Shirpur Education Society's

R. C. Patel Institute of Technology, Shirpur

(An Autonomous Institute)

Course Structure and Syllabus

Second Year B. Tech

Computer Science and Engineering(Data Science)

With effect from Year 2025-26

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

Second Year B. Tech Computer Science and Engineering (Data Science) Semester-IV (w.e.f. 2025-26)														
Sr	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total	Credit	
							Continuous Assessment (CA)							
							TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Average of (TT1 & TT2)	ESE			
				L	T	P	[A]			[B]	[C]	[A+B+C]		
1	PC	RCP23DPC251	Data Structures	3			25	15	15	15	60	100	3	4
	PC	RCP23DPC251L	Data Structures Laboratory			2	25				25	50	1	
2	PC	RCP23DPC252	Machine Learning - I	3			25	15	15	15	60	100	3	4
	PC	RCP23DPC252L	Machine Learning - I Laboratory			2	25				25	50	1	
3	PC	RCP23DPC253	Statistics for Data Science	3			25	15	15	15	60	100	3	4
	PC	RCP23DPC253L	Statistics for Data Science Laboratory			2	25				25	50	1	
4	MD	RCP23DMD251L	Web Engineering Laboratory			4	50				50	100	2	2
5#	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	
6	HS	RCP23XHS281T	Professional and Business Communication Tutorial		2		25					25	2	2
7	HS	RCP23XHS282	Economics and Financial Management	2			25	15	15	15	60	100	2	2
8	SC	RCP23XSC251P	Semester Project-II			2	25				25	50	1	1
			Total	14	2	12	300			75	450	825	22	

#Any 1 Elective Course

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

Program: Computer Science & Engineering (Data Science)	S. Y. B.Tech.	Semester: IV
Data Structures (RCP23DPC251)		
Data Structures Laboratory (RCP23DPC251L)		

Prerequisite: C-Programming

Course Objective(s):

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

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Classify the various linear and non-linear data structures.	L4	Analyze
CO2	Solve the problem using appropriate data structure.	L3	Apply
CO3	Analyze the problem and use suitable data structure for it.	L4	Analyze

Data Structures (RCP23DPC251)
Course Contents

Unit-I — 04 Hrs.

Basics of Algorithms:

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

Unit-II — 09 Hrs.

Introduction to Data Structures:

Introduction, need of Data Structures, Types of Data Structures, Abstract Data Types (ADT).

Linear Data Structures – Linked List:

List as an ADT, Array-based implementation, Linked List implementation, singly linked lists, circularly linked lists, doubly-linked lists, All operations (Insertion, Deletion, Merge, Traversal, etc.), Applications of linked lists - Polynomial Addition.

Unit-III — 05 Hrs.

Linear Data Structure – STACK:

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

Unit-IV — 05 Hrs.

Linear Data Structure – QUEUE:

Queue as an ADT, Operations, Implementation of Linear Queue, Circular and Priority Queue using arrays and Linked List, DEQueue, Applications – Queue Simulation.

Unit-V — 10 Hrs.

Non-Linear Data Structure – TREES:

Tree Terminologies, Tree as an ADT, Binary Tree - Operations, Tree Traversals, Binary Search Tree (BST) - Operations, Expression Trees, K-Dimensional Tree.

Height Balanced Tree: Creation of AVL Tree.

HEAP: Operations on heap, Heap Sort.

Applications: Huffman coding.

GRAPHS: Representation of Graph using arrays and Linked List.

Unit-VI — 09 Hrs.

Searching: Linear Search, Binary Search and Fibonacci search.

Sorting: Bubble Sort, Selection Sort, Heap Sort, Insertion Sort, Radix Sort, Merge Sort, Quick Sort. Analysis of Searching and Sorting Techniques.

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

Data Structures Laboratory (RCP23DPC251L)

List of Laboratory Experiments

Suggested Experiments(At Least 08)

1. Implementations of Linked List using a menu-driven approach.
2. Implementation of different operations on linked list –copy, concatenate, split, reverse, count no. of nodes etc.
3. Implementation of polynomials operations (addition, subtraction) using Linked List.
4. Implementations of stack using menu driven approach.
5. Implementations of Infix to Postfix conversion.
6. Implementation of prefix and postfix evaluation using menu driven approach.
7. Implementation of parenthesis checker using stack.
8. Implementations of Linear queue using menu driven approach.
9. Implementations of circular queue using menu driven approach.
10. Implementations of double ended queue using menu driven approach.
11. Implementation of Priority queue program using array and Linked list.
12. Implementations of Binary Tree using menu driven approach.
13. Implementation of Binary Tree Traversal.
14. Implementations of BST.
15. Implementation of various operations on tree like – copying tree, mirroring a tree, counting the number of nodes in the tree, counting only leaf nodes in the tree.
16. Implementations of Graph traversal using menu driven program (DFS & BSF).
17. Implementations of Selection sort, Radix sort using menu driven.
18. Implementations of Heap & Heap Sort using menu driven program.

19. Implementations of Advanced Bubble Sort and Insertion Sort using menu driven Program.

20. Implementations of searching methods (Index Sequential, Fibonacci search, Binary Search) using a menu-driven program.

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

Minimum eight experiments from the above-suggested list or any other experiment or mini project based on syllabus will be included, which would help the learner to apply the concept learnt.

Text Books:

1. Reema Thareja, "Data Structures using C", 3rd Edition, Oxford, 2023.

2. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, "Fundamentals of Data Structures in C", 2nd Edition, W. H. Freeman and Company, 2010.

3. R. F. Gilberg and B. A. Forouzan, "Data Structures – A Pseudocode Approach with C", 2nd Edition, Cengage Learning, 2007.

4. Thomas H. Cormen, Charles E. Leiserson, Ronald L Rivest, Clifford Stein, "Introduction to Algorithms", 3rd Edition, MIT Pres, 2009.

Large Reference Books:

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

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

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

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

5. Aho, Hopcroft, Ullman, "Data Structures and Algorithms", Addison-Wesley, 2010.

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

Web Links:

1. Tech Guide: https://techdevguide.withgoogle.com/paths/data-structures-and-algorithms/

2. NPTEL Course: https://nptel.ac.in/courses/106102064

Program: Computer Science & Engineering (Data Science)	S. Y. B.Tech.	Semester: IV
Machine Learning - I (RCP23DPC252)		
Machine Learning-I Laboratory (RCP23DPC252L)		

Prerequisite: Mathematics for Intelligent Systems and Python Programming

Course Objective(s):

1. To introduce the concepts of computation learning theory and techniques of Machine Learning.
2. To become familiar with regression, classification and clustering tasks.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Differentiate given problems into classification, clustering and regression problems.	L2	Understand
CO2	Apply machine learning techniques for a given problem.	L3	Apply
CO3	Analyze the dataset, choose appropriate algorithm and evaluate the results.	L4,	Analyze
CO4	Design applications using machine learning algorithms.	L6	Create

Machine Learning - I (RCP23DPC252)
Course Contents

Unit-I — 04 Hrs.

Introduction to Machine Learning: Types of Machine Learning, Issues in Machine Learning,Application of Machine Learning, Steps involved in developing a Machine Learning Application,Hypothesis and Inductive Bias, Bias-Variance Trade-off, Performance measures, Data Validation.

Unit-II — 08 Hrs.

Supervised Machine Learning:

Regression: Linear Regression, Least Mean Square (LMS) algorithm, Gradient Descent, Lasso and Ridge Regression. Polynomial Regression. Logistic Regression, Maximum Likelihood Function.

Unit-III — 08 Hrs.

Supervised Machine Learning:

Classification: Introduction to decision tree, Learning Decision tree using ID3 and Gini index; CART, Overfitting. Ensemble methods: Bagging (Random Forest) and Boosting (AdaBoost and Gradient Boost).

Unit-IV — 06 Hrs.

Supervised Machine Learning: Bayesian Learning: Introduction to Bayesian Learning, Na¨ıve Bayes, Bayesian Network: Representation in Bayesian Belief Network, Inference in Bayesian Network, Applications of Bayesian Network.

Unit-V — 06 Hrs.

Supervised Machine Learning: Support Vector Machine:

Support Vectors, Functional Margin, Geometric Margin, Optimization problem, Lagrange Duality, KKT condition, Maximum margin with noise, Non-linear SVM and Kernel Function

Dimensionality Reduction: Singular Value Decomposition (SVD) and Principal Component Analysis (PCA), t-distributed Stochastic Neighbor Embedding (t-SNE).

Unit-VI — 10 Hrs.

Unsupervised Machine Learning:

Association Rule Mining: Market Basket Analysis, Apriori algorithm and measures of association

Clustering: Partition based clustering (K-means, K-Medoid), Hierarchal Clustering (Agglomerative Clustering), Density Based Clustering (DBSCAN) and Distribution Based Clustering (Expectation Maximisation (EM), Gaussian Mixture Model (GMM)).

Machine Learning-I Laboratory (RCP23DPC252L)

List of Laboratory Experiments

Suggested Experiments(At Least 08)

1. Perform Linear Regression.
2. Perform Logistic Regression.
3. Perform Decision Tree using GINI.
4. Perform CART decision tree algorithm.
5. Perform Ensemble methods.
6. Perform Bayesian Classification.
7. Perform Support Vector Machine.
8. Perform K-means clustering.
9. Perform Association Rule Mining.
10. Mini project based on any machine learning application.

Above-suggested list or any other experiment or mini project based on syllabus will be included, which would help the learner to apply the concept learnt.

Text Books:

1. Tom M.Mitchell, "Machine Learning", McGraw Hill, 1st Edition, 2017.
2. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, 4th Edition, 2020.
3. Peter Harrington, "Machine Learning In Action", DreamTech Press, 1st Edition, 2012.

Reference Books:

1. Andreas C. M¨uller and Sarah Guido, "Introduction to Machine Learning with Python: A Guide for Data Scientists", O'reilly, 1st Edition, 2016.
2. Stephen Marsland, "Machine Learning An Algorithmic Perspective", CRC Press, 2nd Edition, 2014.
3. Kevin P. Murphy, "Machine Learning — A Probabilistic Perspective", MIT Press, Illustrated Edition, 2012.

4. Han Kamber, "Data Mining Concepts and Techniques", Morgann Kaufmann Publishers, 3rd Edition, 2011.

5. Aho, Hopcroft, Ullman, "Data Structures and Algorithms", Addison-Wesley, 2010.

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

Web Links:

1. Towards Data Science: https://towardsdatascience.com

2. Machine Learning — Andrew Ng, Stanford University: https://youtube.com/playlist?list=PLLssT5z DsKh9vYZkQkYNWcItqhlRJLN

3. Commonly used Machine Learning Algorithms: https://www.analyticsvidhya.com/blog/2017/09/common-machinelearning-algorithms/

4. A Tour to Machine Learning Algorithms: https://machinelearningmastery.com/a-tour-of-machine-learningalgorithms/Prepared

Program: Computer Science & Engineering (Data Science)	S. Y. B.Tech.	Semester: IV
Statistics for Data Science (RCP23DPC253)		
Statistics for Data Science Laboratory (RCP23DPC253L)		

Prerequisite: Probability and Statistics

Course Objective(s):

1. To build the strong foundation in statistics which can be applied to analyze data and make predictions.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Examine relations between data.	L2	Understand
CO2	Demonstrate sampling distributions and estimate statistical parameters.	L3	Apply
CO3	Classify data using LDA and evaluate model performance with metrics.	L5	Evaluate
CO4	Develop hypothesis based on data and perform testing using various statistical techniques.	L6	Create
CO5	Perform analysis of variance on data.	L4	Analyze

Statistics for Data Science (RCP23DPC253)
Course Contents

Unit-I — 10 Hrs.

Sampling distribution:

- Central limit theorem.
- Probability of sample mean using Sampling distribution.
- Chi-square distribution.
- Z–distribution.
- Student's t-distribution.
- F-Distribution.

Statistical Estimation:

- Confidence interval of population mean using large and small samples.
- Confidence interval of difference in population means using large and small samples.
- Confidence interval of population proportion.
- Confidence interval of difference in population proportions.
- Confidence interval of population variance and standard deviation.
- Confidence interval of ratio of population variances and standard deviations.
- Estimation of sample size for single mean and single proportion.

Unit-II — 12 Hrs.

Hypothesis Testing for data driven decision making:

- Hypothesis testing: 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.
- Tests using z-statistics: difference between sample proportion and population proportion, difference between two sample proportion, difference between sample mean and population mean with known σ and unknown σ, difference between two sample means, one tailed and two tailed tests.
- Test using t-statistics: difference between sample mean and population mean, difference between two independent sample means, difference between means from the same group, paired-t test.

- Test using F-statistics: equality of population variances.
- Test using chi-square statistics: difference between population variance and sample variance, test of independence, goodness of fit, contingency table.

Unit-III 05 Hrs.

Analysis of Variance (ANOVA) for data analysis:

- One way ANOVA with POST-HOC Analysis (Tukey's Test)
- Two-way ANOVA.

Unit-IV 10 Hrs.

Correlation:

- Scatter plot
- Karl Pearson's coefficient of correlation,
- correlation vs causation
- limits of correlation coefficient
- Spearman's rank correlation coefficient, Repeated ranks

Regression:

- lines of regression
- regression coefficients,
- scatter plot with regression lines
- coefficient of determination
- multiple regression

Unit-V 05 Hrs.

Statistical Analysis:

- Linear Discriminant Analysis (LDA).
- Metrices: FP measures, Confusion Matrix, Accuracy, Precision, Recall, F1-score, Area under the curve (AUC).

Statistics for Data Science Laboratory (RCP23DPC253L)

List of Laboratory Experiments

Suggested Experiments(At Least 08)

1. To perform correlation on data.
2. To visualize regression on data.
3. To prove central limit theorem.
4. To study sampling distributions and their parameters.
5. To perform statistical estimation tests on data.
6. To calculate confidence interval for different parameters.
7. To perform LDA on given datasets.
8. To calculate metrics of regression on data.
9. To perform hypothesis test using t statistics. (Single mean, difference between means, paired t test).
10. To perform hypothesis test using Chi square. (Contingency table)
11. To perform hypothesis test using Chi square. (Goodness of fit)

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

Text Books:

1. S. P. Gupta, "Statistical Methods", Sultan Chand, 46th Edition, 2021.
2. Thomas Hasalwanter, "An Introduction to Statistics with Python", Springer, 1st Edition, 2016.
3. Allen B. Downey, "Think Stats: Probability and Statistics for Programmers", Green Tea Press, 1st Edition, 2011.
4. E. L. Lehmann, Joseph P. Romano, "Testing Statistical Hypotheses", Springer, 3rd Edition, 2008.

Reference Books:

1. Peter Bruce, Andrew Bruce, Peter Gedeck, "Practical Statistics for data scientists 50+ Essential Concepts Using R and Python", Orelly, 2nd Edition, 2020.
2. Freedman, David, Robert Pisani, Roger Pervis, W. W. Norton, "Statistics", 2007.
3. S. C. Gupta, V. K. Kapoor, Sultan Chand, "Fundamentals of mathematical statistics" Edition, 2002.

Web Links:

1. Essentials of Data Science With R Software 1: Probability and Statistical Inference, IIT Kanpur: https://nptel.ac.in/courses/111104146

2. Probability and Statistics: https://onlinecourses.nptel.ac.in/noc21 ma74/preview Prepared

Program: Computer Science & Engineering (Data Science)	S. Y. B.Tech.	Semester: IV
Web Engineering Laboratory (RCP23DMD251L)		

Prerequisite: Programming Fundamentals

Course Objective(s):

To provide the basic framework of web development (MERN Stack) and cloud computing.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Develop a website as per the requirements.	L6	Create
CO2	Apply the concepts of cloud computing to improve the efficiency of web development.	L3	Apply
CO3	Evaluate the requirement of the problem and select appropriate method of web development.	L5	Evaluate

Web Engineering Laboratory (RCP23DMD251L) Course Contents

Unit-I — 02 Hrs.

HTML:

1. Create a static web page using HTML.
2. Create a class timetable using HTML.
3. Create a registration form using HTML.
4. Create a web page using HTML5 tags.

Unit-II — 02 Hrs.

CSS:

1. Design a responsive web page and CSS3 using external CSS (media queries).
2. Design a web page using Bootstrap.
3. Design the admission form using Bootstrap.

Unit-III — 06 Hrs.

Client-Side Scripting:

1. Programs based on objects in JavaScript.
2. Programs based on form validation.
3. Fetch Data from an API Using the Fetch API in JavaScript.

Unit-IV — 08 Hrs.

React JS:

1. Types of Components
2. Single Page Application (Virtual DOM)
3. State
4. React Hooks

Unit-V — 02 Hrs.

Introduction to Git and GitHub:

1. Adding files to the staging area

2. Push new branch

3. Merge into the master

4. Auto Commit

Unit-VI 04 Hrs.

Server-Side Scripting:

1. Installation and Configuration of Node.js server

2. Program based on inbuilt functions in Node.js

Unit-VII 08 Hrs.

Express & MongoDB:

1. Using Mongoose to make schemas in MongoDB.

2. Making API end points using Express and testing using postman.

3. Develop a website and integrate it with pre-defined API.

4. Doing CRUD on database MongoDB using Express.

5. PostgreSQL & Sequelize

Unit-VIII 04 Hrs.

XML & XSL:

1. Design XML using XML DTD and schema.

2. Implementing XSL elements in XML.

3. Validate XML using Node.js

Unit-IX 04 Hrs.

Concepts of Cloud Computing:

1. Introduction to cloud computing.

2. NIST model

3. Service and Deployment models.

Unit-X 04 Hrs.

Networking and Security:

1. Identity and Access Management

2. Networking basics

3. VPC networking and security

4. Design a VPC

5. Build your own VPC and Launch a Web Server

Unit-XI 04 Hrs.

Compute Service:

1. Compute Services overview

2. Elastic Computing

3. Serverless Compute service

4. Deploying and scaling web applications

Unit-XII 04 Hrs.

Storage Service:

1. Cloud object storage

2. Cloud block storage

3. Elastic file system

Unit-XIII 04 Hrs.

Database Service:

1. Cloud Relational database services

2. Cloud NoSQL Databases

3. Elastic load balancing

Above experiments or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Text Books:

1. Vasan Subramanian, "Pro MERN Stack", 2nd Edition, Apress Publication, 2019.

2. Shama Hoque, "Full-Stack React Projects", 2nd Edition, Pac kt Publication, 2020

3. Rajkumar Buyya, James Broberg, Goscinki, "Cloud Computing: Principles and Paradigms", Wiley, 2013.

4. Shalabh Aggarwal, "Flask Framework Cookbook: Over 80 proven recipes and techniques for Python web development with Flask", Packt publication, 2nd Edition, 2019.

Reference Books:

1. Benjamin LaGrone, "HTML5 and CSS3 Responsive Web Design Cookbook", 1st Edition, Packt Publishing, 2013.
2. "DT Editorial Services, Web Technologies: Black Book", 1st Edition, Dreamtech Press, 2018.
3. Christopher Schmitt, Kyle Simpson, "HTML5 Cookbook", 1st Edition, O'Reilly Media Inc., 2011.
4. Uttam K. Roy, "Web Technologies", 1st Edition, Oxford University Press, 2010.
5. Greg Sidelnikov, "React.js Book: Learning React JavaScript Library from Scratch", 1st Edition, Independently Published, 2017.
6. DT Editorial Services, "HTML5 Black Book", 2nd Edition, Dreamtech Press, 2016.
7. Ben Frain, "Responsive Web Design with HTML5 and CSS3", 2nd Edition, Packt Publishing, 2015.
8. Steve Suehring, "JavaScript Step by Step", 3rd Edition, Pearson Education, 2013.
9. Stoyan Stefanov, "React Up and Running: Building Web Applications", 1st Edition, O'Reilly Media Inc., 2016.
10. Velte, "Cloud Computing a Practical Approach", Tata McGraw-Hill Education.
11. Sandip Bhowmik, "Cloud Computing", Cambridge University Press, 2017.
12. Miguel Grinberg, "Flask Web Development", O'Reilly publication,2018.
13. Sack Stouffer Daniel Gaspar, "Mastering Flask Web Development", Packt Publication, 2018.

Web Links:

1. Professional and Lifelong Learning: Web Development Courses — Harvard University
2. Virtual Lab: https://html-iitd.vlabs.ac.in/exp/introduction-to-html/references.html

Program: Computer Science & Engineering (Data Science)	S. Y. B.Tech.	Semester: IV
Project Management (RCP23XOE261)		

Prerequisite: Basic concepts of Management

Course Objective(s):

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

Course Outcomes:

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

Project Management (RCP23XOE261)
Course Contents

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, Charac-

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

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

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

Text Books:

1. Jack Meredith & Samuel Mantel, "Project Management: A managerial approach", 11^{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: Computer Science & Engineering (Data Science)	S. Y. B.Tech.	Semester: IV
Cyber Security, Policies and Laws (RCP23XOE262)		

Prerequisite: Fundamentals of Computers.

Course Objective(s):

1. Familiarize with the provisions and implications of the Digital Personal and Data Protection Act, the obligations of data fiduciaries, the rights and duties of data principals, and mechanisms for resolving breaches.
2. Equip individuals and organisations 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	Understand and describe the major types of cybercrime and navigate legal frameworks and regulations concerning digital personal and data protection.	L2	Understand
CO2	Implement strategies for cybersecurity outlined in the National Cyber Security Policy.	L3	Apply
CO3	Apply appropriate law enforcement strategies to both, prevent and control cybercrime.	L3	Apply
CO4	Comprehend regulations and strategies pertaining to AI (Artificial Intelligence) and large language models.	L2	Understand

Cyber Security, Policies and Laws (RCP23XOE262) Course Contents

Unit-I — 08 Hrs.

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

Unit-II — 08 Hrs.

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

Unit-III — 09 Hrs.

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

Unit-IV — 08 Hrs.

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

Unit-V — 09 Hrs.

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

Text Books:

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

Reference Books:

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

References (Web Resources):

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

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

Prerequisite: 1. Operation Research 2. Mathematics (Calculus)

Course Objective(s):

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

Course Outcomes:

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

Advanced Operations Research (RCP23XOE263) Course Contents

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, McGraw-Hill: Boston MA; 8^{th}(International) Edition, 2005.

2. Ravindran, Philips and Soleberg, Operations Research – Principle and Practice, Second Edition, John Wiley and Sons, 2007.

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

4. Paul A. Jensen, Jonathan F. Bard, Operations Research: models and methods, Wiley Publications, 2003.

5. C. B Gupta, I.K., Optimization Techniques in Operation Research, International Publishing House Pvt. Limited, 2008.

Program: Computer Science & Engineering (Data Science)	S. Y. B.Tech.	Semester: IV
Corporate Finance Management (RCP23XOE264)		

Prerequisite: Nil.

Course Objective(s):

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

Course Outcomes:

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

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. Financial Management, Theory & Practice 8^{th} Edition (2011), by Prasanna Chandra: Tata McGraw Hill Education Private Limited, New Delhi.

2. Indian Financial System, 9^{th} Edition (2015) by M. Y. Khan; Publisher: McGraw Hill Education, New Delhi.

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

Reference Books:

1. Fundamentals of Financial Management, 13^{th} Edition (2015) by Eugene F. Brigham and Joel F. Houston; Publisher: Cengage Publications, New Delhi.

2. Analysis for Financial Management, 10^{th} Edition (2013) by Robert C. Higgins; Publishers: McGraw Hill Education, New Delhi.

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

Prerequisite: Nil.

Course Objective(s):

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

Course Outcomes:

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

Corporate Social Responsibility (RCP23XOE265) Course Contents

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. Corporate Social Responsibility in India, Sanjay K Agarwal, Sage Publications, 2008.

4. Corporate Social Responsibility in India, Bidyut Chakrabarty, Routledge, New Delhi, 2015.

Reference Books:

1. Corporate Social Responsibility: An Ethical Approach, Mark S. Schwartz, Broadview Press, 2011.

2. Attaining Sustainable Growth through Corporate Social Responsibility, George Pohle and Jeff Hittner, IBA Global Business Services, 2008.

3. Strategic Corporate Social Responsibility: Stakeholders in a Global Environment, William B. Werther Jr. and David Chandler, 2nd Edition, Sage Publications, 2011.

Program: Computer Science & Engineering (Data Science)	S. Y. B.Tech.	Semester: IV
Bioinformatics (RCP23XOE266)		

Prerequisite: Nil.

Course Objective(s):

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

Course Outcomes:

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

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), Searching, Retrieving, and Analysing Genomic and Protein data from online databases.

Unit-IV — 09 Hrs.

Systems Biology:

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

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

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

Unit-V — 07 Hrs.

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

Text Books:

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

Reference Books:

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

Program: Computer Science & Engineering (Data Science)	S. Y. B.Tech.	Semester: IV
Human Resource Management (RCP23XOE267)		

Prerequisite: Nil.

Course Objective(s):

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

Course Outcomes:

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

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 – In[illegible] 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, 6th Edition,PHI Learning Pvt. Ltd., 1 Jul 2020.
2. Gary Dessler, Human Resource Management, 16th Edition, Pearson Publications, 2020.

Reference Books:

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

Program: Computer Science & Engineering (Data Science)	S. Y. B.Tech.	Semester: IV
Digital Marketing Management (RCP23XOE268)		

Prerequisite: Nil.

Course Objective(s):

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

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the digital marketing framework & model and consumer behaviour.	L2	Understand
CO2	Develop digital marketing strategy roadmap.	L6	Create
CO3	Explain the terminology and concepts for developing web-specific media plans.	L2	Understand
CO4	Understand concepts related to digital campaign management and revenue generation models.	L2	Understand
CO5	Get a perspective on global digital marketing technology/ tools and future trends	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. Fundamentals of Digital Marketing by Puneet Singh Bhatia, Pearson Education Limited,2017.
2. Digital Marketing by Seema Gupta- McGraw Hill Education, 2022.

Reference Books:

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

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

Prerequisite: Nil.

Course Objective(s):

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

Course Outcomes:

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

Logistics and Supply Chain Management (RCP23XOE269) Course Contents

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 Integrat[illegible]pply Chain Information Technology. Implementation of ERP and Decision Support System.

Unit-VI 06 Hrs.

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

Text Books:

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

Reference Books:

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

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

Prerequisite: Nil

Course Objective(s):

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

Course Outcomes:

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

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

Description of Tutorial Activities

Unit-I — No of Assignment -01

Group Discussion

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

Unit-II — No of Assignments -02

Employment Skills

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

Unit-III — No of Assignment -01

Corporate Storytelling

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

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

Unit-IV No of Assignment -01

Technical Writing and Documentation

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

Unit-V No of Assignment -01

Professional Ethics

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

Unit-VI No of Assignment -02

Interpersonal Skills

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

Batchwise tutorial work of minimum eight assignments from the above suggested list [illegible] assignments based on the syllabus will be included, which would help the learner to apply the concepts learnt.

Books Recommended:

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

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

Prerequisite: Knowledge of Economics and Finance domain current affairs.

Course Objective(s):

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

Course Outcomes:

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

Economics and Financial Management (RCP23XHS282) Course Contents

Unit-I — 06 Hrs.

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

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

Unit-II — 04 Hrs.

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

Unit-III — 04 Hrs.

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

Unit-IV — 04 Hrs.

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

Unit-V — 10 Hrs.

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

Text Books:

1. Datt & Sundharam's Indian Economy by Gaurav Datt & Biswajit Nag, S. Chand Publications, 73rd Edition,2024.

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

Reference Books:

1. Public Economics: The Macroeconomic Perspective by Burkhard Heer, Springer International Publications, 2019.

2. Indian Economy: Economic Ideas, Development, and Financial Reforms by Raj Kumar Sen, Deep & Deep Publications, 2008.

3. Indian Economy: Performance and Policies by Dr. V. C. Sinha, SBPD Publications, 2021.

4. Financial Management by C. Paramasivan, T. Subramanian, New Age Publications, 2nd Edition, 2023.

5. Financial Management Practices in India by Sandeep Goel, Taylor & Francis Publications, 2016.

Program: Computer Science & Engineering (Data Science)	S. Y. B.Tech.	Semester: IV
Semester Project-II (RCP23IPSC401)		

Course Objective(s): Students are expected to design, simulate/implement a project based on the knowledge acquired from current semester subjects.

Course Outcomes:

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

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	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	Apply a collaborative project environment by interacting and dividing project work among team members.	L3	Apply
CO4	Use technical communication skills to present project work in the form of a technical report/paper.	L3	Apply
CO5	Apply teamwork and project management skills to plan, execute, and manage 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 1).
- Report weekly to the project guide along with log book.

Assessment Criteria:

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

Prescribed project report guidelines:

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

- Introduction
- Literature Survey
- Related Theory
- Implementation details

- Project Outcomes
- Conclusion
- References

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

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

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

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

Each group shall present/publish a paper based on the semester project in reputed/peer reviewed Conference/Journal/TechFest/Magazine before end of the semester.

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