



Shirpur Education Society's

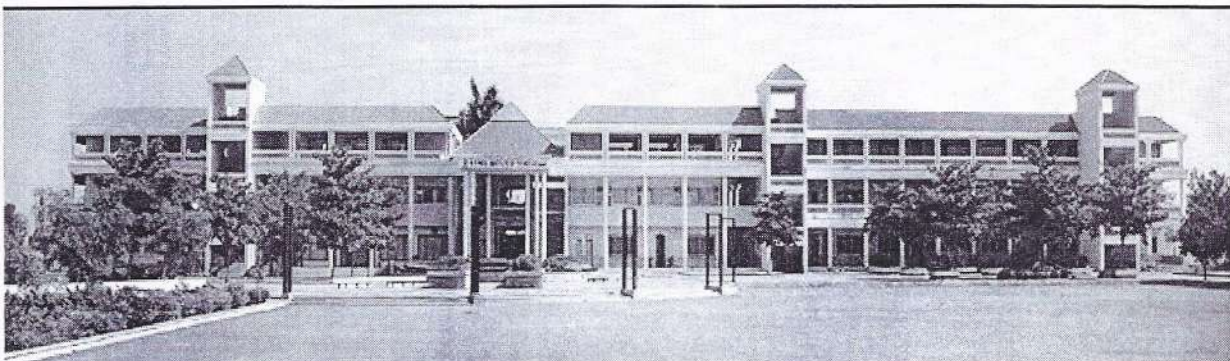
R. C. Patel Institute of Technology, Shirpur
(An Autonomous Institute)

Course Structure and Syllabus

Second Year B. Tech

Artificial Intelligence (AI) and Data Science

With effect from Year 2025-26



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Second Year B. Tech Artificial Intelligence (AI) and Data Science Semester-III (w.e.f. 2025-26)														
Sr	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total	Credit	
				L	T	P	Continuous Assessment (CA)				ESE			
							TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Average of (TT1 & TT2)				
1	PC	RCP23SPC201	Linear Algebra and Optimization Techniques	3			25	15	15	15	60	100	3	3
2	PC	RCP23SPC202	Data Structures	3			25	15	15	15	60	100	3	4
	PC	RCP23SPC202L	Data Structures Laboratory			2	25				25	50	1	
3	PC	RCP23SPC203L	Python for Data Science Laboratory			4	25				25	50	2	2
4	MD	RCP23SMD201	Database Management Systems	2			25	15	15	15	60	100	2	3
	MD	RCP23SMD201L	Database Management Systems Laboratory			2	25				25	50	1	
5#	OE	RCP23XOE211	Product Life Cycle Management	3			25	15	15	15	60	100	3	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	
		RCP23XOE218	Entrepreneurship and Startup Ecosystem	3			25	15	15	15	60	100	3	
6	HS	RCP23XHS233T	Professional and Business Communication Tutorial		2		25				25	2	2	
7	HS	RCP23XHS234	Economics and Financial Management	2			25	15	15	15	60	100	2	2
8	EL	RCP23XEL201L	Community Engagement Service			2	25				25	1	1	
9	SC	RCP23XSC201P	Semester Project-I			2	25				25	50	1	1
Total				13	2	12	275			75	400	750	21	

#Any 1 Elective Course

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Semester - III

Program: Artificial Intelligence and Data Science	S.Y.B.Tech.	Semester: III
Linear Algebra and Optimization Techniques (RCP23SPC201)		

Prerequisite:

1. Solving a simultaneous linear equation using concept of matrices.
2. Calculus.

Course Objectives:

1. Understanding basic concepts of linear algebra.
2. Apply the concepts of vector spaces, linear transformations, matrices and inner product spaces in engineering.
3. To understand the concept of Optimization and enhance the problem solving skills and Optimization techniques.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the concept of a basis in vector spaces and apply it to represent data points in terms of independent features or components.	L3	Apply
CO2	Understand the role of linear transformations in machine learning algorithms, such as linear regression, logistic regression, and neural networks, for mapping inputs to outputs.	L3	Apply
CO3	Apply eigenvectors in the context of secret-key cryptography to understand how transformations in key management can be represented by matrices.	L3	Apply
CO4	Apply the concept of unconstrained optimization techniques to the engineering problems.	L3	Apply



Course Contents

Unit-I

07 Hrs.

Vector Space and Inner Product Spaces:

Preview: Linear combinations of vectors, Linearly dependent and independent vectors. Definition of vector space over $\mathbb{R}$, Subspaces. Basis and Dimension. Dot product in $\mathbb{R}$, Definition of general inner product on a vector space over $\mathbb{R}$. Norm of a vector in an inner product space. Cauchy-Schwarz inequality. Orthogonal sets and orthonormal sets in an inner product space. Orthogonal and orthonormal bases. Gram-Schmidt orthogonalization process simple examples in $\mathbb{R}^2$ and $\mathbb{R}^3$.

Unit-II

06 Hrs.

Linear Transformations: Definition and properties. Kernel and image of a linear transformation, Rank-Nullity Theorem. Invertible Linear Transformation, Relation between matrices and Linear Transformations, Change of bases.

Unit-III

07 Hrs.

Matrices: Eigen values, Eigen vectors and their properties. Cayley-Hamilton theorem (without proof) and its application. Similar matrices, diagonalization of matrix. Functions of square matrix. Singular value decomposition.

Unit-IV

06 Hrs.

Calculus: Gradient, directional derivatives, Jacobian, Hessian, convex sets, convex functions, and its properties. Unconstrained optimization techniques: Newton's method, Quasi Newton method.

Text Books:

1. Jin Ho Kwak and Sungpyo Hong, "Linear Algebra", 2nd Springer, 2004.
2. Bernard Kolman and David, "Introductory Linear Algebra- An applied first course", 9th Edition, Pearson Education, 2011.
3. Hira & Gupta, "Operation Research", S Chand.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley India, 2015.

Reference Books:

1. Rudolf Lidl, Guter Pilz, "Applied Abstract Algebra", 2nd Edition, Springer 2004.
2. Howard Anton, Robert C Busby, "Contemporary linear algebra", Wiley 2003
3. Gilbert Strang, "Introduction to Linear Algebra", 5th Edition, Cengage Learning, 2015.



4. S.D. Sharma, Kedar Nath, "Operations Research (Theory Methods and Applications)", Ram Nath and Co. Meerat, 2024.
5. Singiresu S.Rao, "Engineering optimization (Theory and Practice)", New Age International publication, 2013.
6. B. S. Grewal, "Higher Engineering Mathematics", 43th Edition, Khanna Publishers, India, 2015.
7. Stephen Andrilli and David Hecker, "Elementary Linear Algebra", 5th Edition, Academic Press, 2016.



Program: Artificial Intelligence and Data Science	S.Y.B.Tech.	Semester: III
Data Structures (RCP23SPC202)		
Data Structures Laboratory (RCP23SPC202L)		

Prerequisite: Knowledge of C – Programming

Course Objectives:

1. Familiarize students with linear and non-linear data structures and their application in fundamental algorithms.
2. Introduce students to the design and implementation of various data structures.
3. Provide a foundation in algorithms and time complexity analysis.
4. Teach various sorting and searching techniques and enable comparison of their performance.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain the concept of time and space complexity for algorithms.	L2	Understand
CO2	Apply the concept of various linear and non-linear data structures.	L2	Understand
CO3	Solve the problem using appropriate data structure.	L3	Apply
CO4	Implement appropriate searching and sorting technique for a given problem.	L3	Apply



Course Contents

Unit-I

04 Hrs.

Basics of Algorithms: Algorithms, Characteristics of an Algorithm, Time and Space Complexities, Order of Growth functions, Preliminary Asymptotic Notations.

Data Structures: Introduction, Need of Data Structures, Types of Data Structures, Abstract Data Types (ADT)

Unit-II

06 Hrs.

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

Unit-III

07 Hrs.

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

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

Applications – Queue Simulation.

Unit-IV

08 Hrs.

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

Height Balanced Tree: Creation of AVL Tree

Heap: Operations on heap

Applications: Huffman coding

Unit-V

06 Hrs.

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

Applications of Graphs: Topological sorting

Unit-VI

08 Hrs.

Searching: Linear Search, Binary Search and Fibonacci search.

Sorting: Bubble Sort, Selection Sort, Heap Sort, Insertion Sort, Radix Sort, Merge Sort, Quick Sort.



Analysis of Searching and Sorting Techniques.

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

Data Structures Laboratory (RCP23SPC202L)

List of Laboratory Experiments

Suggested Experiments:

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

Text Books:

1. R. F. Gilberg and B. A. Forouzan, "Data Structures – A Pseudocode Approach with C", 2nd Edition, Cengage Learning, 2005.
2. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, "Fundamentals of Data Structures in C", 2nd Edition, W. H. Freeman, and Company 2008.

Reference Books:

1. Mark A. Weiss, "Data Structures and Algorithm Analysis in C", 4th Edition, Pearson, 2014.
2. M. T. Goodritch, R. Tamassia, D. Mount, "Data Structures and Algorithms in C++", Wiley, 2nd Edition, 2011.
3. Kruse, Leung, Tondo, "Data Structures and Program Design in C", 2nd Edition, Pearson Education, 2013.
4. Tenenbaum, Langsam, Augenstein, "Data Structures using C", 2nd Edition Pearson, 2015.
5. Reema Thareja, "Data Structures using C", Oxford, 2017.
6. Seymour Lipschutz, "Data Structures, Schaum's Outline Series", 1st Edition, Tata McGraw-Hill, 2014.



Program: Artificial Intelligence and Data Science	S.Y.B.Tech.	Semester: III
Python for Data Science Laboratory (RCP23SPC203L)		

Prerequisite: Knowledge of C Programming

Course Objectives:

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.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain basic and object-oriented concepts, data structure implementation in python.	L2	Understand
CO2	Apply file, directory handling and text processing concepts in python.	L2	Understand
CO3	Apply database connectivity and implement DDL and DML commands in Python	L3	Apply
CO4	Use libraries like NumPy, Matplotlib, and Pandas for data manipulation, analysis, and visualization.	L3	Apply



Course Contents

Unit-I

08 Hrs.

Python basics: Data types in python, Operators in python, Input and Output, Control statement, Arrays in python, String and Character in python, Functions, List and Tuples, Dictionaries, limitations of Python

Unit-II

08 Hrs.

Control Statements and Functions: If statement, if-elif-else, Repetition using while loop, for loop, defining a Function, Checking Setting Your Parameters, Default arguments, Variable length arguments, Defining and calling functions within a function, Layers of Functions, Lambda and Filter, Zip (), Map (), Reduce () function, recursion, Function Decorators.

Unit-III

16 Hrs.

Introduction to OOP:: Creating a Class, Self-Variables, Constructors, Types of Methods, Constructors in Inheritance, Polymorphism, the super () Method, Method Resolution Order (MRO), Operator Overloading, Method Overloading Overriding, Interfaces in Python. Exceptions Handling: Exceptions, Exception Handling, Types of Exceptions, Except Block, assert Statement, User Defined Exceptions

Unit-IV

08 Hrs.

Python Modules: Building Modules, Packages: Python Collections Module, Opening and Reading Files and Folders (Python OS Module), Python Datetime Module, Python Math and Random Modules, Text Processing, Regular expression in python

Unit-V

12 Hrs.

Python for Data Science: Numpy: Working with Numpy, Constructing Numpy arrays, Printing arrays, Arithmetic Operations on matrix's, numpy zeros() Matplotlib: Matplotlib- Plot different charts, Pandas: Data Processing, Pandas-Data structure, Pandas- Series data, Data Frames, Introduction to data pre-processing: Data Cleaning, Pandas plotting, Exploratory Data analysis. Data Visualization: Heat map techniques

Python for Data Science Laboratory (RCP23SPC203L)

List of Laboratory Experiments

Suggested Experiments: (Minimum 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. Implement different Machine learning packages like numpy, pandas and matplotlib.
15. Implement Data cleaning techniques and Data plotting's using pandas

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept. Minimum ten experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Practical and Oral 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", 3rd Edition, Dreamtech Press, 2018.
2. Mark Lutz, "Learning Python", 5th Edition, O'Reilly Publication, 2013.
3. E Balagurusamy, "Introduction to computing and problem-solving using Python", McGraw Hill Education, 2018.

Reference Books:

1. Bill Lubanovic, "Introducing Python (2nd Edition)", O'Reilly Media, December 2019.
2. Dan Bader, David Amos, Joanna Jablonski, Fletcher Heisler, "Python Basics: A Practical Introduction to Python (1st Edition)", Real Python, March 2021.
3. Luciano Ramalho, "Fluent Python", 2nd Edition, O'Reilly Media, May 2022.



Program: Artificial Intelligence and Data Science	S.Y.B.Tech.	Semester: III
Database Management Systems (RCP23SMD201)		
Database Management Systems Laboratory (RCP23SMD201L)		

Prerequisite: Computer Basics.

Course Objectives:

1. Understanding Database Fundamentals.
2. Develop Structured Query Language (SQL) for data definition, manipulation, and retrieval, including complex queries and transactions.
3. Learn how to design efficient and normalized database schemas using Entity-Relationship (ER) modeling and normalization techniques.
4. Understand the principles of data integrity, validation, and security measures to protect sensitive information within a database.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Design an optimized database.	L3	Apply
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	Apply indexing mechanisms for efficient retrieval of information from database.	L3	Apply



Course Contents

Unit-I

06 Hrs.

Introduction to database management system: Introduction, Characteristics of databases, File system v/s Database system, Data Abstraction and data independence, DBMS system architecture, Database Administrator.

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

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

Unit-II

06 Hrs.

Structured Query Language (SQL) PLSQL: Overview of SQL, Data Definition Commands, Integrity constraints: key constraints, Domain Constraints, Referential integrity, check constraints, Data Manipulation commands, Data Control commands, aggregate function-group by, having, Views in SQL, joins, Nested and complex queries, security authorization : GRANT REVOKE, Triggers, SQL functions, Procedure.

Unit-III

04 Hrs.

Relational-Database Design: Pitfalls in Relational-Database designs, Concept of normalization, Function Dependencies, First Normal Form, 2NF, 3NF, BCNF.

Unit-IV

06 Hrs.

Transaction Management and Recovery: Transaction concept, Transaction states, ACID properties, Transaction Control Commands, Implementation of atomicity and durability Concurrent Executions, Serializability-Conflict and View, Concurrency Control: Lock-based, Timestamp-based protocols, Validation concurrency control, Deadlock handling, Recovery System: Failure classification, Log based recovery.

Unit-V

06 Hrs.

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

Database Management Systems Laboratory (RCP23SPC202L)

List of Laboratory Experiments

Suggested Experiments: (Minimum 10)



1. To draw an ER diagram for a problem statement.
2. Map the ER/EER to relational schema.
3. To implement DDL and DML commands with integrity constraints.
4. To access & modify Data using basic SQL.
5. To implement aggregate functions.
6. To implement Subqueries.
7. To implement Joins and Views.
8. Implement functions and procedures in SQL
9. To implement TCL commands of transaction in SQL
10. Examine the consistency of database using concurrency control technique (Locks).
11. To implement B-trees/B+ trees..

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept. Minimum ten experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

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

Text Books:

1. Korth, Silberchatz, Sudarshan, "Database System Concepts", 7th Edition, McGraw –Hill, 2019.
2. Elmasri and Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson education, 2016.
3. Peter Rob and Carlos Coronel, "Database Systems Design, Implementation and Management", 5th Revised Edition, Thomson Learning, 2002.
4. G. K. Gupta, "Database Management Systems", 3rd Edition, McGraw – Hill, 2018.
5. The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling, 3rd Edition Released July 2013, Publisher(s): Wiley
6. Seven NoSQL Databases in a Week By Sudarshan Kadambi , Xun (Brian) Wu.

Reference Books:

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



2. Sharaman Shah, "Oracle for Professional", 1st Edition, Shroff Publishers & Distributers Private Limited, 2008.
3. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", 3rd Edition, McGraw – Hill, 2014.
4. Patrick Dalton, "Microsoft SQL Server Black Book", 11th Edition, Coriolis Group, U.S., 1997.
5. Lynn Beighley, "Head First SQL", 1st Edition, O'Reilly Media, 2007.
6. Architecting Data Lakes, 2nd Edition, by Ben Sharma Released April 2018 Publisher(s): O'Reilly Media, Inc.
7. Lan Robinson, Jim Webber and Emil Eifrem Graph databases, O'Reilly Media, 2nd edition.



Program: Open Elective for all Programs	S.Y.B.Tech.	Semester: III
Product Life Cycle Management (RCP23XOE211)		

Prerequisite: Basic management knowledge

Course Objectives:

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.

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



Course Contents

Unit-I

07 Hrs.

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

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

Unit-II

07 Hrs.

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

Unit-III

10 Hrs.

Methodological Evolution of Product Design: Concurrent Engineering, Characteristic Features of Concurrent Engineering, Concurrent Engineering, Life Cycle Approach, Characteristic Features of Life Cycle Approach.

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

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

Unit-IV

07 Hrs.

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

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



Unit-V

08 Hrs.

Engineering Methods for product Duration design & evaluation: Durability of Products and Components, Design for Fatigue, Infinite Life Approach, Design for Finite Life.

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

Text Books:

1. John Stark, "Product Lifecycle Management: Paradigm for 21st Century Product Realization", Springer-Verlag, 2004, ISBN: 1852338105.
2. Fabio Giudice, Guido La Rosa, Antonino Risitano, "Product Design for the environment-A life cycle approach", Taylor & Francis, 2006, ISBN: 0849327229.

Reference Books:

1. Saaksvuori Antti, Immonen Anselmie, "Product Life Cycle Management", Springer, Dreamtech, 2009, ISBN: 3540257314.
2. Michael Grieve, "Product Lifecycle Management: Driving the next generation of lean thinking", Tata McGraw Hill, 2006, ISBN: 0070636265.
3. François Villeneuve, Luc Mathieu, Max Giordano, "Product Life-Cycle Management: Geometric Variations", United Kingdom: Wiley, 2010.



Program: Open Elective for all Programs	S.Y.B.Tech.	Semester: III
Management Information System (RCP23XOE212)		

Prerequisite: Nil

Course Objectives:

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.

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



Course Contents

Unit-I

04 Hrs.

Foundation Concepts:

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

Unit-II

05 Hrs.

Information Technology Infrastructure:

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

Unit-III

10 Hrs.

MIS Tools and applications for Decision making:

- ERP and ERP support of Business
- Business intelligence (BI): Managers and Decision Making
- Decision Support System (DSS): types, components, Data mining
- Executive information system



- Role of AI in decision making
- Role of predictive analytics and data visualization in business

Unit-IV

08 Hrs.

Security and Ethical Challenges

- Information security fundamentals,
- Key principles of information security,
- Common threats and vulnerabilities in MIS
- Security measures and controls,
- Access control mechanisms: authentication, authorization, and accounting (AAA),
- Encryption techniques and cryptographic protocols,
- Ethical, and societal challenges of IT,
- Legal and regulatory framework
- Privacy Policies.

Unit-V

06 Hrs.

Social Computing (SC)

- Web 2.0 and 3.0: static and dynamic platform, integration with AI and IoT.
- SC in business-shopping: leveraging social media platforms, Social listening and sentiment analysis.
- Social computing in Customer Relationship Management (CRM)
- Marketing, operational and analytic CRM,
- E-business and E-commerce – B2B B2C, E-commerce platforms and payment gateways
- Mobile commerce: growth trends, mobile wallets, contactless payments, shopping apps and platforms

Unit-VI

06 Hrs.

- **Information System within Organization:** Acquiring Information Systems and Applications: Various System development life cycle models.
- **Enterprise and Global Management of Information Technology:** Managing Information Technology, Managing Global IT.
- Business processes and information systems



Textbooks:

1. A. K. Gupta, "Management Information System", S. Chand Limited, 2010.
2. K. K. Ghosh, Saini Das, and S. Mukherjee, "Management Information System", Management, IIT, Kharagpur, 2021.

Reference Books:

1. James A O'Brien, George M., Ramesh Behl, "Management Information Systems", 11th Edition, Tata McGraw Hill, 2019.
2. Kelly Rainer, Brad Prince, "Management Information Systems", Wiley, 2016.

Web References:

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



Program: Open Elective for all Programs	S.Y.B.Tech.	Semester: III
Operations Research (RCP23XOE213)		

Prerequisite: Knowledge of Mathematics, Probability.

Course Objectives:

1. Formulate a real-world problem as a linear programming problem and able to solve.
2. Understand the optimisation tools that are needed to solve linear programming problems.

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



Course Contents

Unit-I

12 Hrs.

Introduction to Operations Research:

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

Linear Programming:

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

Unit-II

08 Hrs.

Transportation Problem:

Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – 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 2×2 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 Lieberman, 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: Open Elective for all Programs	S.Y.B.Tech.	Semester: III
Personal Finance Management (RCP23XOE214)		

Prerequisite: NIL

Course Objectives:

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.

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



Course Contents

Unit-I

07 Hrs.

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

Introduction to Personal Finance: 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; Classification of Goods and Services



Unit-V

08 Hrs.

Introduction to Micro – finance:

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

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

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

Text Books:-

1. Asha Singh, M.S. Gupta, "Banking and Financial Sector Reforms in India", Serials Publication.
2. M.S. Gupta & J.B. Singh, "Indian Banking Sector: Essays and Issues", 1st Edition, Serials Publication.
3. K.M. Bhattacharya O.P. Agarwal, "Basics Of Banking & Finance", Himalaya Publishing House.
4. S. Subba Reddy , P. Raghu Ram, "Agricultural Finance and Management".
5. Dr.Vasant Desai, "The Indian Financial System and Development", 4th Edition, Himalaya Publishing House.
6. Sanjay Kumar Satapathy, "Income Tax Management Simple Way of Tax Management, Tax Planning and Tax Saving".
7. Dr. R. K. Jain, "Direct Tax System Income Tax", SBPD Publications.
8. S K Mishra, "Simplified Approach to GST Goods and Services Tax", Educreation Publishing.
9. Todd A Watkins, "Introduction To Microfinance", World Scientific Publishing Company.



Program: Open Elective for all Programs	S.Y.B.Tech.	Semester: III
Public Systems and Policies (RCP23XOE215)		

Prerequisite: Basic Knowledge of Social science and Current affairs.

Course Objectives:

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.

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 public policy on firms and the economy at large and work under various fields as policymakers.	L5	Evaluate



Course Contents

Unit-I 10 Hrs.

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

Unit-II 06 Hrs.

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

Unit-III 08 Hrs.

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

Unit-IV 10 Hrs.

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

Unit-V 05 Hrs.

Case Studies in Expenditure Policy: Public Services

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

Reference Books:

1. Charles Wheelan, "Introduction to Public Policy", W.W. Norton & Company, New York, 2011.
2. Thomas R. Dye, "Understanding Public Policy", Prentice Hall, 2008.
3. Anderson J.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 D 2017.



7. Harvey S Rosen and Ted Gayer, "Public Finance", 10th Edition, McGraw-Hill Education, 2013.
8. Richard A. Musgrave and Peggy B. Musgrave, "Public Finance in Theory and Practice", 5th Edition, McGraw Hill Book, 2017.



Program: Open Elective for all Programs	S.Y.B.Tech.	Semester: III
Fundamentals of Biomedical Instruments (RCP23XOE216)		

Prerequisite:

1. Basic knowledge of Human Anatomy
2. Basic knowledge of Electronics

Course Objectives:

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.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Associate & describe the 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



Course Contents

Unit-I

04 Hrs.

Basic Human Physiology

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

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

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

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

Unit-II

10 Hrs.

Biomaterial, Transducers and Sensors

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

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

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

Unit-III

08 Hrs.

Overview of Medical Instruments

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

Method of operation of these Bio Medical Instruments

ECG, EEG, EMG

Unit-IV

09 Hrs.

Imaging Modalities and Analysis Radio graphic techniques, Computer Tomography

MRI, PET, SPECT

Ultrasonography

Endoscopy

Thermography, Retinal Imaging

Imaging application in Biometric systems

Analysis of digital images



Unit-V

08 Hrs.

Telemetry & Telemedicine

Introduction to Biotelemetry

Physiological parameters compliant to biotelemetry

Components of Biotelemetry system

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

Text Books:

1. Leslie Cronwell, "Biomedical Instrumentation and Measurement", Prentice hall of India, New Delhi, 2007.
2. M.Arumugam, "Bio-Medical Instrumentation", Anuradha Agencies, 2003.
3. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, New Delhi, 2nd Edition, 2003.
4. John G. Webster, "Medical Instrumentation Application and Design", John Wiley and sons, NewYork, 1998.
5. B.D. Ratner, A.S. Hoffmann, F. J. Schoen, J. E. Lemons, "Biomaterials Science - An Introduction to Materials in Medicine", Academic Press, 1997.

Reference Books:

1. Dr Rajendra Prasad, "Electronic Measurement and Instrumentation".
2. Ed. Joseph D. Bronzino, "The Biomedical Engineering Hand Book", 3rd Edition, Boca Raton, CRC Press LLC, 2006.
3. Curry, T. S., Dowdey, J. E., & Murry, R. C., "Christensen's physics of diagnostic radiology". Lippincott Williams & Wilkins, 1990.
4. Joon Park, R. S. Lakes, "Biomaterials: An Introduction", Springer Science & Business Media.



Program: Open Elective for all Programs	S.Y.B.Tech.	Semester: III
IPR and Patenting (RCP23XOE217)		

Prerequisite: NIL

Course Objectives:

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

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



Course Contents

Unit-I

03 Hrs.

Introduction to Intellectual Property Rights (IPR):

- Concept & meaning of IP and IPR.
- General principles of intellectual property rights.
- Need for intellectual property.
- Categories of IPR instruments - Patents, Trademarks, Copyrights, Industrial Designs, Plant variety protection, Trade secrets, Geographical Indications etc.
- Ownership, assignment, licenses, infringement, validity period.
- International treaties on IPR.

Unit-II

09 Hrs.

Copyright and Design

- The Indian Copyright Act, 1957.
- Meaning of copyrights and rights of copyrighted works.
- Types of copyright
- Process of filing a copyright application.
- Introduction to Designs Law – Definitions.
- Registration of designs and procedure.

Unit-III

09 Hrs.

Basics of Patents

- The Indian Patent Act and The Indian Patent Rules.
- Conditions of patentability.
- Patentable and non-patentable inventions.
- Types of patent applications and patent specification.
- Inventors and Applicants.
- Category of applicants - natural person, small entity, startup and others.
- Patent databases and prior art search.



- International Patent Classification code.

Unit-IV

09 Hrs.

Patent Application Drafting

Patent application drafting:

- Application.
- Specification.
- Claims drafting:
 - Independent and dependent claims drafting.
 - Process patent and product patent claims.
- Abstract.
- Drawings.
- Declaration as to inventorship.
- Statement and undertaking.

Drafting response to communications from patent office.

- Reading and understanding examination reports.
- Drafting response.

Unit-V

09 Hrs.

Procedure for Filing a Patent Application, Timelines and Fees

- Application for grant of patent.
- Forms and Fees.
- Request for (early) publication and / or (early) examination.
- Patent examination and hearing.
- Pre-grant and post-grant opposition.

Text Books:

1. A Durafe and D Toradmalle, "Intellectual Property Rights", Wiley, 2020.
2. H Rockman, "Intellectual property law for engineers, scientists, and entrepreneurs", Wiley-IEEE Press, 2020.

Reference Books:



1. Bare Act, "The Patents Act, 1970 with The Patents Rules, 2003", Universal, 2023.
2. Bare Act, "The Copyright Act, 1957", Universal and LexisNexis, 2021.
3. Bare Act, "The Designs ACT, 2000", Commercial Law Publishers (India) Pvt. Ltd. 2021

Online Resources:

1. W. Fisher, "Maps of Intellectual Property" <https://cyber.harvard.edu/people/tfisher/IP/IPMaps.htm>
2. World Intellectual Property Organisation courses <https://www.wipo.int/academy/en/>
3. Prof. Feroz Ali, "Patent Drafting for Beginners", https://onlinecourses.nptel.ac.in/noc24_hs59/preview



Program: Open Elective for all Programs	S.Y.B.Tech.	Semester: III
Entrepreneurship and Startup Ecosystem (RCP23XOE218)		

Prerequisite: NIL

Course Objectives:

1. To foster an entrepreneurial mindset.
2. To guide in building effective Business Models.
3. To educate regarding Intellectual property and Fundraising for Innovative Ventures.

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



Course Contents

Unit-I

06 Hrs.

Understanding the Entrepreneurial Ecosystem

- Introduction to Entrepreneurship and Startups
- Role of Entrepreneurship in economy
- Global and Local Entrepreneurial Landscapes
- Role of Incubators and Accelerators
- Case Studies of Successful Startups

Unit-II

08 Hrs.

Developing a Startup Mindset

- Cultivating an Entrepreneurial Mindset
- Market Analysis and Segmentation
- Opportunity Recognition
- Innovation and Idea Generation
- Feasibility Analysis of Business Ideas
- Role of innovation in Entrepreneurship
- Fostering creativity
- Practical Exercises and Workshops on Creative Problem Solving

Unit-III

10 Hrs.

Business Model Development

- Introduction to Business Models
- Lean Startup Methodology
- Prototyping and Minimum Viable Product (MVP)
- Financial Projections and Budgeting
- Various forms of Business Ownership
- Compliance and Legal Regulations
- Operations and Supply Chain Management



- Human Resource Management
- Developing a marketing Strategy
- Managing Growth Challenges

Unit-IV

08 Hrs.

Technological Innovation and Intellectual Property

- Technology and Entrepreneurship
- Intellectual Property Basics (Patents, Trademarks, Copyrights)
- Patent Search and Analysis
- Strategies for Protecting Intellectual Property
- Ethical Considerations in Technology and Innovation

Unit-V

07 Hrs.

Fundraising and Investment Strategies

- Fundraising Options for Startups
- Angel Investors and Venture Capital
- Crowdfunding Platforms
- Financial Modelling for Startups
- Crafting an Effective Pitch

Books Recommended:

1. Alexander Osterwalder and Yves Pigneur, "Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers", John Wiley & Sons, Jul2010.
2. Peter Thiel and Blake Masters, "Zero to One: Notes on Startups, or How to Build the Future", Virgin Books, 2015.
3. Alejandro Cremades, "The Art of Startup Fundraising: Pitching Investors, Negotiating the Deal, and Everything Else Entrepreneurs Need to Know", John Wiley & Sons, Inc., Hoboken, New Jersey, 2016.
4. Christensen, Clayton M. "The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail", Boston, MA: Harvard Business School Press, 1997.
5. Brad Feld and Jason Mendelson, "Venture Deals: Be Smarter Than Your Lawyer and Venture Capitalist", Wiley, 4th Edition, 1 October 2019.



Program: Artificial Intelligence and Data Science	S.Y.B.Tech.	Semester: III
Professional and Business Communication Tutorial (RCP23XHS233T)		

Prerequisite: Basic course in Effective Communication Skills.

Course Objectives:

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.

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 in corporate situations.	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 Activities

Unit-I

No. of Assignments:01

Group Discussion:

Purpose of a GD, types of GD, criteria for evaluating GD, Dos and Don'ts of GD

Activity: The 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:** The students will prepare and submit their individual resume according to the professional requirements.

Interview Skills:

Types and modes of interview, Preparation for interview, Dos and Don'ts of interview, frequently asked questions during interview

Activity: The students will submit a write-up on the FAQs and participate in mock interviews

Unit-III

No. of Assignments:01

Corporate Story Telling:

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

Activity: The students will be divided into groups of 8-12 and asked to give a team presentation using storytelling technique and submit the hardcopy of the ppt.



Unit-IV

No. of Assignments: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: The students will be divided into groups of 8-12 and each group will conduct a mock meeting based on an agenda and submit a writeup of the meeting documentation.

Unit-V

No. of Assignments:01

Professional Ethics:

Effective work habits, accountability, integrity, and excellence

Activity: The students will be divided into groups of 8-12 and each group will analyse a case involving an ethical issue and submit the writeup.

Unit-VI

No. of Assignments: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 goals

Activity: Each student will submit a writeup about a case involving time management.

Term 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.



Reference Books:

1. Fred Luthans, "Organizational Behavior", McGraw Hill, edition.
2. Lesiker and Petit, "Report Writing for Business", McGraw Hill, edition.
3. Huckin and Olsen, "Technical Writing and Professional Communication", McGraw Hill.
4. Wallace and Masters, "Personal Development for Life and Work", 12th Edition, Thomson Learning.
5. Heta Murphy, "Effective Business Communication", Mc Graw Hill, edition.
6. Sharma R.C. and Krishna Mohan, "Business Correspondence and Report Writing", Tata McGraw-Hill Education.
7. Ghosh, B. N., "Managing Soft Skills for Personality Development", Tata McGraw Hill.
8. Bell, Smith, "Management Communication" Wiley India Edition, 3rd Edition.
9. Dr. Alex, K., "Soft Skills", S Chand and Company.
10. Subramaniam, R., "Professional Ethics" Oxford University Press.
11. Sandeep Das, "How Business Story Telling Works: Increase Your Influence and Impact", Penguin Random House India Pvt. Ltd.



Program: Artificial Intelligence and Data Science	S.Y.B.Tech.	Semester: III
Economics and Financial Management (RCP23XHS234)		

Prerequisite: Knowledge of Economics and Finance domain current affairs.

Course Objectives:

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.

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



Course Contents

Unit-I Introduction to Economics

06 Hrs.

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 Role of Government and RBI

04 Hrs.

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 Government Policies

04 Hrs.

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 Overview of Financial Management

04 Hrs.

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 Overview of Financial Statements

08 Hrs.

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. Gaurav Datt and Biswajit Nag, "Datt & Sundharam's Indian Economy", S. Chand Publications, 73th Edition, 2024.



2. Prasanna Chandra, "Fundamentals of Financial Management", McGraw Hill Publications,,7th Edition, 2020.

Reference Books:

1. Burkhard Heer, "Public Economics: The Macroeconomic Perspective", Springer International Publication 2019.
2. Raj Kumar Sen, "Indian Economy: Economic Ideas, Development, and Financial Reforms", Deep & Deep Publication, 2008.
3. Dr. V. C. Sinha, "Indian Economy: Performance and Policies", SBPD Publications, 2021.
4. C. Paramsvian, T. Subramanian, "Financial Management", New Age Publications, 2009.
5. "Financial Management Practices in India", Sandeep Goel, Taylor & Francis Publications, 2016.



Program: Artificial Intelligence and Data Science	S.Y.B.Tech.	Semester: III
Community Engagement Service (RCP23XEL201L)		

Prerequisite: Fundamentals of core branch, Communication Skills

Course Objectives:

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

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



Course Contents

Unit-I

Open Activities

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

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

Unit-II

Technical (Program core related)

Cyber-crime, security awareness and vulnerabilities – sensitization, information dissemination and awareness sessions in indicated focus areas.

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

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.

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

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



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

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

Sr.No.	Timestamp	Traffic Density	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.

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



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. Study, analyse report a residential society – capacity of water requirement, present day borewells in action, approximate.

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
2. Ex.1 Milk Adulteration: <https://www.youtube.com/watch?v=pbnmeRUBxKk>
3. Ex.2 Watermelon Adulteration: <https://www.youtube.com/watch?v=yrLAj7oJies>

Product	Adulterant	Testing Method	Result	Remarks



Activity Endorsement Certificate

Date:

Community engagement service is a mandatory course, of two credits, 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

A candidate needs to secure a minimum of 50% marks to be declared to have completed the course.

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, permission letters, etc.) [05 marks]	
2	Participant Feedback [05 marks]	
3	Participant attendance [05 marks]	
	TOTAL	

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	
	TOTAL	



Program: Artificial Intelligence and Data Science	S.Y.B.Tech.	Semester: III
Semester Project-I (RCP23XSC201P)		

Course Objectives:

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

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 departmental 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 4).
- 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 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 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/ Program- ming	Result Ver- ification	Presentation	Total
			5	5	5	5	5	25





Shirpur Education Society's

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

Course Structure and Syllabus

Second Year B. Tech

Artificial Intelligence (AI) and Data Science

With effect from Year 2025-26



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

Second Year B. Tech Artificial Intelligence (AI) and Data Science Semester-IV (w.e.f. 2025-26)

Sr	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total	Credit	
				L	T	P	Continuous Assessment (CA)				ESE			
							TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Average of (TT1 & TT2)				
							[A]			[B]	[C]	[A+B+C]		
1	PC	RCP23SPC251	Probability and Statistical Inference	3			25	15	15	15	60	100	3	3
2	PC	RCP23SPC252	Design and Analysis of Algorithms	2			25	15	15	15	60	100	2	3
	PC	RCP23SPC252L	Design and Analysis of Algorithms Laboratory			2	25				25	50	1	
3	PC	RCP23SPC253	Artificial Intelligence	2			25	15	15	15	60	100	2	3
	PC	RCP23SPC253L	Artificial Intelligence Laboratory			2	25				25	50	1	
4	EL	RCP23SPC254L	Web Development Laboratory			2	25				25	50	1	1
5	MD	RCP23SMD251	Introduction to Operating Systems and Networking Fundamentals	2			25	15	15	15	60	100	2	3
	MD	RCP23SMD251L	Introduction to Operating Systems and Networking Fundamentals Laboratory			2	25				25	50	1	
6#	OE	RCP23XOE261	Project Management	3			25	15	15	15	60	100	3	3
		RCP23XOE262	Cyber Security, Policies and Laws	3			25	15	15	15	60	100	3	
		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	
7	HS	RCP23XHS283L	Design Thinking Laboratory			2	25					25	1	1
8	HS	RCP23XHS284	Universal Human Values	3			25	15	15	15	60	100		3
9	SC	RCP23XSC251P	Semester Project - II			2	25				25	50	1	1
Total				15		12	300			90	485	875	21	

#Any 1 Elective Course

Prepared by:
Prof. V. V. Katre

Prof. Dr. D. R. Patil
BOS Chairman

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

Checked by:
Prof. T. A. Tayde

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

Prof. Dr. J. B. Patil
Director

Semester - IV

Program: Artificial Intelligence and Data Science	S.Y.B.Tech.	Semester: IV
Probability and Statistical Inference (RCP23SPC251)		

Prerequisite: Calculus, Descriptive Statistics, Basics of probability.

Course Objectives:

1. To understand random variables with their probability distributions to build a model.
2. To estimate population parameters from random samples and perform error analyses and use statistical estimation in training and evaluating AI/ML algorithms.
3. To understand and apply the basic concepts of statistical inference, confidence limits and hypothesis testing to validate AI/ML models.
4. To understand and apply the concepts of analysis of variance for feature selection and model comparison in AI/ML.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Apply the concepts of probability and distributions to some case studies.	L3	Apply
CO2	Demonstrate sampling distributions and estimate statistical parameters.	L3	Apply
CO3	Develop hypothesis based on data and perform testing using various statistical techniques.	L4	Analyze
CO4	Perform analysis of variance on data.	L4	Analyze

Course Contents

Unit-I

10 Hrs.

Random Variables and Probability Distributions: Concept of a Random Variable, Discrete Probability Distributions, Continuous Probability Distributions, Mathematical Expectation, Statistical Independence. Expectation, Variance and their properties, Covariance, Correlation **Discrete Probability Distributions:** Binomial Distribution, Poisson distribution. **Continuous Probability Distributions:** Normal Distribution, Areas under the Normal Curve, Applications of the Normal Distribution, Normal Approximation to the Binomial. Two dimensional random variable - Joint, marginal, conditional distributions, covariance and correlation. Application of probability distributions in predicting outcomes (e.g., classification probabilities).

Unit-II

11 Hrs.

Sampling distribution: Random Sampling, Sampling Distributions, Sampling Distribution of Means, Law of Large numbers, the Central limit theorem, population distribution, Z - distribution, Student's t-distribution, F-Distribution, Chi-square distribution, Chi-square test for feature independence in machine learning datasets. **Statistical Estimation Theory:** Characteristics of estimators, consistency, unbiasedness, unbiased estimates, efficient estimates, sufficient estimators, point estimates, interval estimates, determination of sample size for estimating mean and proportions, estimates of population parameters, probable error. **Confidence interval:** Population mean, difference between two population means, population proportion, difference between two population proportions, variance, ratio of variances of two populations. Application of confidence intervals to evaluate model performance metrics.

Unit-III

11 Hrs.

Test of Hypothesis: Test of significance, null and alternative hypothesis, type I and type II error, factors affecting Type II error, probability of Type II error, power of test, p Value, critical region, level of significance. **Parametric Test:** Test the difference between sample proportion and population proportion, difference between two sample proportion, difference between sample mean and population mean with known σ and unknown σ , difference between two sample means, one tailed and two tailed tests using z-statistics and t-statistics. Test the equality of population variance using F-statistics. **Non-parametric Test:** Test of independence, goodness of fit using chi-square statistics, Sign Test, Wilcoxon Signed-Rank Test, Mann-Whitney U Test, Kruskal-Wallis Test, Friedman Test, Runs Test, Kolmogorov-Smirnov Test, Shapiro-Wilk Test for normality.

Unit-IV

10 Hrs.

Analysis of Variance (ANOVA) for data analysis: Simple linear regression, Sample size cal-

culatation, one-way ANOVA, POST-HOC Analysis (Tukey's Test), randomized block design, two-way ANOVA. Use of ANOVA in feature selection and evaluating multiple machine learning models. Application of two-way ANOVA for analyzing the impact of hyper parameters and data preprocessing techniques on model performance.

Text Books:

1. Statistical Methods, S. P. Gupta, Sultan Chand, 2021, 46th revised edition.
2. Probability - Statistics and Random Processes by T. Veerarajan, McGraw Hill Education. 3rd edition, 2017.
3. Think Stats: Probability and Statistics for Programmers, Allen B. Downey, Green Tea Press, 2011.
4. Testing Statistical Hypotheses, E. L. Lehmann, Joseph P. Romano, Springer, 2008, third edition.
5. An Introduction to Statistics with Python, Thomas Hasalwanter, Springer, 2016

Reference Books:

1. Fundamentals of mathematical statistics, S. C. Gupta, V. K. Kapoor, Sultan Chand, 12th edition, 2020.
2. Practical Statistics for data scientists 50+ Essential Concepts Using R and Python, Peter Bruce, Andrew Bruce, Peter Gedeck, Orelly, second edition, 2020.
3. Statistics, Freedman, David, Robert Pisani, Roger Pervis, W. W. Norton, 2007
4. Introduction to Probability and Statistics for Engineers and Scientists, Sheldon M Ross, Elsevier, fifth edition, 2014.
5. Casella, G., & Berger, R. L., Statistical Inference, Cengage, 2021.
6. Wasserman, L., All of Statistics, Springer, 2004.

Program: Artificial Intelligence and Data Science	S.Y.B.Tech.	Semester: IV
Design and Analysis of Algorithms (RCP23SPC252)		
Design and Analysis of Algorithms Laboratory (RCP23SPC252L)		

Prerequisite: Computer Programming, Data structure.

Course Objectives:

1. To provide mathematical approach for Analysis of Algorithms.
2. To solve problems using various algorithmic strategies.
3. To analyze algorithms for solving problems.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze the performance of algorithms using asymptotic analysis.	L4	Analyze
CO2	Apply the concept of Greedy method to solve all feasible solutions of problems.	L3	Apply
CO3	Find optimal solution of problem by applying the concept of dynamic programming strategy.	L3	Apply
CO4	Understand the concepts of backtracking, branch and bound to represent solution by state space tree.	L2	Understand
CO5	Implement string matching techniques and Develop an understanding of approximation algorithms as a strategy to handle NP-hard problems	L3	Apply

Course Contents

Unit-I

05 Hrs.

Introduction: Analysis of control statements and loops, solving recurrences using tree, substitution and Master's theorem. Problem solving using Divide and Conquer – Binary search, Merge sort, Quick sort, Randomized Quick Sort, Karatsuba multiplication, Max–Min problem.

Unit-II

06 Hrs.

Greedy Method: Introduction, properties of Greedy algorithms, Fractional knapsack, Activity selection, Job sequencing with deadlines, Graph algorithms: Minimum Spanning Tree (Prim's Kruskal's), Single-source shortest path (Dijkstra's), Coin change, Analysis of all algorithms.

Unit-III

08 Hrs.

Dynamic Programming: Introduction and principle of optimality, components and characteristics of DP. Fibonacci sequence, Coin change (DP version), 0/1 Knapsack, Matrix Chain Multiplication, Floyd Warshall (All pairs shortest path), Bellman–Ford (Single source shortest path), Travelling Salesperson Problem, Longest Common Subsequence (LCS), Analysis of all algorithms.

Unit-IV

04 Hrs.

Backtracking and Branch and Bound: Basics of backtracking, N–Queens, Sum of subsets, Graph coloring and analysis of algorithms.

Branch and bound: Introduction, types of bounding, 0/1 Knapsack using B&B.

Unit-V

05 Hrs.

String Matching Algorithms: The naive string-matching algorithm, The Rabin Karp algorithm, The Knuth Morris Pratt algorithm NP hard and NP Complete: Concept of approximation algorithms, Introduction to P, NP, NP hard problems.

Design and Analysis of Algorithms Laboratory (RCP23SPC252L)

List of Laboratory Experiments

Suggested Experiments:

1. Implementation of binary search.
2. Implementation of Min Max algorithm.
3. Implementation of Karatsuba algorithm for long integer multiplication.
4. Fractional Knapsack implementation using greedy approach.
5. Implementation of Activity selection using greedy approach.
6. Implementation of Kruskal's/ Prim's algorithm using greedy approach.
7. Implementation of job sequencing with deadline using greedy approach.
8. Implementation of other greedy algorithms eg: tree vertex split, subset cover, container loading, coin changing, optimal; merge patterns (Huffman tree).
9. Implementation of Single source shortest path (Dijkstra's algorithm).
10. Implementation of Bellman Ford algorithm using Dynamic programming.
11. Implementation of Longest Common Subsequence algorithm using Dynamic programming.
12. Implementation of Travelling Salesperson problem using Dynamic programming.
13. Implementation of all pair shortest path using dynamic programming.
14. Implementation of N-queen problem using Backtracking.
15. Implementation of Knuth Morris Pratt string matching algorithm.

Minimum Ten Experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Text Books:

1. S. Sridhar, "Design and Analysis of Algorithms", 1st Edition, Oxford Education, 2018.
2. Goodrich M T, "Design and Analysis of Algorithms", Wiley, New Delhi, 2021.
3. Ellis Horowitz, Sartaj Sahni, S. Rajsekaran, "Fundamentals of computer algorithms", University Press.

Reference Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, “Introduction to Algorithms”, 4th Edition, The MIT Press, 2022.
2. Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, “Algorithms”, Tata McGraw- Hill Edition. S. K. Basu, “Design Methods and Analysis of Algorithm”, PHI, 2008.
3. John Kleinberg, Eva Tardos, “Algorithm Design”, Pearson, 2005.
4. Michael T. Goodrich, Roberto Tamassia, “Algorithm Design”, Wiley Publication, 2015.

Program: Artificial Intelligence and Data Science	S.Y. B.Tech.	Semester: IV
Artificial Intelligence (RCP23SPC253)		
Artificial Intelligence Laboratory (RCP23SPC253L)		

Prerequisite: Foundation of Artificial Intelligence.

Course Objectives:

1. To introduce the concepts of artificial intelligence, search algorithms, knowledge representation, and data analysis.
2. To apply various AI techniques, including search algorithms, knowledge representation methods, and data mining techniques, to solve real-world problems

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze and Evaluate Search Strategies.	L4	Analyze
CO2	Design and Implement Heuristic and Local Search Solutions	L3	Apply
CO3	Formulate and Solve Constraint Satisfaction Problems.	L4	Analyze
CO4	Develop Optimal Strategies for Adversarial Environments.	L5	Evaluate

Course Contents

Unit-I

05 Hrs.

Uninformed Search Algorithms: Best-first search, Search data structures, Redundant paths, Measuring problem-solving performance, Uninformed Search Strategies: Breadth-first search, Uniform-cost search, Depth-first search and the problem of memory, Depth-limited and iterative deepening search, Bidirectional search, Comparing uninformed search algorithms.

Unit-II

06 Hrs.

Informed Search Algorithms: Greedy best-first search, A* search, Search contours, Satisficing search: Inadmissible heuristics and weighted A*, Memory-bounded search, Bidirectional heuristic search, The effect of heuristic accuracy on performance, Generating heuristics from- relaxed problems, sub problems and landmarks.

Unit-III

06 Hrs.

Local Search and Optimization Problems: Hill-climbing search, TSP, Escaping Local Optima, Stochastic Local Search, Evolutionary algorithms- Genetics Algorithm, Ant Colony Optimization.

Unit-IV

06 Hrs.

Constraint Satisfaction Problems: Defining Constraint Satisfaction Problems, Constraint Propagation: Inference in CSPs, Backtracking Search for CSPs, Local Search for CSPs, The Structure of Problems.

Unit-V

05 Hrs.

Adversarial Search and Games: Game Theory, Optimal Decisions in Games- The minimax search algorithm, Alpha-Beta Pruning, Monte Carlo Tree Search, Stochastic Games, Limitations of Game Search Algorithms.

Artificial Intelligence Laboratory (RCP23SPC253L)

List of Laboratory Experiments

1. Implement Breadth-First Search (BFS) and Depth-First Search (DFS) to find a path from a start to an end point in a simple grid-based maze. Compare the path found and the number of nodes expanded by each.
2. Implement the Uniform-Cost Search (UCS) algorithm to find the minimum-cost path in a graph where edges have varying non-negative costs. Use the Route Finding problem (e.g., city connections with distances/tolls).
3. Implement the Iterative Deepening Depth-First Search (IDDFS) algorithm and demonstrate how it combines the benefits of DFS (low memory) and BFS (optimality for unweighted paths).
4. Implement Bidirectional Search for an unweighted graph and show the intersection point to demonstrate its advantage in reducing the search frontier size.
5. Implement the Greedy Best-First Search algorithm to solve the 8-Puzzle problem, using the Manhattan Distance.
6. Implement the A* Search algorithm for pathfinding on a grid (like a map or a 2D game environment).
7. Implement A* for the 8-Puzzle problem and derive an admissible heuristic by relaxing the problem constraints.
8. Implement the Hill-Climbing Search algorithm to find the maximum value of a simple mathematical function, demonstrating its susceptibility to local optima.
9. Implement Simulated Annealing (a form of Stochastic Local Search) to find a near-optimal solution for a small instance of the Traveling Salesperson Problem (TSP).
10. Implement a basic Genetic Algorithm (GA) to find the global optimum of a known non-linear function. Focus on implementing the core steps: selection, crossover, and mutation.
11. Implement the Minimax Search Algorithm for an elementary game like Tic-Tac-Toe to ensure the AI plays an optimal game.
12. Extend the Minimax implementation from Practical 12 to include Alpha-Beta Pruning. Visually demonstrate or count the number of nodes that are pruned to show the efficiency gain.
13. Implement N-Queens (N=8, 12, 16) with Heuristics using backtracking.
14. Hospital Roster Generator with Preferences Tasks: 14 nurses, 28-day month, 3 shifts/day, fairness + preference constraints. Hard: coverage, no 6 consecutive nights.

Minimum 10 experiments from the above suggested list or any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Text Books:

1. Saptarsi Goswami, AI for Everyone: a beginner's Handbook for AI, Pearson Publication, 2024.
2. Russell/Norvig, Artificial Intelligence: A Modern Approach, 4th Edition, 2022.
3. Mikan, Artificial Intelligence: A Modern Approach, 2020.

Reference Books:

1. Nils J. Nilsson, Principles of Artificial Intelligence, Narosa Publication, 1993.
2. Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill Publication, 2013.
3. Patrick H. Winston, Artificial Intelligence, 3rd edition, Pearson Education, 1992.

Program: Artificial Intelligence and Data Science	S.Y.B.Tech.	Semester: IV
Web Development Laboratory (RCP23SPC254L)		

Prerequisite:

Programming Fundamentals

Course Objectives:

1. To introduce the fundamental concepts of web development using HTML, CSS, and client-side scripting.
2. To enable students to design and develop responsive and interactive web pages using CSS3, Bootstrap, and JavaScript.
3. To impart knowledge of modern front-end development frameworks like React JS and the concept of single-page applications (SPA).
4. To familiarize students with version control systems using Git and GitHub for collaborative software development.
5. To provide hands-on experience in server-side scripting using Node.js, Express.js, and MongoDB for building full-stack web applications

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Develop static and dynamic web pages using HTML5 and CSS3 with responsive design principles.	L3	Apply
CO2	Implement client-side interactivity using JavaScript, including DOM manipulation, form validation, and data fetching through APIs.	L3	Apply
CO3	Design and deploy React-based applications using components, states, and hooks for efficient front-end management.	L3	Apply
CO4	Utilize Git and GitHub for source code management, version control, and collaborative development workflows..	L3	Apply
CO5	Build and integrate RESTful APIs using Node.js, Express, and MongoDB to perform CRUD operations and connect the front-end with the back-end efficiently.	L3	Apply

Course Contents

Unit-I **02 Hrs.**

HTML: Create a static web page using HTML, Create a class timetable using HTML, Create a registration form using HTML, Create a web page using HTML5 tags.

Unit-II **02 Hrs.**

CSS: Design a responsive web page and CSS3 using external CSS (media queries), Design a web page using Bootstrap, Design the admission form using Bootstrap

Unit-III **04 Hrs.**

Client-Side Scripting: Programs based on objects in JavaScript, Programs based on form validation, Fetch Data from an API Using the Fetch API in JavaScript.

Unit-IV **04 Hrs.**

React JS: Types of Components, Single Page Application (Virtual DOM) State React Hooks.

Unit-V **03 Hrs.**

Introduction to Git and GitHub: Adding files to the staging area, Push new branch, Merge into the master Auto Commit.

Unit-VI **04 Hrs.**

Server-Side Scripting: Installation and Configuration of Node.js server, Program based on inbuilt functions in Node.js .

Unit-VII **09 Hrs.**

Express & MongoDB: Using Mongoose to make schemas in MongoDB, Making API end points using Express and testing using postman, Develop a website and integrate it with pre-defined API, Doing CRUD on database MongoDB using Express.

Web Development Laboratory (RCP23SPC254L))

List of Laboratory Experiments

1. To create a static website using basic and semantic HTML5 tags (header, nav, section, article, footer).
2. To design and display a weekly class timetable using HTML tables.
3. To design a user registration form collecting name, email, gender, and password.
4. To design a responsive layout using CSS3 and media queries.
5. To create a professional-looking admission form using Bootstrap components.
6. To validate user input fields using JavaScript before form submission.
7. To fetch and display JSON data from a public API using the Fetch API.
8. To create functional and class-based components and use `useState()` hook.
9. To build a simple REST API using Express and perform CRUD operations on MongoDB.
10. To demonstrate version control operations using Git and GitHub.

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

Text Books:

1. John Dean, Web Programming with HTML5, CSS3 and JavaScript, Jones Bartlett Learning, 2019. Glenn Johnson, Programming in HTML5 with JavaScript and CSS3", Microsoft Press, 2013 Edition.
2. Adam Bretz and Colin J. Ihrig, Full Stack JavaScript Development with MEAN, SitePoint Pty. Ltd., 2015.
3. Venkat Subramaniam, "Rediscovering JavaScript, Master ES6, ES7, and ES8", The Pragmatic Bookshelf, 2018.
4. Alex Banks and Eve Porcello, Learning React Functional Web Development with React and Redux, O'Reilly, 1st Edition, 2017 Edition 5.
5. Andrew Mead, Learning Node.js Development, Packt Publishing, 2018 Edition 6.

Reference Books:

1. Ethan Brown, Web Development with Node and Express, O'Reilly, 2019.
2. Shama Hoque Full-Stack React Projects: Learn MERN stack development by building modern web apps using MongoDB, Express, React, and Node.js, 2nd Edition Packt Publication, 2020.

Web resources:

1. Learn Python - MDN Web Docs - Learn Web Development, <https://developer.mozilla.org/en-US/docs/Learn>
2. freeCodeCamp - Full Stack Development, Step-by-step lessons and projects for full-stack web development, including MongoDB and REST APIs, <https://www.freecodecamp.org/learn>
3. Udemy - Full Stack Web Development Course, <https://www.udemy.com/course/full-stack-web-development>

Program: Artificial Intelligence and Data Science	S.Y.B.Tech.	Semester: IV
Introduction to Operating Systems and Networking Fundamentals (RCP23SMD251)		
Introduction to Operating Systems and Networking Fundamentals Laboratory (RCP23SMD251L)		

Prerequisite: Computer Fundamentals.

Course Objectives:

1. Understand the functionality of an Operating System, its core components, and the interactions among them, focusing on scheduling, deadlocks, memory management, synchronization, file management, and I/O policies.
2. Analyze contemporary issues and challenges in protocol design within layered architecture, exploring the strengths and weaknesses of different routing protocols.
3. Analyze contemporary issues and challenges in the design and implementation of network protocols within a layered architecture, with a focus on their strengths, weaknesses, and compatibility with network standards.
4. Evaluate and compare various routing protocols, assessing their effectiveness in different network scenarios and their impact on performance, reliability, and scalability.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the architecture and functionality of computer systems and operating systems, focusing on process, thread management, and optimizing system efficiency through scheduling algorithms.	L2	Understand
CO2	Apply principles of concurrency to address classical synchronization problems, and implement deadlock handling and memory management strategies.	L3	Apply
CO3	Demonstrate data communication concepts at the physical layer and differentiate between the ISO-OSI and TCP/IP models.	L2	Understand
CO4	Design networks with appropriate IP addressing schemes, including subnetting and supernetting, and analyse networking protocols at the data link and transport layers	L4	Analyze

Course Contents

Unit-I

02 Hrs.

Operating System overview: Evolution of operating system, monolithic vs. microkernel, Types of Operating Systems

Unit-II

06 Hrs.

Process Management: Concept of a Process, Process States, creation and termination, Process Description, Process Control Block. **Threads:** Concept of a Thread, Types of Threads Thread states, Concept of Multithreading, **Scheduling:** Types of Schedulers, Types of Scheduling mechanisms, Pre-emptive and Non-preemptive, Scheduling algorithms and their performance evaluation: FCFS, SJF, SRTF, Priority based, Round Robin.

Unit-III

06 Hrs.

Deadlock and Memory management: **Deadlock:** Principles of deadlock, Conditions for deadlock, Resource Allocation Graph, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery. Solution using Semaphore and Monitor. **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:** Structure of Page Tables, Demand Paging, Page Replacement Strategies: FIFO, Optimal, LRU, LFU, Thrashing.

Unit-IV

06 Hrs.

Introduction to Networking: Introduction to computer network, network application, Network topologies and devices. Reference models: Layer details of OSI, TCP/IP model. **Physical and Data Link Layer:** Types of Media, Duties of Data Link Layer, Error Detection and Correction (Hamming Code, CRC, Checksum), Sliding Window CSMA/CA, CSMA/CD, **Wired LANS:** Ethernet

Unit-V

05 Hrs.

Network Layer: Network Layer design issues, IPv4 Addressing (Classfull and Classless), IPv4 Protocol, IPv6 Protocol, Network Address Translation (NAT), Routing algorithms: Link state routing, Distance Vector Routing Protocols. Congestion control algorithms: Open loop congestion control, Closed loop congestion control, Token Leaky bucket algorithms.

Unit-VI

03 Hrs.

Transport Layer and Application Layer: Port Addressing, Transport service primitives, Connection management (Handshake, Teardown), UDP, TCP, Working of: DNS, HTTPS, SMTP, Telnet, FTP.

Introduction to Operating Systems and Computer Networking

Fundamentals Laboratory(RCP23SMD251L)

List of Laboratory Experiments

1. Explore Linux Commands.
2. Write a program to demonstrate the concept of preemptive and non-preemptive scheduling algorithms.
3. Write a program to demonstrate the concept of dynamic partitioning placement algorithms i.e. Best Fit, First Fit, Worst-Fit etc.
4. Write a program in C demonstrate the concept of page replacement policies for handling page faults eg: FIFO, LRU etc.
5. Write a program in C to do disk scheduling - FCFS, SCAN, C-SCAN.
6. Execute and evaluate network administration commands and demonstrate their use in different network scenarios.
7. Building of wired wireless topology using Cisco Packet Tracer.
8. Write a program to implement A) Error Detection and Correction B. Framing.
9. Write a program to implement Sliding Window Protocols- Selective Repeat, Go Back N.
10. Write a program to implement Congestion Control algorithms.
11. Write a program to find out class of a given IP address, subnet mask first last IP address of that block.
12. Implement the TCP and UDP socket programming for client server architecture.

Minimum 10 experiments from the above suggested list or any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Text Books:

1. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, 8th Edition, 2014, ISBN-10: 0133805913 • ISBN-13: 9780133805918.
2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley Sons , Inc., 9th Edition, 2016, ISBN 978-81-265-5427-0

3. Andrew Tannenbaum, Operating System Design and Implementation, Pearson, 3rd Edition, 2011
4. Andrew S. Tanenbaum, David J. Wetherall, - Computer Networks, Pearson Education, 6th edition 2021
5. Behrouz A. Forouzan, -Data Communications and Networking, TMH ,9th edition 2022
6. Oliver C Ibe - Fundamentals of Data Communication Networks, Wiley Publications ,2nd edition 2022.
7. James F. Kurose, Keith W. Ross, -Computer Networking, A Top-Down Approach Featuring the Internet, Pearson Education, 8th edition 2021.

Reference Books:

1. Achyut Godbole and Atul Kahate, Operating Systems, Mc Graw Hill Education, 3rd Edition, 2017
2. Behrouz A. Forouzan, Firouz Mosharraf, Computer Networks: A Top-Down Approach, Mc Graw Hill, 2023.
3. Dhanashree K. Toradmalle, Computer Networks and Network Design, Wiley, 2020.

Program: Open Elective for all Programs	S.Y.B.Tech.	Semester: IV
Project Management (RCP23XOE261)		

Prerequisite: Basic concepts of Management

Course Objectives:

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:

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.	L4	Analyze
CO5	Differentiate between traditional waterfall approach and agile scrum methodology for software development projects	L4	Analyze

Course Contents

Unit-I

08 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

09 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

09 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

08 Hrs.

Agile project management:: Agile principle, Agile Manifesto, Agile process framework, Characteristics 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”, 11th Edition, Wiley India.
2. Erik Larson, Clifford Gray, “Project Management: The Managerial Process”, 8th 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), 7th Edition, Project Management Institute PA, USA.
2. Gido Clements, “Project Management”, Cengage Learning.
3. Gopalan, “Project Management”, Wiley India.
4. Dennis Lock, “Project Management”, 9th Edition, Gower Publishing England.
5. Kalpesh Ashar, “Agile Essentials You Always Wanted to Know”, Vibrant Publishers U.S.A.

Program: Open Elective for all Programs	S.Y.B.Tech.	Semester: IV
Cyber Security, Policies and Laws (RCP23XOE262)		

Prerequisite: Fundamentals of Computers.

Course Objectives:

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.
3. Understand the legal frameworks, regulatory standards, and security requirements associated with cyber law, including penalties, adjudication processes, and established cybersecurity standards.

Course Outcomes:

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	Navigate legal frameworks and regulations concerning digital personal data protection, including provisions of the Indian IT Act and Digital Personal Data Protection Act (2023).	L3	Apply
CO3	Implement strategies for cybersecurity outlined in the National Cyber Security Policy.	L3	Apply
CO4	Apply appropriate law enforcement strategies to both, prevent and control cybercrime.	L3	Apply
CO5	Comprehend regulations and strategies pertaining to AI (Artificial Intelligence) and large language models.	L2	Understand

Course Contents

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

09 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

08 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

09 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: Open Elective for all Programs	S.Y.B.Tech.	Semester: IV
Advanced Operations Research (RCP23XOE263)		

Prerequisite: Operation Research, Mathematics (Calculus)

Course Objectives:

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:

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

Course Contents

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 07 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 07 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 11 Hrs.

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”, 8th(International) Edition, McGraw-Hill: Boston MA, 2005.
2. Ravindran, Philips and Soleberg, “Operations Research – Principle and Practice”, 2nd 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.

Program: Open Elective for all Programs	S.Y.B.Tech.	Semester: IV
Corporate Finance Management (RCP23XOE264)		

Course Objectives:

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:

CO	Course Outcomes	Blooms Level	Blooms Description
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

Course Contents

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

09 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

09 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

08 Hrs.

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. Prasanna Chandra, "Financial Management, Theory & Practice", 8th Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2011.
2. M. Y. Khan, "Indian Financial System", 9th Edition, McGraw Hill Education, New Delhi, 2015.
3. I. M. Pandey, "Financial Management", 11th Edition, S. Chand (G/L) & Company Limited, New Delhi, 2015.

Reference Books:

1. Eugene F. Brigham and Joel F. Houston, "Fundamentals of Financial Management", 13th Edition, Cengage Publications, New Delhi, 2015.
2. Robert C. Higgins, "Analysis for Financial Management", 10th Edition, McGraw Hill Education, New Delhi, 2013.

Program: Open Elective for all Programs	S.Y.B.Tech.	Semester: IV
Corporate Social Responsibility (RCP23XOE265)		

Prerequisite: Nil.

Course Objectives:

1. To make students understand the concept, theories and application of CSR for the Development of the Society.
2. To analyse and apply ethical frameworks such as Utilitarianism, Deontology, and Virtue Ethics, guiding responsible decision-making in corporate governance, supply chains, and other CSR applications.
3. To examine CSR legislation, trends, and corporate initiatives within India and globally, with a focus on Section 135 of the Companies Act 2013, Schedule VII, and Public-Private Partnerships, enhancing student understanding of regulatory and strategic CSR drivers.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Upon completion of this course, students will be able to analyse and critique the ethical dimensions of Corporate Social Responsibility initiatives, demonstrating a comprehensive understanding of CSR principles and their ethical underpinnings.	L5	Evaluate
CO2	Upon completion of this course, students will demonstrate an understanding of 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	Upon completion of this course, students will be able 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
CO4	Evaluate the key drivers of CSR in India, understanding market pressures, civil society influence, and regulatory frameworks, while assessing case studies of successful CSR initiatives.	L5	Evaluate
CO5	Design and propose CSR strategies and community engagement programs that align with sustainable development goals, emphasizing corporate volunteering, stakeholder engagement, and public-private partnerships.	L6	Create

Course Contents

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

09 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

09 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

09 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. Sanjay K. Agarwal, "Corporate Social Responsibility in India", Sage Publications, 2008.
4. Bidyut Chakrabarty, "Corporate Social Responsibility in India", Routledge, New Delhi, 2015.

Reference Books:

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

Program: Open Elective for all Programs	S.Y.B.Tech.	Semester: IV
Bioinformatics (RCP23XOE266)		

Course Objectives:

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:

CO	Course Outcomes	Blooms Level	Blooms Description
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

Course Contents

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 **09 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 **09 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. Jean-Michel Claverie and Cedric Notredame, “Bioinformatics For Dummies”, 2019.
2. Phillip Compeau and Pavel Pevzner, “Bioinformatics Algorithms: An Active Learning Approach”, Active Learning Publishers, 2019.

Reference Books:

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

Program: Open Elective for all Programs	S.Y.B.Tech.	Semester: IV
Human Resource Management (RCP23XOE267)		

Course Objectives:

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:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand and distinguish the changing environment of the HRM and the role of the HR managers.	L2	Understand
CO2	Understand and analyse the recruitment process and the application of the IT.	L3	Apply
CO3	Understand and examine the importance of the training and development.	L4	Analyze
CO4	Understand and determine the pay plans, performance appraisal and compensation.	L4	Analyze
CO5	Understand and explain the importance of the labour relation, the employee security and collective bargaining.	L2	Understand

Course Contents

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

09 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

09 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.

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”, 6th Edition, PHI Learning Pvt. Ltd., 1 Jul 2020.
2. Gary Dessler, “Human Resource Management”, 16th Edition, Pearson Publications, 2020.

Reference Books:

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

Program: Open Elective for all Programs	S.Y.B.Tech.	Semester: IV
Digital Marketing Management (RCP23XOE268)		

Course Objectives:

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:

CO	Course Outcomes	Blooms Level	Blooms Description
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	L2	Understand

Course Contents

Unit-I

08 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

09 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. Puneet Singh Bhatia, “Fundamentals of Digital Marketing”, Pearson Education Limited, 2017.
2. Seema Gupta, “Digital Marketing”, McGraw Hill Education, 2022.

Reference Books:

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

Program: Open Elective for all Programs	S.Y.B.Tech.	Semester: IV
Logistics and Supply Chain Management (RCP23XOE269)		

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

Course Objectives:

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:

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

Course Contents

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

09 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

07 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

07 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 Folinis, “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: Artificial Intelligence and Data Science	S.Y.B.Tech.	Semester: IV
Design Thinking Laboratory (RCP23XHS283L)		

Prerequisite:

1. Basic understanding with the development life cycle of products, processes, software, or services.
2. Basic knowledge of iterative frameworks (not mandatory)

Course Objectives:

1. To introduce students to the fundamentals, history, and importance of design thinking and its role in solving complex, real-world problems.
2. To develop students' empathy and user-research skills by teaching them how to gather insights, create personas, and map user journeys.
3. To equip students with the skills to define and reframe problem statements effectively, identifying opportunity areas and stakeholder touchpoints.
4. To foster creative ideation, prototyping, and testing skills through hands-on exercises that incorporate strategic innovation and rapid prototyping techniques.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand and apply the design thinking process to analyze and solve real-world problems.	L2	Understand
CO2	Develop the ability to empathize with users, create user personas, and design empathy and journey maps tailored to specific challenges.	L3	Apply
CO3	Demonstrate proficiency in defining clear and actionable problem statements that uncover areas of opportunity.	L3	Apply
CO4	Generate diverse ideas using ideation techniques, such as brainstorming and SCAMPER, to approach problem-solving creatively and collaboratively.	L6	Create
CO5	Create and test prototypes, iterating based on feedback and validating solutions through digital platforms and peer review.	L6	Create

Course Contents

Unit-I

08 Hrs.

Introduction to Design Thinking and Strategic Innovation: 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. 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.

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

05 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

05 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.

Design Thinking Laboratory (RCP23XHS283L)

List of Laboratory Experiments

Suggested Experiments:

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 the SCAMPER technique, Brainstorming, and brain-writing as a collaborative ideation technique to create multiple creative ideas/ solutions 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 prototypes based on the ideas generated in the 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 ten 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 miniproject is mandatory.

Text Books:

1. I. Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", Wiley, 2013.
2. M. Lewrick, P. Link, and L. Leifer, "The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems", Wiley, 2018.

3. T. Lockwood, “Design Thinking: Integrating Innovation, Customer Experience, and Brand-Value”, Allworth Press, 2010.
4. K. T. Ulrich and S. D. Eppinger, “Product Design and Development”, McGraw-Hill Education, 6th Edition, 2016.
5. C. J. Meadows and C. Parikh, “The Design Thinking Workbook: Essential Skills for Creativity and Business Growth”, Emerald Publishing, 2022.

Reference Books:

1. T. Kelley and D. Kelley, “Creative Confidence: Unleashing the Creative Potential Within Us All”, HarperCollins Publisher, 2013.
2. T. Brown, “Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation”, HarperCollins, 2013.
3. J. Knapp, J. Zeratsky, and B. Kowitz, “Sprint: How to Solve Big Problems and Test New Ideas in Just Five Days”, Simon & Schuster, 2016.
4. Chakrabarti, “Engineering Design Synthesis: Understanding, Approaches and Tools”, Springer, 2002.
5. K. Otto, and K. Wood, “Product Design”, Prentice Hall, 2000.

Program: Artificial Intelligence and Data Science	S.Y.B.Tech.	Semester: IV
Universal Human Values (RCP23XHS284)		

Course Objectives:

1. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
2. To help students initiate a process of dialog within themselves to know what they ‘really want to be’ in their life and profession
3. To help students understand the meaning of happiness and prosperity for a human being.
4. To facilitate the students to understand harmony at all the levels of human living and live accordingly.
5. To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life.

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

Course Contents

Unit-I

05 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

06 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 fulfilment. Trust and Respect as the foundational values of relationship, Understanding the meaning of Trust; Difference between intention and competence, Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family). Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family!

Unit-IV

04 Hrs.

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

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

Reference Books:

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age International Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth, Mohandas Karamchand Gandhi.
5. Small is Beautiful, E. F. Schumacher.
6. Slow is Beautiful, Cecile Andrews.
7. Economy of Permanence, J. C. Kumarappa.
8. Bharat Mein Angreji Raj, Pandit Sunderlal.
9. Rediscovering India, Dharampal.
10. Hind Swaraj or Indian Home Rule, Mohandas K. Gandhi.
11. India Wins Freedom, Maulana Abdul Kalam Azad.
12. Vivekananda, Romain Rolland (English).
13. Gandhi, Romain Rolland (English).

Program: Artificial Intelligence and Data Science	S.Y.B.Tech.	Semester: IV
Semester Project-II (RCP23XSC251P)		

Course Objectives:

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

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 departmental 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 4).
- 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 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 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/ Program- ming	Result Ver- ification	Presentation	Total
			5	5	5	5	5	25