XOE266)

## Course Contents

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### Unit-I

08 Hrs.

#### Foundations of Molecular and Cellular Biology:

Introduction to molecular biology: DNA, RNA, proteins, and their roles in cellular processes

Cell structure and function: Organelles, membrane structure, and cellular transport

Cell cycle regulation: phases of the cell cycle, checkpoints, and cell cycle control mechanisms

### Unit-II

08 Hrs.

#### Genetics and Genomics:

Mendelian genetics: Inheritance patterns, Punnett squares, and genetic crosses

Chromosome structure and organization: karyotyping, gene mapping, and genetic linkage

Introduction to genomics: genome structure, organization, and variation

Techniques in molecular genetics: PCR, DNA sequencing, and gene cloning

### Unit-III

08 Hrs.

#### Genomic and Protein Databases:

Types of genomic databases such as GenBank, Ensemble, and UCSC Genome Browser, Understand the structure and content of protein databases such as UniProt and Protein Data Bank (PDB), Searching, Retrieving, and Analysing Genomic and Protein data from online databases.

### Unit-IV

08 Hrs.

#### Systems Biology:

Introduction to Systems Biology: Modeling biological systems and network analysis, Bioinformatics tools for systems biology and modeling complex biological processes.

Principles of molecular evolution: Mutation, Selection, and genetic drift.

Phylogenetic analysis: Tree construction, sequence alignment, and molecular clock.

### Unit-V

07 Hrs.

**Applications and Case Studies:** Applications of Bioinformatics in Medicine, Agriculture, and Biotechnology, Case Studies (Integrating Cellular and Molecular Biology with Bioinformatics) and Research Examples, Ethical and Legal Issues in Bioinformatics, Future Trends and Emerging Technologies in Bioinformatics.



## Text Books:

1. Bioinformatics For Dummies, Jean-Michel Claverie and Cedric Notredame, For Dummies, 2019.
2. Bioinformatics Algorithms: An Active Learning Approach by Phillip Compeau and Pavel Pevzner, Active Learning Publishers, 2019.

## Reference Books:

1. Introduction to Bioinformatics, Arthur Lesk, Biologist Bioinformatics Expert, 2019.
2. Introduction to Biomedical Data Science, Robert Hoyt, Informatics Education, 2019.
3. Python for Biologists: A Complete Programming Course for Beginners, Martin Jones, Oxford University Press, 2013.
4. An Introduction to Bioinformatics Algorithms, Neil C. Jones, and Pavel A. Pevzner, MIT Press, 2004.
5. Exploring Bioinformatics: A Project-Based Approach, Caroline St. Clair, and Jonathan E. Visick, Jones Bartlett Learning, 2014.





<b>Program: Computer Engineering</b>	<b>S.Y. B.Tech.</b>	<b>Semester: IV</b>
<b>Human Resource Management (RCP23XOE267)</b>		

**Prerequisite:** Nil.

### **Course Objective(s):**

1. To introduce the students with basic concepts, techniques and practices of the human resource managements.
2. To provide opportunity of learning Human resource management (HRM) processes, related with the functions, and challenges in the emerging perspective of today's organizations.
3. To familiarize the students about the importance of the labour relations in the organization.

### **Course Outcomes:**

On completion of the course, the learner will be able to:

<b>CO</b>	<b>Course Outcomes</b>	<b>Blooms Level</b>	<b>Blooms Description</b>
CO1	Understand the changing environment of the HRM and the role of the HR managers.	L2	Understand
CO2	Understand the recruitment process and the application of the IT.	L2	Understand
CO3	Understand the importance of the training and development.	L2	Understand
CO4	Understand about the pay plans, performance appraisal and compensation.	L2	Understand
CO5	Understand the importance of the labour relation, the employee security and collective bargaining.	L2	Understand



# Human Resource Management (RCP23XOE267) Course Contents

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## Unit-I

07 Hrs.

**Human Resource Function:** Human Resource Philosophy – Changing environments of HRM – Strategic human resource management – Using HRM to attain competitive advantage – Trends in HRM – Organisation of HR departments – Line and staff functions – Role of HR Managers.

## Unit-II

10 Hrs.

**Recruitment & Placement:** Job analysis: Methods - IT and computerised skill inventory - Writing job specification - HR and the responsive organisation.

Recruitment and selection process: Employment planning and forecasting - Building employee commitment: Promotion from within - Sources, Developing and Using application forms - IT and recruiting on the internet.

Employee Testing & selection: Selection process, basic testing concepts, types of test, work samples & simulation, selection techniques, interview, common interviewing mistakes, Designing & conducting the effective interview, small business applications, computer aided interview.

## Unit-III

08 Hrs.

**Training & Development:** Orientation & Training: Orienting the employees, the training process, need analysis, Training techniques, special purpose training, Training via the internet.

Developing Managers: Management Development - The responsive managers - On-the-job and off the-job Development techniques using HR to build a responsive organisation.

Performance appraisal: Methods - Problem and solutions - MBO approach - The appraisal interviews - Performance appraisal in practice.

Managing careers: Career planning and development - Managing promotions and transfers.

## Unit-IV

08 Hrs.

**Compensation & Managing Quality:** Establishing Pay plans: Basics of compensation - factors determining pay rate - Current trends in compensation - Job evaluation - pricing managerial and professional jobs - Computerised job evaluation.

Pay for performance and Financial incentives: Money and motivation - incentives for operations employees and executives - Organisation wide incentive plans - Practices in Indian organisations.

Benefits and services : Statutory benefits - non-statutory (voluntary) benefits - Insurance benefits -retirement benefits and other welfare measures to build employee commitment.



## Unit-V

06 Hrs.

**Labour relations and employee security:** Industrial relation and collective bargaining: Trade unions - Collective bargaining - future of trade unionism. Discipline administration - grievances handling - managing dismissals and separation.

Labour Welfare: Importance & Implications of labour legislations - Employee health - Auditing HR functions, Future of HRM function.

### Text Books:

1. Pattanayak, Biswajeet, Human Resource Management, 6<sup>th</sup> Edition, PHI Learning Pvt. Ltd., 1 Jul 2020.
2. Gary Dessler, Human Resource Management, 16<sup>th</sup> Edition, Pearson Publications, 2020.

### Reference Books:

1. Stephen Robbins, Organizational Behavior, 16<sup>th</sup> Edition, 2013.
2. Aswathapa, Human resource management: Text & cases, 6<sup>th</sup> Edition, 2011.
3. C. B. Mamoria and S V Gankar, Dynamics of Industrial Relations in India, 2015, Himalaya Publishing, 15<sup>th</sup> Edition, 2015.
4. P. Subba Rao, Essentials of Human Resource management and Industrial relations, 5<sup>th</sup> Edition, 2013, Himalaya Publishing.
5. Laurie Mullins, Management & Organizational Behavior, Latest Ed, 2016, Pearson Publications.
6. Raymond J. Stone, Anne Cox, Mihajla Gavin, Human Resource Management, 10<sup>th</sup> Edition, John Wiley & Sons, 14 Dec 2020.
7. V S P Rao, Human Resource Management, 3<sup>rd</sup> Edition, 2010, Excel publishing.





<b>Program: Computer Engineering</b>	<b>S.Y. B.Tech.</b>	<b>Semester: IV</b>
<b>Digital Marketing Management (RCP23XOE268)</b>		

**Prerequisite:** Nil.

### **Course Objective(s):**

1. Explain the evolution and technology of digital marketing, including underlying frameworks.
2. Understand digital business strategy and emerging business structures.
3. Cover digital marketing planning, operations setup, and implementation of search campaigns, alongside emerging concepts like Big Data, IoT, SMB, B2B marketing, and SoLoMo.

### **Course Outcomes:**

On completion of the course, the learner will be able to:

<b>CO</b>	<b>Course Outcomes</b>	<b>Blooms Level</b>	<b>Blooms Description</b>
CO1	Understand the digital marketing framework & model and consumer behaviour.	L2	Understand
CO2	Develop digital marketing strategy roadmap.	L6	Create
CO3	Explain the terminology and concepts for developing web-specific media plans.	L2	Understand
CO4	Understand concepts related to digital campaign management and revenue generation models.	L2	Understand
CO5	Get a perspective on global digital marketing technology/tools and future trends	L3	Apply





# Digital Marketing Management (RCP23XOE268) Course Contents

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## Unit-I

06 Hrs.

**Introduction to Digital Marketing:** Emergence of Digital Marketing as a tool, media consumption drivers for new marketing environment, applications and benefits of digital marketing.

**Digital Marketing Framework:** Delivering enhanced customer value, market opportunity analysis and digital services development, ASCOR framework.

**Digital Marketing Models Creation:** Factors impacting digital marketplace, value chain digitization, business models.

**The Consumer for Digital Marketing:** Consumer behavior on the internet, evolution of consumer behavior models, managing consumer demand, integrated marketing communications (IMC).

## Unit-II

12 Hrs.

**Digital marketing Strategy Development:** Elements of assessment phase, macro-micro environmental analysis, marketing situation analysis.

**Digital Marketing Internal Assessment and Objectives Planning:** Analyzing present offerings mix, marketing mix, core competencies analysis and internal resource mapping. Digital presence analysis, digital marketing objectives development and review.

**Digital Marketing Strategy Definition:** Understanding digital business strategy and structures, consumer development strategy, offering mix for Digital, digital pricing models, managing promotional channels and developing the extended Ps- People, process, programs and performance.

**Digital marketing Strategy Roadmap:** Developing digital marketing strategy roadmap, the 6s digital marketing implementation strategy, marketing across the product life cycle.

## Unit-III

08 Hrs.

**Digital Marketing Planning and Setup:** Understanding digital media planning terminology and stages, steps to creating marketing communications strategy, introduction to search marketing, display marketing, social media marketing.

**Digital Marketing Operations Setup:** Basics of lead generation and conversion marketing, website content development and management, elements of user experience, web usability and evaluation.

## Unit-IV

08 Hrs.

**Digital marketing Execution:** Basic elements of digital campaign management, search execution, display execution, social media execution, content marketing.

**Digital marketing Execution Elements:** Digital revenue generation models, managing service



delivery and payments, managing digital implementation challenges like ecommerce, internal & external and consumer specific challenges.

## Unit-V

05 Hrs.

**Digital Business – Present and Future:** Digital Marketing – Global Landscape, digital marketing overview – global spend, advertising spend, and technology/tools landscape.

Data technologies (Big data and IOT) impacting marketing, segment based digital marketing and SoLoMo – the next level of hyperlocal marketing.

## Text Books:

1. Fundamentals of Digital Marketing by Puneet Singh Bhatia, Pearson Education Limited, 2017.
2. Digital Marketing by Seema Gupta- McGraw Hill Education, 2022.

## Reference Books:

1. Digital Marketing Excellence: Planning, Optimizing and Integrating Online Marketing by Dave Chaffey and P. R. Smith, 5<sup>th</sup> Edition, Taylor & Francis, 2017.
2. Digital Marketing: Strategy, Implementation and Practice- 6<sup>th</sup> Edition by Dave Chaffey Fiona Ellis-Chadwick, Pearson Education Limited, 2019.
3. Digital marketing by Vandana Ahuja, Oxford University Press, 2015.
4. The Art of Digital Marketing by Ian Dodson, John Wiley & Sons, 2016.



Program: Computer Engineering	S.Y. B.Tech.	Semester: IV
Logistics and Supply Chain Management (RCP23XOE269)		

**Prerequisites:** Latest trend of information technology in retail industry and logistic applications.

### Course Objective(s):

1. To develop advanced strategic thinking skills in supply chain management and logistics to effectively analyse and optimize supply networks.
2. To attain proficiency in leveraging cutting-edge tools and technologies to enhance supply chain efficiency and supply chain transformation.
3. Design and implement collaborative supply chain and sourcing strategies to promote information sharing and optimise coordination.

### Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Develop a sound understanding of the important role of supply chain management in today's business environment.	L2	Understand
CO2	Develop criteria and standards to achieve improved business performance by integrating and optimizing the total logistics and supply-chain process.	L6	Create
CO3	Summarize the value of focusing on information business logistics systems which drives improved accuracy and decision-making at all levels of management.	L2	Understand
CO4	Become familiar with current supply chain information technology management trends.	L2	Understand
CO5	Use available technologies to enhance work performance and support supply chain functions, processes, transactions, and communications.	L3	Apply





# Logistics and Supply Chain Management (RCP23XOE269) Course Contents

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## Unit-I

05 Hrs.

**Introduction:** What Is Supply Chain Management? The Development Chain, Global Optimization, Managing Uncertainty and Risk, The Complexity in Supply Chain Management, Key Issues in Supply Chain Management.

## Unit-II

06 Hrs.

**Network Planning:** Introduction, Network Design- Data Collection, Data Aggregation, Transportation Rates, Mileage Estimation, Warehouse Costs, Warehouse Capacities, Potential Warehouse Locations, Service Level Requirements, Future Demand, Model and Data Validation, Solution Techniques, Key Features of a Network Configuration Supply Chain Planning; Inventory Positioning and Logistics Coordination -Strategic Safety Stock.

## Unit-III

08 Hrs.

**The Value of Information:** Introduction, The Bullwhip Effect-Quantifying the Bullwhip Effect, The Impact of Centralized Information on the Bullwhip Effect, Methods for Coping with the Bullwhip Effect, Information Sharing and Incentives, Effective Forecasts, Information for the Coordination of Systems, Locating Desired Products, Lead-Time Reduction, Information and Supply Chain Trade-offs-Conflicting Objectives in the Supply Chain, Designing the Supply Chain for Conflicting Goals ,Decreasing Marginal Value of Information.

## Unit-IV

08 Hrs.

**Supply Chain Integration :** Introduction, Push, Pull, and Push-Pull Systems-Push-Based Supply Chain, Pull-Based Supply Chain, Push-Pull Supply Chain ,Identifying the Appropriate Supply Chain Strategy, Implementing a Push-Pull Strategy The Impact of Lead Time Demand-Driven Strategies The Impact of the Internet on Supply Chain Strategies-what is E-Business, the Grocery Industry , the Book Industry , the Retail Industry and Impact on Transportation and Fulfillment.

## Unit-V

06 Hrs.

**Information Technology and Business Process :** Introduction, The Importance of Business Processes, Goals of Supply Chain IT, Supply Chain Management System Components, Decision-Support Systems, IT for Supply Chain Excellence, Sales and Operations Planning Integrating Supply Chain Information Technology. Implementation of ERP and Decision Support System.





## Unit-VI

06 Hrs.

**Technology Standards:** Introduction, IT Standards, Information Technology Infrastructure-Interface Devices, System Architecture and Electronic Commerce. Service-Oriented Architecture (SOA)-Technology Base: IBM and Microsoft and ERP Vendor Platform: SAP and Oracle. Radio Frequency Identification (RFID)- applications, point of sale data, business benefits and supply chain efficiency.

### Text Books:

1. Sunil Chopra, Peter Meindl “Supply Chain Management-Strategy, Planning, and Operation”, Pearson Publications 2016.
2. David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi, “Designing and Managing the Supply Chain-Concepts, Strategies, and Case Studies”, McGraw-Hill/Irwin 2008.

### Reference Books:

1. Ian Sadler, “Logistics and Supply Chain Integration”, SAGE Publications, 2007.
2. Donald Waters, “Supply Chain Management - An Introduction to Logistics”, Bloomsbury Publishing, 2019.
3. Dimitris Folinas, “E-Logistics and E-Supply Chain Management-Applications for Evolving Business”, IGI Global publications, 2013.
4. Martin Christopher, “Logistics & Supply Chain Management”, Pearson Education publications, 2016.



Program: Computer Engineering	S.Y. B.Tech.	Semester: IV
Semester Project-II (RCP23XSC251P)		

### Course Objective(s):

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

### Course Outcomes:

On completion of the course, the learner will be able to:

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



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.

Student is expected to:

- ### 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).

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 5.

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

Departmental committee (including project guide) will evaluate project as per Table 6.

Table 4: Log Book Format

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

Table 5: 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 6: Evaluation Table

Sr	Exam Seat No	Name of Student	Project Selection	Design/ Simulation/ Logic	Hardware/ Program-ming	Result Ver-ification	Presentation	Total
			5	5	5	5	5	25





Program: Computer Engineering	S.Y. B.Tech.	Semester: IV
Professional and Business Communication Tutorial (RCP23XHS281T)		

**Prerequisite:** Nil

### Course Objective(s):

1. To inculcate professional and ethical attitude at the workplace.
2. To enhance communication and interpersonal skills.
3. To develop effective employability skills .
4. To hone written skills for technical documentation .

### Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Apply group discussion techniques in professional situations	L3	Apply
CO2	Use employability skills to optimize career opportunities	L3	Apply
CO3	Employ storytelling techniques for effective presentation	L3	Apply
CO4	Prepare technical documents using appropriate style, format, and language	L6	Create
CO5	Analyze the concept of professional ethics.	L4	Analyze
CO6	Demonstrate interpersonal skills in professional and personal situations	L3	Apply



The course is designed to equip students with essential skills, crucial for navigating the contemporary job market successfully and fostering a positive work environment through effective communication and collaboration. The assignments comprise of a combination of interactive activities, discussions, case studies and real-world simulations, to help students, not only to ace job interviews and professional interactions, but also to contribute positively to the ethical and productive functioning of any organization. For the project work, students must prepare and present a well-researched and persuasive business proposal, in groups, integrating the skills and knowledge acquired throughout the course.

## Description of Tutorial Activities

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### Unit-I

No of Assignment -01

#### Group Discussion

- Purpose of a GD, types of GD, criteria for evaluating GD, Dos and Don'ts of GD.
- **Activity:** Students will be divided into groups of 8-12 and each group will be given a topic/case to discuss within a given time frame. Each student will submit a write-up on their observations of the GD.

### Unit-II

No of Assignments -02

#### Employment Skills

- **Resume Writing:** Types of resumes, structure, content, and formatting of resume.
- **Activity:** Students will prepare and submit their individual resume according to professional requirements.
- **Interview Skills:** Types and modes of interview, preparation for interview, Dos and Don'ts of interview, frequently asked questions during interview.
- **Activity:** Students will submit a write-up on the FAQs and participate in mock interviews.

### Unit-III

No of Assignment -01

#### Corporate Storytelling

- Elevator pitch, product stories, event stories, stories in presentations, storytelling in SOPs and interviews, storytelling to manage conflict or to motivate.



- **Activity:** Students will be divided into groups of 8-12 and asked to give a team presentation using storytelling techniques and submit the hardcopy of the PPT.

## Unit-IV

No of Assignment -01

### Technical Writing and Documentation

- Business Proposal Writing: Types of business proposals, format of proposal, language and style, presentation of proposal.
- Meeting Documentation: Planning layout of meetings, observing meeting decorum, drafting notice, agenda, and minutes of meeting.
- **Activity:** Students will be divided into groups of 8-12 and each group will conduct a mock meeting based on an agenda and submit a write-up of the meeting documentation.

## Unit-V

No of Assignment -01

### Professional Ethics

- Effective work habits, accountability, integrity, and excellence.
- **Activity:** Students will be divided into groups of 8-12 and each group will analyze a case involving an ethical issue and submit the write-up.

## Unit-VI

No of Assignment -02

### Interpersonal Skills

- Team Building: Difference between group and team, importance of teamwork, strategies to be a good team player
- **Activity:** The students will be divided into groups of 8-12 and each group will be assigned a task to be accomplished as a team, for which they will submit the writeup.
- Leadership: Types of leadership, leadership styles, case studies.
- **Activity:** Each student will submit a writeup involving a leader they admire, analysing various aspects of his leadership style.
- Time Management: Importance of time management, cultural views of time, 80/20 rule, time wasters, setting priorities and goal.
- **Activity:** Each student will submit a writeup about a case involving time management.

Batchwise tutorial work of minimum eight assignments from the above suggested list or any other assignments based on the syllabus will be included, which would help the learner to apply the concepts





learnt.

### Books Recommended:

1. Fred Luthans, "Organizational Behavior", 12<sup>th</sup> Edition, McGraw Hill, 2010.
2. Lesika and Pettit, "Report Writing for Business", 9<sup>th</sup> Edition, McGraw Hill, 1994.
3. Huckin and Olsen, "Technical Writing and Professional Communication", 2<sup>nd</sup> Edition, McGraw Hill, 1991.
4. Wallace and Masters, "Personal Development for Life and Work", 12<sup>th</sup> Edition, Thomson Learning, 2010.
5. Herta Murphy, "Effective Business Communication", 7<sup>th</sup> Edition, McGraw Hill, 2017.
6. Sharma R. C. and Krishna Mohan, "Business Correspondence and Report Writing", 5<sup>th</sup> Edition, Tata McGraw-Hill Education, 2017.
7. Ghosh, B. N., "Managing Soft Skills for Personality Development", Tata McGraw Hill, 2017.
8. Bell, Smith, "Management Communication", 3<sup>rd</sup> Edition, Wiley India Edition, 2014.
9. Dr. Alex, K., "Soft Skills", 3<sup>rd</sup> Edition, S. Chand and Company, 2009.
10. Subramanian R., "Professional Ethics", 2<sup>nd</sup> Edition, Oxford University Press, 2017.
11. Sandeep Das, "How Business Story Telling Works: Increase Your Influence and Impact", Penguin Random House India Pvt. Ltd., 2023.

### Evaluation Scheme:

#### Continuous Assessment (A):

Term Work: 25 marks.

Term Work shall comprise of: Minimum 8 assignments: 15 marks.

Business Proposal presentation: 10 marks.





Program: Computer Engineering	S.Y. B.Tech.	Semester: IV
Economics and Financial Management (RCP23XHS282)		

**Prerequisite:** Knowledge of Economics and Finance domain current affairs.

### Course Objective(s):

1. To describe the relationships among variables to analyse economic issues.
2. To Explain the function of the market and prices as an allocative mechanism.
3. To identify key macroeconomic indicators and measures of economic change, growth, and development.
4. To understand basic concepts of financial management and their application in investment and financing decisions.
5. To explore the relationship between Financial Management and Financial Statements.

### Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyse individual decision making, how prices and quantities are determined in product and factor markets, microeconomic and macroeconomic outcomes.	L4	Analyze
CO2	Analyse the performance and functioning of government, RBI, markets, and institutions in the context of social and economic problems.	L4	Analyze
CO3	Analyse the current economic status of India at global levels and provision in budget to address economic issues at national level.	L4	Analyze
CO4	Describe an understanding of the overall role and importance of the finance function.	L2	Understand
CO5	Analyse financial performance and make appropriate inferences..	L4	Analyze



# Economics and Financial Management (RCP23XHS282) Course Contents

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## Unit-I

06 Hrs.

**Introduction to Economics:** Fundamentals of Economics, Definition and scope of economics, the nature of the economic problem, finite resources and unlimited wants, definitions of the factors of production and their rewards, definition of opportunity cost, the influence of opportunity cost on decision making.

**Microeconomics and Macroeconomics:** The role of markets in allocating resources, the market system, introduction to the price mechanism, Demand, Supply and Price determination, Price elasticity of demand and supply (PED).

## Unit-II

04 Hrs.

**Role of Government and RBI:** Money, Banking, Households, Firms, economies and diseconomies of scale, Market Structure, Fiscal Policy, Monetary Policy, Economic Growth, causes and consequences of recession, causes of economic growth, measurement of economic growth inflation and deflation, living standards, indicators of living standards.

## Unit-III

04 Hrs.

**Government Policies:** Last 20 years Journey of Indian Economy, Measures taken to grow Indian Economy, Meaning of India is the world's fifth-largest economy by nominal GDP and the third-largest by purchasing power parity (PPP), On a per capita income basis, India ranked 139th by GDP (nominal) and 127th by GDP (PPP) (Data reference year 2023), Comparison of top 5 largest economies in world, Discuss key points of India latest union budget and its impact on Indian economy and citizens, Meaning of Initiatives like Make in India, Digital India, Skill India etc. and expected impact on Indian Economy.

## Unit-IV

04 Hrs.

**Overview of Financial Management:** Fundamentals of financial management, principles and functions of the financial management, Strategy, methods, and techniques of the financial management, Overview of financial instruments, financial markets, financial Institutions.

## Unit-V

08 Hrs.

**Overview of Financial Statements:** Balance Sheet, Profit and Loss Account, and Cash Flow Statement; Purpose of Financial Ratio Analysis; Liquidity Ratios; Efficiency or Activity Ratios; Profitability Ratios; Capital Structure Ratios; Stock Market Ratios.



## Text Books:

1. Datt & Sundharam's Indian Economy by Gaurav Datt & Biswajit Nag, S. Chand Publications, 73<sup>rd</sup> Edition, 2024.
2. Fundamentals of Financial Management by Prasanna Chandra, McGraw Hill Publications, 7<sup>th</sup> Edition, 2020.

## Reference Books:

1. Public Economics: The Macroeconomic Perspective by Burkhard Heer, Springer International Publications, 2019.
2. Indian Economy: Economic Ideas, Development, and Financial Reforms by Raj Kumar Sen, Deep & Deep Publications, 2008.
3. Indian Economy: Performance and Policies by Dr. V. C. Sinha, SBPD Publications, 2021.
4. Financial Management by C. Paramasivan, T. Subramanian, New Age Publications, 2<sup>nd</sup> Edition, 2023.
5. Financial Management Practices in India by Sandeep Goel, Taylor & Francis Publications, 2016.

