Shirpur Education Society's

# R. C. Patel Institute of Technology, Shirpur

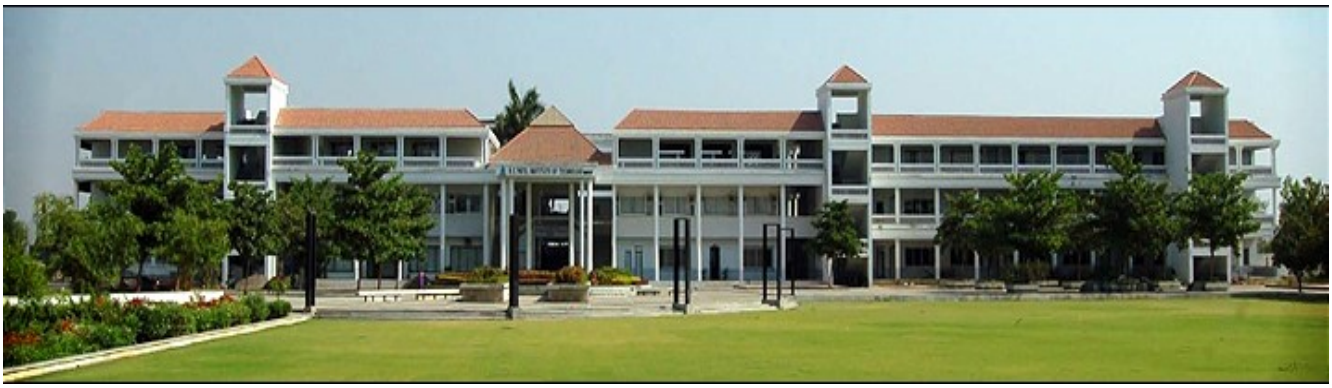
## (An Autonomous Institute)

# Course Structure and Syllabus

## Second Year B. Tech

## Artificial Intelligence and Machine Learning

**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 and Machine Learning Semester-IV (w.e.f. 2025-26)

| Sr | Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | | Total | Credit | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Continuous Assessment (CA) | | | | | | | |
| | | | | L | T | P | TA | Term Test 1 (TT1) | Term Test 2 (TT2) | Average of ( TT1 & TT2 ) | ESE | | | |
| | | | | | | | [A] | | | [B] | [C] | [A+B+C] | | |
| 1 | PC | RCP23APC251 | Probability and Statistical Inference | 3 | | | 25 | 15 | 15 | 15 | 60 | 100 | 3 | 3 |
| 2 | PC | RCP23APC252 | Design and Analysis of Algorithms | 2 | | | 25 | 15 | 15 | 15 | 60 | 100 | 2 | 3 |
| | PC | RCP23APC252L | Design and Analysis of Algorithms Laboratory | | | 2 | 25 | | | | 25 | 50 | 1 | |
| 3 | PC | RCP23APC253 | Artificial Intelligence | 2 | | | 25 | 15 | 15 | 15 | 60 | 100 | 2 | 3 |
| | PC | RCP23APC253L | Artificial Intelligence Laboratory | | | 2 | 25 | | | | 25 | 50 | 1 | |
| 4 | PC | RCP23APC254L | Programming Laboratory-II (Web Development) | | | 2 | 25 | | | | 25 | 50 | 1 | 1 |
| 5 | MD | RCP23AMD255 | Database Management Systems | 2 | | | 25 | 15 | 15 | 15 | 60 | 100 | 2 | 3 |
| | MD | RCP23AMD255L | Database Management Systems 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 | 3 |
| 9 | SC | RCP23XSC251P | Semester Project-II | | | 2 | 25 | | | | 25 | 50 | 1 | 1 |
| | | | Total | 15 | | 12 | 300 | | | 90 | 510 | 900 | 21 | |

#Any 1 Elective Course

Prepared by:
Dr. N. G. Shinde

Checked by:
Dr. S. P. Patil

Prof. Dr. D. R. Patil
BOS Chairman

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

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

Prof. Dr. J. B. Patil
Director

R. C. Patel Institute of Technology, Shirpur
SES
Autonomous

# Artificial Intelligence and Machine Learning
## S. Y. B. Tech.
## Semester - IV

| Program: Artificial Intelligence and Machine Learning | S. Y. B.Tech. | Semester: IV |
|---|---|---|
| **Probability and Statistical Inference (RCP23APC251)** | | |

**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. | L6 | Create |
| CO4 | Perform analysis of variance on data. | L4 | Analyze |

# Probability and Statistical Inference (RCP23APC251)
# Course Contents

## Unit-I 10 Hrs.

**Random Variables and Probability Distributions:** Concept of a Random Variable, Discrete Probability Distributions, Continuous Probability Distributions, Statistical Independence. Expectation, Variance and their properties. 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 06 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. Application of Chi-square test for feature independence in machine learning datasets.Statistical Estimation Theory: Characteristics of estimators, consistency, unbiasedness, unbiased estimates, efficient estimators, 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 07 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  and unknown , 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. Application of hypothesis testing to validate given model assumptions.

## Unit-IV 05 Hrs.

**Analysis of Variance (ANOVA) for data analysis:** Simple linear regression, Sample size calculation, 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. S. P. Gupta, Sultan Chand, "Statistical Methods", $46^{th}$ revised Edition, 2021.
2. T. Veerarajan, "Probability - Statistics and Random Processes", McGraw Hill Education, $3^{rd}$ Edition, 2017.
3. Allen B. Downey, "Think Stats: Probability and Statistics for Programmers", Green Tea Press, 2011.
4. E. L. Lehmann, Joseph P. Romano, "Testing Statistical Hypotheses", Springer, 2008, $3^{rd}$ Edition.
5. Thomas Hasalwanter, "An Introduction to Statistics with Python", Springer, 2016.


## Reference Books:


1. S. C. Gupta, V. K. Kapoor, Sultan Chand, "Fundamentals of mathematical statistics", $12^{th}$ Edition, 2020.
2. Peter Bruce, Andrew Bruce, Peter Gedeck, "Practical Statisticsfor data scientists 50+ Essential Concepts Using R and Python", $2^{nd}$ Edition, Orelly, 2020.
3. Freedman, David, Robert Pisani, Roger Pervis, W. W. Norton, "Statistics", 2007.
4. Sheldon M Ross, "Introduction to Probability and Statistics for Engineers and Scientists", Elsevier, $5^{th}$ Edition, 2014.

| Program: Artificial Intelligence and Machine Learning | S. Y. B.Tech. | Semester: IV |
|---|---|---|
| **Design and Analysis of Algorithms (RCP23APC252)** | | |
| **Design and Analysis of Algorithms Laboratory (RCP23APC252L)** | | |

**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 | Illustrate optimal solution of problem by applying the concept of dynamic programming strategy. | L3 | Apply |
| CO4 | Explain the concepts of backtracking, branch and bound to represent solution by state space tree. | L2 | Understand |
| CO5 | Apply string matching techniques. | L3 | Apply |

# Design and Analysis of Algorithms (RCP23APC252)
# Course Contents

## Unit-I — 05 Hrs.

**Introduction:** Analysis of control statements and loops, solving recurrences using tee, 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–queen problem, Sum of subsets, Graph coloring, Analysis of all 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 Advanced Topics in Algorithm Design: Concept of approximation algorithms, Introduction to P, NP, NP-hard problems.

# Design and Analysis of Algorithms Laboratory (RCP23APC252L)

## List of Laboratory Experiments (Any 10)

**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.

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

**Instructions to Perform Algorithms on Competitive Programming Platforms:**
To implement, test, and analyze classical algorithms from Greedy, Dynamic Programming, Divide and Conquer, and Backtracking paradigms using online programming environments such as LeetCode, HackerRank, CodeChef, Codeforces or any other Equivalent Coding Platforms.

**General Guidelines:**

1. Students should log in to any competitive coding platform using their registered email ID.

2. Each algorithm listed below must be implemented using an appropriate programming language (C / C++ / Java).

3. Before coding, analyze the algorithm's design technique, input-output structure, and time complexity.

4. Implement, compile, and execute each algorithm with at least two sample test cases.

5. Record the output and note the observed performance (execution time or step count if applicable).

6. Use the problem statement section of the IDE to write a short description of:

   - Algorithm name
   - Problem type (Greedy / DP / Backtracking / Divide & Conquer)
   - Time and space complexity

7. Submit your source code, output screenshots, and complexity analysis for evaluation.

8. Maintain all records in a lab journal (Writeup for experiment) on Microsoft Teams for continuous assessment.

## Text Books:


1. S. Sridhar, "Design and Analysis of Algorithms", $1^{st}$ 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", $4^{th}$ Edition, The MIT Press, 2022.

2. Michael T. Goodrich, Roberto Tamassia, "Algorithm Design", Wiley Publication, 2015.

3. Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, "Algorithms", Tata McGraw-Hill Edition.

4. John Kleinberg, Eva Tardos, "Algorithm Design", Pearson.

5. Michael T. Goodrich, Roberto Tamassia, "Algorithm Design", Wiley Publication.

## Web Resources Blogs and Websites:

(a) AoA: https://aofa.cs.princeton.edu/online/

(b) DAA: https://www.coursera.org/learn/analysis-of-algorithms

(c) Leetcode: https://leetcode.com/problemset/all/

(d) Hackerrank: https://www.hackerrank.com/domains/tutorials/10-days-of-javascript

(e) Codeforces: https://codeforces.com/problemset

(f) Codechef: https://www.codechef.com/practice

## Online Resources:

(a) Fundamental Algorithms: Design and Analysis, Prof. Sourav Mukhopadhyay, IIT Kharagpur. https://onlinecourses.nptel.ac.in/noc23_cs39/preview

(b) Design and Analysis of Algorithms, Prof. Abhiram G Ranade, Prof. Ajit A ,Diwan, Prof. Sundar Viswanathan, IIT Bombay. https://nptel.ac.in/courses/106101059

(c) Design and Analysis of Algorithms, IIT Madras. https://nptel.ac.in/courses/106106131

| Program: Artificial Intelligence and Machine Learning | S. Y. B.Tech. | Semester: IV |
|---|---|---|
| Artificial Intelligence (RCP23APC253) | | |
| Artificial Intelligence Laboratory Laboratory (RCP23APC253L) | | |

**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. | L3 | Apply |
| CO2 | Design and Implement Heuristic and Local Search Solutions. | L5 | Evaluate |
| CO3 | Formulate and Solve Constraint Satisfaction Problems. | L6 | Create |
| CO4 | Develop Optimal Strategies for Adversarial Environments. | L5 | Evaluate |

# Artificial Intelligence (RCP23APC253)
# Course Contents

## Unit-I 05 Hrs.

**Search Techniques:** State space search, Domain Independent Algorithms, Deterministic Search, **Uninformed Search Algorithms:** Breadth-first search, Depth first search, Depth First iterative deepening search - optimal and space-efficient, Uniform cost search, Bidirectional search, Comparing uninformed search algorithms.

## Unit-II 05 Hrs.

**Informed Search Algorithms:** Branch and bound, A* algorithm, Search contours, Satisficing search: admissible and inadmissible heuristics, weighted A*, Best first, monotone condition. Memory-bounded search, Bidirectional heuristic search, The effect of heuristic accuracy on performance, Generating heuristics from relaxed problems, sub problems and landmarks.

## Unit-III 05 Hrs.

**Local Search and Optimization Problems:** Hill-climbing search, Escaping Local Optima, Stochastic Local Search, Local Beam Search, Simulated Annealing, Tabu Search, Traveling Salesperson problem, Evolutionary algorithms- Genetics Algorithms, Ant Colony Optimization, Particle Swarm Optimization.

## Unit-IV 05 Hrs.

**Adversarial Search and Games:** Game Theory, Board games and game tree, Classification of Games (Zero-Sum vs. General-Sum), Optimal Decisions in Games, The minimax search algorithm, Alpha–Beta Pruning, Monte Carlo Tree Search, Stochastic Games, Limitations of Game Search Algorithms.

## Unit-V 08 Hrs.

**Planning and Constraint Satisfaction Problems:**

**Planning:** Automated Domain independent planning, Forward and Backward search, Goal Stack Planning, Plan Space Planning, Means Ends Analysis, Graphplan, algorithm AO*.

**Constraint Satisfaction Problems:** Binary constraint networks, Solving CSPs , Arc Consistency, propogation, lookahead search. Backtracking Search for CSPs - Minimum Remaining Values (MRV) and Least Constraining Value (LCV).

# Artificial Intelligence Laboratory (RCP23APC253L)

## List of Laboratory Experiments (Any 10)

**Suggested 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 the Unification Algorithm for First-Order Logic expressions and use it as a component to simulate a simple Forward or Backward Chaining inference system with a small knowledge base.

14. Hospital Roster Generator with Preferences Tasks:
    - 14 nurses, 28-day month, 3 shifts/day, fairness + preference constraints.
    - Hard: coverage, no 6 consecutive nights.

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

## Text Books:


1. David L. Poole and Alan K. Mackworth, "Artificial Intelligence: Foundations of Computational Agents", Cambridge University Press, $3^{rd}$ Edition, 2023.
2. Russell/Norvig, "Artificial Intelligence: A Modern Approach", $4^{th}$ Edition, 2022.
3. "Artificial intelligence a modern approach", Mikan Ltd ISBN- No 978-1914063183, 2020.
4. Deepak Khemani, "A First Course in Artificial Intelligence", McGraw Hill Education (India), 2013.


## Reference Books:


1. Saptarsi Goswami, "AI for Everyone: a beginner's Handbook for AI", Pearson Publication, 2024.
2. Deepak Khemani, "A First Course in Artificial Intelligence", McGraw Hill Publication.


## Web Links:

1. https://nptel.ac.in/courses/106105079
2. https://thestempedia.com/blog/simple-ai-and-machine-learning-projects-for-students-and-beginners/
3. https://nptel.ac.in/courses/106105078

| Program: Artificial Intelligence and Machine Learning | S. Y. B.Tech. | Semester: IV |
|---|---|---|
| **Programming Laboratory-II (Web Development) (RCP23APC254L)** | | |

**Prerequisite:** Python programming.

This syllabus is designed to provide AIML students with the foundational skills to develop web applications and deploy their models. It introduces the student to lightweight frameworks like Flask and FastAPI, before moving on to a full-featured framework like Django. This tiered approach allows students to choose the best tool for the job.

## Course Objectives:

1. To get familiar with the basics of web fundamentals, including HTML, CSS, and JavaScript.
2. To acquire knowledge and skills for creating responsive web pages and developing a complete web application considering both client-side and server-side programming.
3. To learn how to build efficient and scalable APIs using Python frameworks like Flask and FastAPI.
4. To understand the full-stack development lifecycle using the Django framework.
5. To gain the ability to establish database connections, perform CRUD operations, and implement secure API endpoints.

## Course Outcomes:

| CO | Course Outcomes | Blooms Level | Blooms Description |
|---|---|---|---|
| CO1 | Implement interactive web pages using HTML5, CSS3, and Bootstrap. | L3 | Apply |
| CO2 | Apply JavaScript to add functionality to a web page and perform DOM manipulation. | L3 | Apply |
| CO3 | Construct API endpoints using Flask and FastAPI for machine learning model integration. | L3 | Apply |
| CO4 | Build full-stack web applications using the Django framework. | L3 | Apply |
| CO5 | Apply the knowledge of different libraries to establish connections with databases and perform CRUD operations. | L3 | Apply |
| CO6 | Implement API endpoints, handle incoming requests, validate data, and generate suitable responses. | L3 | Apply |

# Programming Laboratory-II (Web Development)
# (RCP23APC254L)
# Course Contents

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## Unit-I 04 Hrs.

**Web Fundamentals: HTML, CSS, and Bootstrap:** Introduction to HTML5, including syntax, tags, attributes, and semantic elements. Introduction to CSS3, covering selectors, properties, layout, and responsive design concepts like Flexbox. Introduction to Bootstrap, including grid systems, components, and responsive layouts.

## Unit-II 06 Hrs.

**JavaScript Fundamentals:** Introduction to JavaScript, including variables, data types, control structures, and functions. Explore JavaScript DOM manipulation, event handling, and modern features like ES6+. Introduction to asynchronous programming with promises and async/await.

## Unit-III 06 Hrs.

**Python Web Frameworks: Flask and FastAPI:** Introduction to **Flask** as a lightweight microframework, ideal for simple applications and prototypes, Routing and request handling, Introduction to **FastAPI** as a high-performance framework for building APIs, highlighting its use of Python type annotations and automatic documentation.

## Unit-IV 04 Hrs.

**Back-end Development with Django:**

Introduction to the Django framework, its features, and the **Model-View Template (MVT) architectural pattern.** Set up a Django environment and project directory. Learn to define models with the **Object-Relational Mapper (ORM)** and use the built-in admin interface. Learn to create views, map URLs, and use Django's robust templating system for dynamic web pages.

## Unit-V 04 Hrs.

**REST APIs with Django:**

Understand the principles of **RESTful architecture.** Use the Django REST Framework (DRF) to build APIs for ML model integration. Cover request handling, data validation, serialization, and authentication for API endpoints.

## Unit-VI 04 Hrs.

**Database Connectivity and Deployment:** Learn to configure and work with different databases like **MySQL or PostgreSQL** within Django. Implement CRUD operations. Introduce deployment concepts and practices, using Linux and Nginx.

# Programming Laboratory-II (Web Development)
# (RCP23APC254L)
# List of Laboratory Experiments (Any 15)

1. Develop an informative webpage using HTML5 tags, including various sections, images, and links.
2. Design and style a responsive web page using Bootstrap grids and components.
3. Write JavaScript to validate a web form, ensuring fields like name, email, and mobile number meet specific criteria.
4. Create a simple Flask application with a few routes that render static and dynamic content.
5. Build a basic RESTful API using Flask to serve a small dataset in JSON format.
6. Develop a high-performance API with FastAPI that accepts data and returns a response, utilizing its automatic data validation feature.
7. Integrate a pre-trained machine learning model into the FastAPI application as an API endpoint, allowing it to perform a task like sentiment analysis.
8. Set up a Django development environment and create a new project. Create a Django app with models, views, and templates to build a simple blog.
9. Implement CRUD (Create, Retrieve, Update, Delete) operations for the blog posts using Django's views.
10. Add a user authentication system (login, logout, registration) to the Django blog.
11. Build a full-fledged RESTful API for the Django blog using the Django REST Framework (DRF).
12. Connect the Django blog to a PostgreSQL database and perform database migrations.
13. Use the FastAPI endpoint from Experiment 7 to build a frontend web page (using HTML/CSS/JS) that sends user input to the API and displays the model's output.
14. Deploying a Regular HTML website with Apache and Nginx.
15. Deploying Django with Gunicorn and Nginx
16. Deploying a Python ML app with Systemd and Gunicorn
17. Deploy a python web app using Heroku, PythonAnywhere or Digital Ocean.

18. Mini Project: Build and deploy a full-stack web application that serves as a dashboard or interface for an ML model. The project should demonstrate data visualization and user interaction by leveraging a Django backend with a DRF API and a simple HTML/CSS/JS frontend..

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

## Text Books:

For HTML, CSS, and JavaScript Fundamentals:

1. HTML and CSS: Design and Build Websites by Jon Duckett, 2011.
2. JavaScript and JQuery: Interactive Front-End Web Development by Jon Duckett, 2014.
3. Flask Web Development: Developing Web Applications with Python by Miguel Grinberg, 2018.
4. Django for Beginners by William S. Vincent, 2025.
5. Building Python Web APIs with FastAPI by Abdulazeez, 2022.

## Reference Books:

1. Eloquent JavaScript by Marijn Haverbeke. 2024
2. Django for APIs: Build web APIs with Python and Django by William S. Vincent. A project based guide to building modern web APIs with Django and the Django REST Framework (DRF). 2025
3. Django by Example by Antonio Mele. 2024
4. Learning Web Design: A Beginner's Guide by Jennifer Niederst Robbins. 2025
5. The Full Stack Developer by Chris Northwood. 2023 .

## NPTEL Courses:

1. https://nptel.ac.in/courses/106106156
2. https://nptel.ac.in/courses/106106182
3. https://onlinecourses.swayam2.ac.in/aic20_sp11/preview

| Program: Artificial Intelligence and Machine Learning | S. Y. B.Tech. | Semester: IV |
|---|---|---|
| Database Management Systems (RCP23AMD255) | | |
| Database Management Systems Laboratory (RCP23AMD255L) | | |

**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.

## Course Outcomes:

| 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 |

# Database Management Systems (RCP23APC255)
# Course Contents

## Unit-I 06 Hrs.

**Introduction to Database Concepts and Relational Data Model:** Introduction, Characteristics of databases, File system v/s Database system, Users of Database system, Schema and Instance, 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 Introduction to the Relational Model, relational schema and concept of keys, Mapping the ER and EER Model to the Relational Model, Star schema and Snowflake schema, Data Warehousing OLAP Operations.

## Unit-II 06 Hrs.

**Structured Query Language:** Overview of SQL, Data Definition Commands, Data Manipulation commands, Integrity constraints - key constraints, Domain Constraints, Referential integrity, check constraints, Data Control commands, Transaction Control Commands, Set and String operations, group by, having, Views in SQL, joins, Nested and complex queries, Triggers and Stored Procedures.

## Unit-III 06 Hrs.

**Relational–Database Design:** Pitfalls in Relational-Database designs, Concept of normalization, Function Dependencies, Normal Forms- 1NF, 2NF, 3NF, BCNF, 4NF, 5NF .

## Unit-IV 06 Hrs.

**Transaction Management and Recovery:** ransaction Concept, ACID properties, Transaction States, Concurrent Executions, Serializability, Concurrency Control Protocols: Lock-based, Deadlock Handling, Recovery System: Failure classification, Log based recovery .

## Unit-V 04 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 (RCP23APC255L)
# List of Laboratory Experiments (Any 10)

**Suggested Experiments:**

1. To draw an ER diagram for a problem statement.
2. Map the ER/EER to relational schema.
3. To implement DDL and DML commands with integrity constraints.
4. To design and implement a Star Schema
5. Design and Implementation of a Snowflake Schema
6. To perform OLAP operations on the data warehouse to analyze multidimensional data.
7. To access & modify Data using basic SQL.
8. To implement aggregate functions
9. To implement Joins and Views
10. To implement Subqueries.
11. To implement triggers
12. To implement security and authorization in SQL
13. Examine the consistency of database using concurrency control technique (Locks)
14. To implement B-trees/B+ trees.

**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", $7^{th}$ Edition, McGraw –Hill, 2019.
2. Elmasri and Navathe, "Fundamentals of Database Systems", $7^{th}$ Edition, Pearson education, 2016.
3. Peter Rob and Carlos Coronel, "Database Systems Design, Implementation and Management", $5^{th}$ Revised Edition, Thomson Learning, 2002.
4. G. K. Gupta, "Database Management Systems", $3^{rd}$ Edition, McGraw – Hill, 2018.

## Reference Books:


1. Dr. P. S. Deshpande, "SQL and PL/SQL for Oracle 10g, Black Book", Dreamtech Press, 2012.
2. Sharaman Shah, "Oracle for Professional", 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.

| Program: Artificial Intelligence and Machine Learning | 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 | Develop earned value technique and determine & predict status of the project. Capture lessons learned during project phases and document them for future reference. | L6 | Create |
| CO5 | Categorize differences between traditional waterfall approach and agile scrum methodology for software development projects | L4 | Analyze |

# Project Management (RCP23XOE261)
# 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", $11^{th}$ Edition, Wiley India.
2. Erik Larson, Clifford Gray, "Project Management: The Managerial Process", $8^{th}$ Edition, McGraw Hill Education.
3. Jim Highsmith, Pearson Education, "Agile Project Management", Low Price Edition, India.


## Reference Books:


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

| Program: Artificial Intelligence and Machine Learning | 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.

## Course Outcomes:

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

# Cyber Security, Policies and Laws (RCP23XOE262)
# 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. Nina Godbole, Sunit Belapur, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley-2011.
2. Gurdip Kaur, "Understanding Cybersecurity Management in Decentralized Finance: Challenges, Strategies, and Trends", 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: Artificial Intelligence and Machine Learning | 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 | Use linear integer programming models and apply the O.R. algorithms and techniques to solve linear integer programming problems. | L3 | Apply |
| CO3 | Evaluate best satisfying solution under a varying quantity of resources and priorities of the goals. | L5 | Evaluate |
| CO4 | Apply decision models and solve nonlinear programming- unconstrained optimization problems. | L3 | Apply |
| CO5 | Apply decision models and solve nonlinear programming- constrained optimization problems. | L3 | Apply |

# Advanced Operations Research (RCP23XOE263)
# 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 06 Hrs.

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

## Unit-III 12 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 12 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 06 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", $8^{th}$(International) Edition, McGraw-Hill: Boston MA, 2005.

2. Ravindran, Philips and Soleberg, "Operations Research – Principle and Practice", $2^{nd}$ 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: Artificial Intelligence and Machine Learning | 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 | Explain Indian finance system | L2 | Understand |
| CO2 | Apply concepts of time value money and risk returns to product, services and business. | L3 | Apply |
| CO3 | Explain corporate finance and working capital management. | L2 | Understand |
| CO4 | Use Investment and finance decisions. | L3 | Apply |
| CO5 | Use dividend decisions. | L3 | Apply |

# Corporate Finance Management (RCP23XOE264)
# Course Contents

## Unit-I 09 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 08 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", $8^{th}$ Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2011.
2. M. Y. Khan, "Indian Financial System", $9^{th}$ Edition, McGraw Hill Education, New Delhi, 2015.
3. I. M. Pandey, "Financial Management", $11^{th}$ Edition, S. Chand (G/L) & Company Limited, New Delhi, 2015.


## Reference Books:


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

| Program: Artificial Intelligence and Machine Learning | S. Y. B.Tech. | Semester: IV |
|---|---|---|
| Corporate Social Responsibility (RCP23XOE265) | | |

## Course Objectives:

1. To understand the fundamental concepts and significance of Corporate Social Responsibility (CSR) in a global and Indian context, exploring its historical evolution, key stakeholders, and the benefits for business and 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 | Explain and critique the concept of CSR and its evolution, understanding its relevance and impact on stakeholders in both business and societal contexts. | L2 | Understand |
| CO2 | Apply ethical theories and frameworks to real-world CSR issues, demonstrating an understanding of ethical decision-making processes in business scenarios. | L3 | Apply |
| CO3 | Analyse CSR-related legislation and compliance requirements in India, particularly the Companies Act 2013, and assess how these laws shape corporate behaviour and responsibilities. | L4 | Analyze |
| 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, emphasising corporate volunteering, stakeholder engagement, and public-private partnerships. | L6 | Create |

# Corporate Social Responsibility (RCP23XOE265)
# 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 09 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 08 Hrs.

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

## Text Books:


1. Andrew Crane, Dirk Matten, "Corporate Social Responsibility: Definition, Core Issues, and Recent Developments", Oxford University Press.
2. O. C. Ferrell, John Fraedrich, Linda Ferrell, "Business Ethics: Ethical Decision Making & Cases", Cengage Learning.
3. 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: Artificial Intelligence and Machine Learning | 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 | Summarize the structure and function of cells, organelles, and biomolecules | L2 | Understand |
| CO2 | Explain the types of data stored in bioinformatics databases and their relevance to biological research. | L2 | Understand |
| CO3 | Explain genomic databases and understand the structure and content of protein databases. | L2 | Understand |
| CO4 | Explain system biology concepts and molecular evolution | L2 | Understand |
| CO5 | Apply knowledge of cellular and molecular biology concepts to analyze a biological problem. | L3 | Apply |

# Bioinformatics (RCP23XOE266)
# Course Contents

## 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 09 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 09 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), biological databases and their classification, genome sequence databases, protein structure databases, composite databases. Searching, Retrieving, and Analysing Genomic and Protein data from online databases, Human genome project.

## 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 07 Hrs.

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

## Text Books:


1. 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. Pevzne, "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: Artificial Intelligence and Machine Learning | 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 | Explain and distinguish the changing environment of the HRM and the role of the HR managers. | L2 | Understand |
| CO2 | Apply and analyse the recruitment process and the application of the IT. | L3 | Apply |
| CO3 | Analyze and examine the importance of the training and development. | L4 | Analyze |
| CO4 | Analyze and determine the pay plans, performance appraisal and compensation. | L4 | Analyze |
| CO5 | Describe and explain the importance of the labour relation, the employee security and collective bargaining. | L2 | Understand |

# Human Resource Management (RCP23XOE267)
# Course Contents

## Unit-I 08 Hrs.

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

## Unit-II 10 Hrs.

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

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

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

## Unit-III 08 Hrs.

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

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

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

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

## Unit-IV 08 Hrs.

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

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

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

## Unit-V 08 Hrs.

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

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

## Text Books:


1. Pattanayak, Biswajeet, "Human Resource Management", $6^{th}$ Edition, PHI Learning Pvt. Ltd., 1 Jul 2020.
2. Gary Dessler, "Human Resource Management", $16^{th}$ Edition, Pearson Publications, 2020.


## Reference Books:


1. Stephen Robbins, "Organizational Behavior", $16^{th}$ Edition, 2013.
2. Aswathapa, "Human resource management: Text & cases", $6^{th}$ Edition, 2011.
3. C. B. Mamoria and S V Gankar, "Dynamics of Industrial Relations in India", $15^{th}$ Edition, Himalaya Publishing, 2015.
4. P. Subba Rao, "Essentials of Human Resource management and Industrial relations", $5^{th}$ 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", $10^{th}$ Edition, John Wiley & Sons, 14 Dec 2020.
7. V S P Rao, "Human Resource Management", $3^{rd}$ Edition, Excel publishing, 2010.

| Program: Artificial Intelligence and Machine Learning | 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 | Explain 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 | Explain concepts related to digital campaign management and revenue generation models. | L2 | Understand |
| CO5 | Apply perspective on global digital marketing technology/tools and future trends | L3 | Apply |

# Digital Marketing Management (RCP23XOE268)
# 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 11 Hrs.

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

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

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

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

## Unit-III 08 Hrs.

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

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

## Unit-IV 08 Hrs.

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

**Digital marketing Execution Elements:** Digital revenue generation models, managing service delivery and payments, managing digital implementation challenges like ecommerce, internal & external and consumer specific challenges.

## Unit-V 07 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", $5^{th}$ Edition, Taylor & Francis, 2017.
2. Dave Chaffey Fiona Ellis-Chadwick, "Digital Marketing: Strategy, Implementation and Practice", $6^{th}$ 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: Artificial Intelligence and Machine Learning | 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 | Explain 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 | Explain current supply chain information technology management trends. | L2 | Understand |
| CO5 | Use available technologies to enhance work performance and support supply chain functions, processes, transactions, and communications. | L3 | Apply |

# Logistics and Supply Chain Management (RCP23XOE269)
# Course Contents

## 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 07 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 09 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 06 Hrs.

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

## Unit-VI 06 Hrs.

**Technology Standards:** Introduction, IT Standards, Information Technology Infrastructure-Interface

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

## Text Books:


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


## Reference Books:


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

| Program: Artificial Intelligence and Machine Learning | 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.

## Course Outcomes:

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

# Design Thinking Laboratory (RCP23XHS283L)
# Course Contents

## Unit-I Introduction to Design Thinking and Strategic Innovation 08 Hrs.

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 Empathize Phase 04 Hrs.

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 Define Phase 05 Hrs.

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/touch points as well as stakeholders for proposed solution interventions.

## Unit-IV Ideate Phase 05 Hrs.

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 Prototype and Validation 06 Hrs.

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 (Any 10)

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## 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.

## 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, $6^{th}$ 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.

## Web Resources:

1. Design and Innovation:
   - https://openstax.org/books/entrepreneurship/pages/4-suggested-resources
2. Overview of Design Thinking:
   - https://www.interaction-design.org/literature/topics/design-thinking
   - 10 Models for Design Thinking. In 2004, business consultants Hasso... | by Libby Hoffman — Medium
   - https://www.tcgen.com/designthinking/#What_is_Design_Thinking_and_How_Does_it_Relate_to_Product_Development
3. Understand, observe and define the problem:
   - https://www.nngroup.com/articles/empathy-mapping/
   - https://uxdesign.cc/the-purpose-of-a-journey-map-and-how-can-it-galvanize-action-9a628b7ae6e

4. Ideation and prototyping:
    - https://www.interaction-design.org/literature/topics/prototyping
    - https://www.uxmatters.com/mt/archives/2019/01/prototyping-user-experience.php
5. Testing and implementation:
    - https://www.nngroup.com/articles/usability-testing-101/
    - https://www.interaction-design.org/literature/article/test-your-prototypes-how-to-gather-feedback-and-maximise-learning
6. Design thinking in various sectors:
    - https://www.tutorialspoint.com/design_thinking/design_thinking_quick_guide.htm

## Online Courses: NPTEL

1. Creative Engineering Design (https://nptel.ac.in/courses/107108010)
2. Understanding Creativity and Creative Writing (https://nptel.ac.in/courses/109101017)
3. Understanding Design Thinking & People CentredDesign (https://nptel.ac.in/courses/109104109)
4. Design Thinking - A Primer (https://nptel.ac.in/courses/110106124)
5. Product Engineering and Design Thinking (https://nptel.ac.in/courses/112105316)

| Program: Artificial Intelligence and Machine Learning | S. Y. B.Tech. | Semester: IV |
|---|---|---|
| Universal Human Values (RCP23XS284) | | |

## Course Objectives:

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

## Course Outcomes:

| CO | Course Outcomes | Blooms Level | Blooms Description |
|---|---|---|---|
| CO1 | Describe 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 | Illustrate between the Self and the Body, understand the meaning of Harmony in the Self the Co-existence of Self and Body. | L3 | Apply |
| CO3 | Explain 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 | Explain the harmony in nature and existence and work out their mutually fulfilling participation in the nature. | L2 | Understand |
| CO5 | Illustrate between ethical and unethical practices and start working out the strategy to actualize a harmonious environment wherever they work. | L3 | Apply |

# Universal Human Values (RCP23XS284)
# 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 05 Hrs.

**Understanding Harmony in the Human Being - Harmony in Myself:**

Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body'.Understanding the Body as an instrument of 'I' (I being the doer, seerand enjoyer), Understanding the characteristics and activities of'I' andharmony in 'I', Understanding the harmony of I with theBody; correctappraisal of Physical needs, meaning of Prosperity in detail, Programsto 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 meaningof 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 05 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.

## Unit-V 04 Hrs.

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

## Text Books:


1. 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. Economy of Permanence, J. C. Kumarappa.
7. Bharat Mein Angreji Raj, Pandit Sunderlal.
8. Rediscovering India, Dharampal.
9. Hind Swaraj or Indian Home Rule, Mohandas K. Gandhi.
10. India Wins Freedom, Maulana Abdul Kalam Azad.
11. Vivekananda, Romain Rolland (English).
12. Gandhi, Romain Rolland (English).

| Program: Artificial Intelligence and Machine Learning | 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.

## Course Outcomes:

| CO | Course Outcomes | Blooms Level | Blooms Description |
|---|---|---|---|
| CO1 | Analyze a survey of several available literatures in the preferred field of study. | L4 | Analyze |
| CO2 | Describe various/alternate approaches to complete a project. | L2 | Understand |
| CO3 | Determine a collaborative project environment by interacting and dividing project work among team members. | L3 | Apply |
| CO4 | Apply their project work in the form of a technical report / paper and thereby improve the technical communication skill. | L3 | Apply |
| CO5 | Describe 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/ Programming | Result Verification | Presentation | Total |
|---|---|---|---|---|---|---|---|---|
| | | | 5 | 5 | 5 | 5 | 5 | 25 |