Shirpur Education Society's

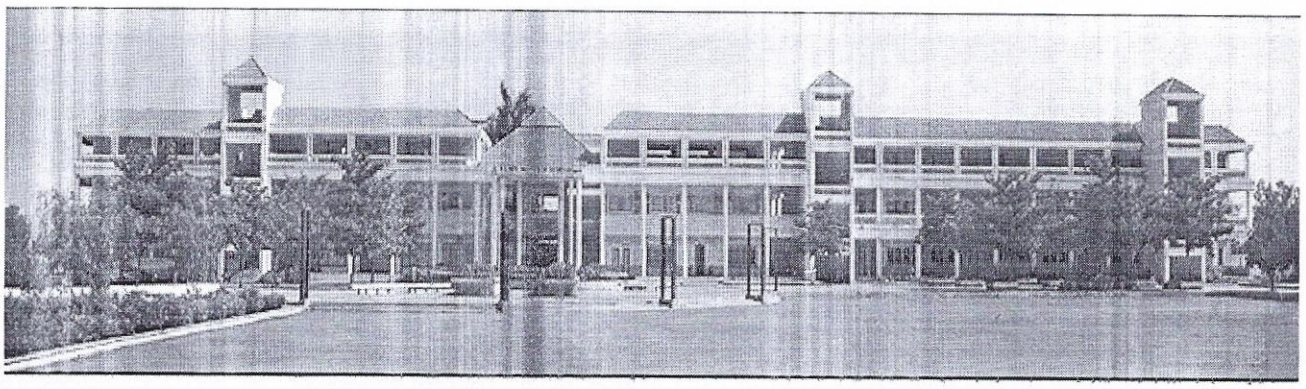
R. C. Patel Institute of Technology, Shirpur

(An Autonomous Institute)

Course Structure

Third Year B. Tech. (Information Technology)

With effect from Year 2026-27



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Third Year B.Tech Information Technology Semester-V (w.e.f. 2026-27)														
Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total	Credits	
							Continuous Assessment (CA)							
							TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Average of(TT1 & TT2)	ESE			
				L	T	P	[A]			[B]	[C]	[A+B+C]		
1	PC	RCP23IPC301	Computer Networks	3			25	15	15	15	60	100	3	4
	PC	RCP23IPC301L	Computer Networks Laboratory			2	25				25	50	1	
2	PC	RCP23IPC302	Artificial Intelligence	3			25	15	15	15	60	100	3	4
	PC	RCP23IPC302L	Artificial Intelligence Laboratory			2	25				25	50	1	
3	PC	RCP23IPC303	Data Warehousing and Mining	3			25	15	15	15	60	100	3	4
	PC	RCP23IPC303L	Data Warehousing and Mining Laboratory			2	25				25	50	1	
4	MD	RCP23IMD301	Statistical Analysis	3			25	15	15	15	60	100	3	4
	MD	RCP23IMD301L	Statistical Analysis Laboratory			2	25				25	50	1	
5#	PE	RCP23IPE311	Advanced Data Structures and Algorithms	3			25	15	15	15	60	100	3	4
		RCP23IPE311L	Advanced Data Structures and Algorithms Laboratory			2	25				25	50	1	
		RCP23IPE312	Computer Graphics	3			25	15	15	15	60	100	3	
		RCP23IPE312L	Computer Graphics Laboratory			2	25				25	50	1	
		RCP23IPE313	Microcontroller and Embedded System	3			25	15	15	15	60	100	3	
		RCP23IPE313L	Microcontroller and Embedded System Laboratory			2	25				25	50	1	
		RCP23IPE314	User-Centered Design	3			25	15	15	15	60	100	3	
		RCP23IPE314L	User-Centered Design Laboratory			2	25				25	50	1	
6	SC	RCP23XSC301P	Semester Project-III			2	25				25	50	1	1
7	HS	RCP23XHS331	Constitution of India	1										A
8	SC	RCP23ISC301	Data Processing and Optimization with Generative AI	1			40					40	1	1
			Total	17	0	12	315			75	450	840	22	

Any 1 Programme Elective Course and A Audit Course

Prepared by: Chaudhari
Prof. N. R. Chaudhari

Prof. Dr. D. R. Patil
BOS Chairman

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

Checked by:
Ms. A. Z. Ansari

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

Prof. Dr. J. B. Patil
Director

Semester - V

Program: Information Technology	T.Y. B.Tech.	Semester: V
Computer Networks (RCP23IPC301)		
Computer Networks Laboratory (RCP23IPC301L)		

Prerequisite: Computer System Basics.

Course Objectives: The objective of the course is to introduce the students to the layered approach in communication network. This course aims to provide the students with an introduction to standard client-server-based applications. The course will also enable the students to explore the services and protocols of each layer and choose appropriate protocols while sending data from the sender to the receiver using guided or unguided transmission media.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Describe the fundamental components of computer networks and layered reference models.	L2	Understand
CO2	Analyse various concerns at different layers in reference models using suitable techniques.	L4	Analyze

Computer Networks (RCP23IPC301)
Course Contents

Unit-I 03 Hrs.

Introduction Network devices, Network Types: LAN, MAN, WAN, Network topology, OSI Reference Model, TCP/IP Suite, Comparison of OSI and TCP/IP.

Unit-II 03 Hrs.

Physical Layer: Transmission Media: Guided Media – Twisted Pair, Coaxial Cable, Fiber Optics; Unguided Media (Wireless): Radio Waves, Microwave, Bluetooth and Infrared.

Unit-III 10 Hrs.

Data Link Layer: Two Types of Links, Data Link Control: Framing, Flow and Error Control, Error Detection and Correction (Hamming Code, CRC, Checksum), Two DLC Protocols: HDLC, PPP.

Medium Access Control Sublayer: Channel Allocation problem, Multiple Access Protocol (Aloha, Carrier Sense Multiple Access (CSMA/CA, CSMA/CD), Wired LANS: Ethernet, Ethernet Standards, Virtual LAN.

Unit-IV 09 Hrs.

Network Layer: Introduction: Network Layer design issues, Communication Primitives: Unicast, Multicast, Broadcast. IPv4 Addressing (Classful and Classless), Subnetting, Supernetting design problems, IPv4 Protocol, Network Address Translation (NAT) Routing algorithms: Shortest Path (Dijkastra's), Link state routing, Distance Vector Routing Protocols - ARP, RARP, ICMP, IGMP Congestion control algorithms: Open loop congestion control, Closed loop congestion control, QoS parameters, IPv6 packet format, Transition from IPv4 to IPv6.

Unit-V 10 Hrs.

Transport Layer: Transport Layer Protocols: Simple Protocol, Stop-and-Wait Protocol, Go-Back-N Protocol (GBN), Selective-Repeat Protocol, Bidirectional Protocols: Piggybacking, User Datagram Protocol: User Datagram, UDP Services, UDP Applications, Transmission Control Protocol: TCP Services, TCP Features, TCP Segment, A TCP Connection, Flow Control, Error Control, TCP Congestion Control, TCP Timers.

Unit-VI 07 Hrs.

Application Layer: Introduction: Providing Services, Application layer Paradigms, Client-Server

Paradigm: Application Programming Interface, Using Services of the Transport Layer, Standard Client Server applications: World Wide Web and HTTP, FTP, Electronic Mail, TELNET, Secure Shell (SSH), Domain Name System (DNS), Beyond Networking: Software Defined Networking (SDN), Quantum Networking, Network Function Virtualization.

Computer Networks Laboratory (RCP23IPC301L)

List of Laboratory Experiments

Suggested Experiments:

1. To study basic networking commands like ping, tracert, nslookup, netstat, ARP, RARP, ipconfig, ifconfig, dig, traceroute, nslookup, netstat.
2. Implementation of specific network topology with respect to number of nodes and physical layer configuration.
3. To create and analyse a network using NS2.
4. To install Wireshark and study the packet headers.
5. Implementation of connection-oriented client server programming using TCP.
6. Implementation of connectionless client server programming using UDP.
7. Implementation of Routing Protocol.
8. Implementation of Stop and Wait protocol.
9. Implement and demonstrate CRC for identifying errors and error-free codeword transmission.
10. Implement Hamming code implementation.

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

Text Books

1. B.A. Forouzan, *Data Communications and Networking with TCP/IP Protocol Suite*, 6th Edition, TMH, 2022.
2. Andrew S. Tanenbaum, *Computer Networks*, 6th Edition, Pearson Education, 2020.

Reference Books

1. Behrouz A. Forouzan and Forouzan Mosharrat, *Computer Networks: A Top-Down Approach*, Special Indian Edition, McGraw Hill Education, 2017.

2. James F. Kurose and K.W. Ross, *Computer Networking: A Top-Down Approach Featuring the Internet*, 7th Edition, Pearson Education, 2017.

3. L.L. Peterson and B.S. Davie, *Computer Networks: A Systems Approach*, 4th Edition, Elsevier India, 2007.

4. Mayank Dave, *Computer Networks*, Cengage Learning, 2012.

5. Achyut Godbole and Atul Kahate, *Data Communications and Networks*, 2nd Edition, McGraw Hill, 2017.

NPTEL Courses

1. `https://nptel.ac.in/courses/106105080`

2. `https://nptel.ac.in/courses/106105081`

3. `https://nptel.ac.in/courses/106106243`

Program: Information Technology	T.Y. B.Tech.	Semester: V
Artificial Intelligence (RCP23IPC302)		
Artificial Intelligence Laboratory (RCP23IPC302L)		

Prerequisite: Knowledge of Programming Language and Algorithms.

Course Objectives: The course explores AI techniques like informed, uninformed and adversarial searching to solve real-life problems in a state space tree representation. The course also acquaints learners to advance topics of AI such as planning, handling uncertainty and Neural networks.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Apply search strategies for solving problems.	L4	Analyze
CO2	Draw inferences using knowledge.	L4	Analyze
CO3	Analyse various learning models.	L4	Analyze
CO4	Interpret intelligent systems for problem solving.	L2	Understand

Artificial Intelligence (RCP23IPC302)
Course Contents

Unit-I

07 Hrs.

Introduction to Artificial Intelligence: Problems solvable by AI, Intelligent Systems: Categorization, AI vs Human Intelligence, AI vs Machine Learning vs Deep Learning, Applications of AI: NLP, Computer Vision, Speech Processing, Robotics, Signal processing. Developments in AI: Responsible AI, Generative AI, Explainable AI, Quantum AI.

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

Problem Solving: Problem Solving Agent, Representing and formulating real-world problems as state spaces for AI-driven problem solving.

Unit-II

08 Hrs.

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

Informed Search: Uniform Cost Search, Greedy Best First Search, A* Search, AO* Search, Memory bounded heuristic Search.

Unit-III

08 Hrs.

Local Search & Optimization: Hill Climbing search and its variations: simple, steepest ascent, stochastic; Genetic algorithms: Basic GA operators, working, GA applications

Adversarial Search: Examples of games as search problems, Minimax algorithm, Alpha-Beta Pruning.

Planning: Planning problems, Algorithms for Classical Planning, Heuristics for Planning, Hierarchical Planning, Planning and Acting in Nondeterministic Domains.

Unit-IV

08 Hrs.

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

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

Unit-V

06 Hrs.

Types of Learning: Supervised, Unsupervised, Reinforcement and Inductive Learning.

Artificial Neural Networks: Supervised and unsupervised Neural networks, Perceptron, Feed Forward Network, Backpropagation Algorithm.

Unit-VI

05 Hrs.

Expert Systems: Knowledge Representation in Expert Systems, Expert System Shells, ES Architecture, Phases in Building Expert Systems, Knowledge Acquisition, Applications of Expert Systems, Examples of Expert Systems, Case Study on MYCIN Rule Based System.

Artificial Intelligence Laboratory (RCP23IPC302L)

List of Laboratory Experiments

Suggested Experiments:

1. Define an AI Problem in a Real-World Scenario: Identify a relevant, high-impact AI problem. Choose from trending domains: Autonomous systems, Medical AI, Fake news detection, etc. Include PEAS description, agent type, and problem formulation.
2. Identify and analyze Uninformed Search Algorithm to solve the problem.
3. Identify and analyze Informed Search Algorithm to solve the problem.
4. Visualize search trees using Graphviz or Matplotlib or any other tool.
5. Program to implement Local Search algorithm: Hill Climbing search.
6. Program on Genetic Algorithm to solve an optimization problem in AI.
7. Implement Game Playing using Modern Adversarial Search: Build AI that can compete and adapt.
8. To develop and implement a Bayesian Network using Python or tools like `pgmpy` to effectively handle uncertainty in real-world AI scenarios, supported by relevant case studies.
9. To design and implement a program that applies to the Perceptron Learning or Backpropagation Algorithm for learning from data, using real-world case studies.
10. To implement rule-based systems and knowledge representation using any language (LISP/PROLOG/Pyt
11. Implementation on any AI game: Wumpus World, Tic-tac-toe, 8-Queens Problem.
12. Case study of an AI Application.

Any 10 experiments based on syllabus may be included, which would help the learner to understand topic/concept.

Text Books:

1. Stuart J. Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach*, 4th Edition, Pearson Education, 2020.
2. Lavika Goel, *Artificial Intelligence: Concepts and Applications*, Wiley India, 2021.
3. Deepak Khemani, *A First Course in Artificial Intelligence*, 3rd Edition, McGraw Hill Education (India), 2023.
4. Saroj Kaushik, *Artificial Intelligence*, 3rd Edition, Cengage Learning, 2022.
5. George F. Luger, *Artificial Intelligence: Structures and Strategies for Complex Problem Solving*, 6th Edition, Pearson Education, 2009.

Reference Books:

1. Elaine Rich and Kevin Knight, *Artificial Intelligence*, 3rd Edition, McGraw Hill Education (India), 2010.
2. S.N. Sivanandam and S.N. Deepa, *Principles of Soft Computing*, 3rd Edition, Wiley, 2019.
3. Han Kamber, *Data Mining Concepts and Techniques*, 3rd Edition, Morgan Kaufmann Publishers, 2011.
4. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, *Deep Learning*, MIT Press, 2016.

NPTEL Courses:

1. `https://onlinecourses.nptel.ac.in/noc24_cs08/preview`
2. `https://onlinecourses-archive.nptel.ac.in/noc17_cs30/course`
3. `https://onlinecourses.nptel.ac.in/noc21_ge20/preview`

Program: Information Technology	T.Y. B.Tech.	Semester: V
Data Warehousing and Mining (RCP23IPC303)		
Data Warehousing and Mining Laboratory (RCP23IPC303L)		

Prerequisite: Database Systems

Course Objectives: This course emphasizes data management using data warehousing and data mining concepts for decision-making in an organization. Data mining is introduced as an exploratory methodology to gather data coming from various sources and preprocess it for mining.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Design data warehouse models using dimension-modeling techniques.	L6	Create
CO2	Analyze the data using appropriate Online Analytical Processing (OLAP) model.	L4	Analyse
CO3	Apply appropriate data mining techniques on data sets to retrieve relevant information.	L3	Apply

Data Warehousing and Mining (RCP23IPC303)
Course Contents

Unit-I

08 Hrs.

Foundations of Data Warehousing and Dimensional Modelling: Introduction to Strategic Information Systems, Importance and Characteristics of Data Warehouses. Comparison: Data Warehouse vs. Data Marts vs. Data Lakes, Top-down and Bottom-up Approaches to DW Development, Data Warehouse Architecture and Components.

Dimensional Modelling: ER vs. Dimensional Modelling, Star Schema, Snowflake Schema, Galaxy Schema (Fact Constellation), Fact Tables: Additive, Semi-additive, Factless Fact Tables.

Dimension Tables: Slowly Changing Dimensions (SCD Types 1, 2, 3), Aggregate Fact Tables and Performance Optimization.

Unit-II

06 Hrs.

ETL Process and Online Analytical Processing (OLAP): ETL Overview and its Importance in DW, Data Extraction Techniques: Incremental vs Full Load, Log-based Change Data Capture.

Data Transformation: Data Cleaning, Enrichment, Standardization, De-duplication, Data Loading Strategies: Batch, Real-time, and Micro-batch Loading, OLTP vs. OLAP systems

OLAP: Concepts, Cubes, and Dimensional Modeling, OLAP Operations: Drill-down, Rollup, Slice, Dice, Pivot (Rotation), OLAP Models: MOLAP, ROLAP, HOLAP – Comparative Analysis.

Unit-III

07 Hrs.

Introduction to Data Mining, Data Exploration and Preprocessing: Knowledge Discovery in Databases (KDD) Process, Data Mining Tasks: Classification, Clustering, Association, Prediction, Real-world Applications: Healthcare, Banking, ECommerce, Data Exploration Techniques: Attribute Types, Statistical Summaries, Visualization Tools: Matplotlib, Seaborn, Tableau, Data Preprocessing: Data Cleaning, Integration, Reduction, Transformation, Discretization.

Unit-IV

09 Hrs.

Classification Techniques: Supervised Learning and Classification, Decision Tree Algorithms (ID3), Attribute Selection.

Bayesian Classification: Naïve Bayes, Model Evaluation: Accuracy, Precision, Recall, F1 Score, Area Under the Receiver Operating Characteristic curve (ROC AUC), Crossvalidation, Bootstrapping,

Holdout, Ensemble Methods: Bagging, Boosting, AdaBoost, Random Forests, Gradient Boosting, XGBoost, LightGBM.

Clustering: K-means, K-medoids, Hierarchical (Agglomerative, Divisive), Clustering Evaluation.

Unit-V 06 Hrs.

Mining Frequent Patterns, Association and Correlations: Market Basket Analysis, Frequent, Closed, Maximal Itemsets, Support, Confidence, Apriori Algorithm and Optimizations.

Association Rule Mining: Lift, FP-Growth Algorithm.

Unit-VI 06 Hrs.

Spatial and Web Mining: Spatial vs. Spatial vs. Traditional Data Mining, Spatial Data Types and Structures: Raster, Vector, Quad-trees, R-trees.

Spatial Association Rules and Clustering: DBSCAN, CLARANS.

Web Mining : Content, Structure, Usage, Web Mining Tools: Beautiful Soup, Scrapy, Google Analytics, Applications in Search Engine Optimization (SEO), Personalization, Social Network Analysis.

Data Warehousing and Mining Laboratory(RCP23IPC303L)

List of Laboratory Experiments

Suggested Experiments:

1. **Data Exploration and Visualization using BI Tools:** Use tools like Power BI or Tableau to explore datasets and visualize patterns to support warehouse design.
2. **Design and Creation of a Data Warehouse/Data Mart:** Identify relevant source tables and populate sample data. Create an Information Package Diagram (IPD). Design dimensional models: Star Schema, Snowflake Schema and Fact Constellation Schema.
3. **ETL Process Simulation:** Demonstrate Extraction, Transformation and Loading using tools like Talend, Pentaho or Python scripts.
4. **Data Preprocessing Techniques:** Perform data cleaning, handling missing values, normalization, discretization and feature selection using Python (Pandas, Scikit-learn) or R.
5. **OLAP Operations on Multidimensional Data:** Simulate OLAP operations such as Slice, Dice, Drill-down, Roll-up and Pivot using BI tools or a simulated cube in Excel/Python.

6. **Classification Algorithm Implementation:** Implement and evaluate Decision Tree (ID3) and Naïve Bayes classifier. Use tools like Scikit-learn or WEKA for comparison.
7. **Clustering Algorithm Implementation:** Implement K-Means, Hierarchical Clustering (Single, Complete and Average Linkage) and DBSCAN.
8. **Association Rule Mining Implementation:** Implement Apriori Algorithm and FP-Growth Algorithm.
9. **Advanced Web Mining Algorithms:** Implement PageRank Algorithm to simulate web page importance. Implement HITS Algorithm to identify hubs and authorities in a web graph.
10. **Spatial Data Mining and Clustering:** Implement CLARANS or ST-DBSCAN for spatial clustering.

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

Text Books

1. Paulraj Ponniah, *Data Warehousing: Fundamentals for IT Professionals*, 2nd Edition, Wiley India, 2013.
2. Han and Kamber, *Data Mining Concepts and Techniques*, 3rd Edition, Morgan Kaufmann, 2012.

Reference Books

1. P.N. Tan, M. Steinbach and Vipin Kumar, *Introduction to Data Mining*, 2nd Edition, Pearson Education, 2018.
2. H. Dunham, *Data Mining: Introductory and Advanced Topics*, 1st Edition, Pearson Education, 2006.
3. Thareja Reema, *Data Warehousing*, 1st Edition, Oxford University Press, 2009.

NPTEL Courses

1. `https://nptel.ac.in/courses/106105174`
2. `https://nptel.ac.in/courses/110107092`

Program: Information Technology	T.Y. B.Tech.	Semester: V
Statistical Analysis (RCP23IMD301)		
Statistical Analysis Laboratory (RCP23IMD301L)		

Prerequisite: Knowledge of Programming Language and Algorithms

Course Objectives: The objective of this course is to make the learner explore statistical concepts, which include probability, probability distributions, sampling, estimation, hypothesis testing, regression, correlation analysis and multiple regression.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Interpret data using Descriptive Statistics.	L2	Understand
CO2	Draw the inferences by applying appropriate statistical test on the given data.	L3	Apply

Statistical Analysis (RCP23IMD301)
Course Contents

Unit-I 02 Hrs.

Introduction to Statistical Analysis: Introduction, Meaning of Statistics, The Scientific Method, Characteristics of Statistics, Data Measurement, Populations and Samples, Sampling Techniques, Census and Sampling Method, Parameter and Statistic, Independent and Dependent Variables, Examining Relationships.

Unit-II 04 Hrs.

Modeling Data: Types of Data, Data Transformation, Measures of Central Tendency (mean, median. Mode), Measures of Variability (range, IQR, variance, standard deviation), Measures of Shape (skewness, coefficient of skewness), Relationship between Mean, Median, Mode, Kurtosis, Estimator and Estimate, Standard Error, Sampling distribution of the sample means/proportion.

Unit-III 07 Hrs.

Statistical Introduction, Null and Alternative Hypothesis, Type I and Type II Error, The Procedure of Hypothesis Testing, Hypothesis Testing of a Population Mean using z statistic, t statistic, Testing Hypothesis about a proportion, Testing hypothesis about a variance.

Unit-IV 07 Hrs.

Statistical Inference About Two Populations: Introduction, Hypothesis Testing about the Difference in Two Means Using the z Statistic (Population Variances Known), Hypothesis Testing about the Difference in Two Means: Independent Samples and Population Variances Unknown, Difference in Two Population Means Using the t-Test, Statistical Inferences for Two Related Populations Statistical Inferences About Two Population Proportions, Testing Hypotheses About Two Population Variances.

Unit-V 10 Hrs.

Analysis of Variance: Introduction to Design of Experiments, One-way ANOVA, The Randomized Block Design, Two-way ANOVA, MANOVA (one way).

Unit-VI 12 Hrs.

Non-Parametric Statistical Tests: Chi-square Goodness-of-Fit Test, Chi-Square as a test of independence, Runs Test: Up and Down Runs: Above and Below Runs; Length of Runs, Mann-Whitney

U Test, Wilcoxon Matched-Pairs Signed Rank Test for small and large sample, Kruskal-Wallis Test, Friedman Test.

Statistical Analysis Laboratory (RCP23IMD301L)

List of Laboratory Experiments

Suggested Experiments:

1. To summarize and describe the features of a dataset using descriptive statistics.
2. To implement single population tests for mean, proportion and variance.
3. To implement two population tests for mean and proportion.
4. To implement two population tests for variance.
5. To implement Chi-Square Test for Independence and Goodness-of-Fit.
6. To compare the means of two or more independent groups for a continuous dependent variable using ANOVA.
7. To analyse group differences for multiple related outcome variables using MANOVA.
8. To compare the distributions of two independent samples using Mann-Whitney U Test.
9. To perform non-parametric methods for comparing the central tendency of two groups (either related or independent).
10. To determine randomness of length of data using Runs test.

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

Text Books

1. Ken Black, *Business Statistics for Contemporary Decision Making*, 6th Edition, Wiley Publication, 2011.
2. Gupta, S.P., *Statistical Methods*, 46th Edition, Sultan Chand & Sons, 2012.
3. Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani, *An Introduction to Statistical Learning with Applications in R*, 3rd Edition, Springer Science Business Media, New York, 2013.

Reference Books

1. D.C. Montgomery and G.C. Runger, *Applied Statistics and Probability for Engineers*, 7th Edition, Wiley, 2020.

2. Agresti, A., *An Introduction to Categorical Data Analysis*, 3rd Edition, John Wiley & Sons, 2012.

3. Hastie T., Tibshirani R. and Friedman J., *The Elements of Statistical Learning: Data Mining, Inference and Prediction*, 3rd Edition, Springer Series in Statistics, 2011.

NPTEL Courses

1. `https://nptel.ac.in/courses/111104146`

Program: Information Technology	T.Y. B.Tech.	Semester: V
Advanced Data Structures and Algorithms (RCP23IPE311)		
Advanced Data Structures and Algorithms Laboratory (RCP23IPE311L)		

Prerequisite: Basic Knowledge of Data Structures, algorithms, and any programming language like C or JAVA

Course Objectives: This course emphasizes recent evolutions of data structures and algorithms apt for new paradigms of computation and applications to various domains of computer science. The course also introduces techniques such as amortized complexity analysis to the students.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Solve a problem using appropriate data structure and algorithm.	L3	Apply
CO2	Perform performance analysis of the chosen algorithm.	L4	Analyse

Advanced Data Structures and Algorithms (RCP23IPE311)

Course Contents

Unit-I — 09 Hrs.

Analysis of Data Structures: Amortized Complexity- Aggregate Method, Accounting Method, Potential Method.

Data Structures for String: Tries and Compressed Tries, Suffix Tree and Suffix array.

Spatial Data Structures: Interval, Segment, Range, Priority Search Tree, KD Tree, R Tree with application.

Unit-II — 10 Hrs.

Heaps: Heap ordered Tree, Leftist Heap, Skew Heap, Binomial Heap, Fibonacci Heaps, Treap.

Balanced Search Trees: HHeight Balance and Weight Balance Trees, Red-Black Tree, Splay Tree, Skip List, Randomized BST, Tango Tree with application.

Unit-III — 06 Hrs.

Hash Tables: Universal Families of Hash Functions, Perfect Hash Functions, Cuckoo Hashing

Probabilistic Data Structures: Bloom filters, Count-Min Sketch, HyperLogLog. Locality Sensitive Hashing, Hash Tree (Merkle Tree) with application.

Unit-IV — 05 Hrs.

Probabilistic and Randomized Algorithms: Probabilistic approach to algorithm and Randomized Analysis, Indicator Random Variable (IRV), Randomized Quick Sort, Analysis of Hiring Problem, Las Vegas and Monte Carlo algorithm.

Unit-V — 08 Hrs.

Graph Based Algorithms: Flow Network Introduction: Residual Network, Augmenting Path, Ford Fulkerson Method, Edmonds-Karp Method, Push-Relable Algorithm, Relable to Front algorithm. Bipartite Matching: Maximum Bipartite Matching, Weighted Bipartite Matching.

Unit-VI — 04 Hrs.

Computational Geometry: Line Segment Properties, Convex Hull Graham's scan algorithm, Conic

Programming.

Online Algorithms: Competitive Ratio and K-Server.

Advanced Data Structures and Algorithms Laboratory (RCP23IPE311L)

List of Laboratory Experiments

Suggested Experiments:

1. Experiment on Amortized Analysis to analyze the average performance of operations over a sequence on a particular data structure.
2. Experiment to implement any spatial data structure such as KD Tree or Quad Tree to store and search multidimensional points.
3. Experiment to implement a balanced search tree such as Red-Black Tree and perform insertion and deletion operations.
4. Experiment to perform various operations such as Insert, Delete and Extract-Min/Max on Heap data structures.
5. Experiment to explore and implement data structures such as Trie, Suffix Array or Suffix Tree for efficient string manipulation and pattern matching.
6. Experiment to implement Flow Network Algorithms for computing Maximum Flow and Bipartite Matching.
7. Experiment to assess the role of randomization in designing efficient and simple algorithms.
8. Experiment to implement Graham's Scan Algorithm for Convex Hull construction.

Minimum 1 experiment based on each module numbered wherein students need to select a problem statement of relevance and provide the implementable solution by selecting appropriate advanced data structures. Also perform analysis of it.

Text Books

1. Thomas H. Cormen, Charles E. Leiserson and Ronald L. Rivest, *Introduction to Algorithms*, 3rd Edition, MIT Press, 2009.

2. Peter Brass, *Advanced Data Structures*, 1st Edition, Cambridge University Press, 2008.

3. Suman Saha and Shailendra Shukla, *Advanced Data Structures: Theory and Applications*, 1st Edition, CRC Press and Taylor & Francis, 2019.

Reference Books

1. Dinesh Mehta and Sartaj Sahni, *Handbook of Data Structures and Applications*, 1st Edition, Chapman & Hall/CRC, 2005.

2. Daniel R. Page, *Advanced Data Structures: An Introduction to Data Structures and Algorithms*, Kindle Edition, 2020.

3. Rajeev Motwani and Prabhakar Raghavan, *Randomized Algorithms*, Cambridge University Press.

4. Harsh Bhasin, *Algorithms Design and Analysis*, Oxford University Press, 2015.

NPTEL Courses

1. `http://nsm.iitm.ac.in/cse/services/adv_dsa/`

2. `https://nptel.ac.in/courses/106102064`

Program: Information Technology	T.Y. B.Tech.	Semester: V
Computer Graphics (RCP23IPE312)		
Computer Graphics Laboratory (RCP23IPE312L)		

Prerequisite: Basic Mathematics, C Programming, Java

Course Objectives: The course intends to introduce the students to fundamental knowledge and basic technical competence in the field of computer graphics. The course will introduce the basic concepts of Computer graphics. The course will also acquaint the student with algorithms for generating and rendering graphical models, mathematics for geometrical transformations. The course will also enable students to apply various techniques of projections, shading, illumination and lighting to graphical models.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Implement scan conversion algorithms for lines, circles, curves and polygon.	L3	Apply
CO2	Apply appropriate Transformations on a given object.	L3	Apply
CO3	Design an animation sequence.	L6	Create

Computer Graphics (RCP23IPE312)
Course Contents

Unit-I

08 Hrs.

Introduction to Computer Graphics and Output Primitives: Graphics primitives- pixel, resolution, aspect ratio, frame buffer, refresh rates, Display Devices, Bitmap and Vector based graphics, Overview of Coordinate system.

Scan Conversion of: point, line using Digital differential analyser & Bresenham's algorithm, circle using midpoint approach and Bresenham.

Polygons: Concave Polygon, Convex Polygon, Inside/Outside Test.

Area Filling: Scan Line Polygon Fill Algorithm, Boundary Fill Algorithm and Flood Fill Algorithm.

Unit-II

08 Hrs.

Two Dimensional Transformations: Basic Geometrical 2D transformations- Translation, Rotation, Scaling, Reflection, Shear, their homogeneous Matrix representation, and Composite transformation.

Three Dimensional Transformations: Translation, Rotation, Scaling, Rotation about an arbitrary axis.

Unit-III

09 Hrs.

Viewing Transformations and Projections: Introduction, Viewing Pipeline, View Coordinate reference frame, Window to Viewport Transformation, Point Clipping, Line clipping: Cohen Sutherland Algorithm, Liang Barsky Algorithms, Polygon Clipping: Sutherland Hodgeman Polygon Clipping and Weiler Atherton, Text Clipping. Three-Dimensional Viewing Pipeline, Viewing Transformation, Projections: Parallel (Oblique and Orthographic), Perspective (one Point, two point and three point).

Unit-IV

08 Hrs.

Light, Color, Shading and Hidden Surfaces: Properties of Light, Color Models - CIE chromaticity diagram, RGB, HSV, CMY.

Illumination Models: Ambient Light, Diffuse reflection, specular reflection, Phong Model, combined diffuse and specular reflections with multiple light sources, Warn Model.

Shading Algorithms: Introduction to Rendering, Halftone, Gouraud and Phong Shading.

Hidden Surfaces: Introduction, Back face detection and removal, Algorithms: z buffer, Painter's

algorithm, Area Subdivision (Warnock).

Unit-V 05 Hrs.

Curves: Introduction to curves, interpolation and approximation, Blending Function, Bezier and B-spline curves.

Fractals: Introduction, Classification, Fractal Generation- Snowflake, Sierpinski Gasket, Koch Curve, Cantor Middle-Thirds Set, Hilbert Curve, Applications of Fractals.

Unit-VI 04 Hrs.

Introduction to Animation: Key Frame Animation, Animation Sequence, Motion Control Methods, Morphing, Warping (only Mesh Warping).

Computer Graphics Laboratory (RCP23IPE312L)

List of Laboratory Experiments

Suggested Experiments:

1. Implementation of Line Drawing Algorithms: DDA and Bresenham Algorithm. Generate lines with different styles such as Dotted, Dashed, Centered and Thick Lines.
2. Implementation of Circle Generation Algorithms and generation of Concentric Circles.
3. Implementation of Area Filling Algorithms: Boundary Fill, Flood Fill and Scan Line Polygon Fill.
4. Generate a Bezier Curve for n Control Points.
5. Program for performing Two-Dimensional Transformations.
6. Implementation of Line Clipping Algorithms.
7. Implementation of Polygon Clipping Algorithms.
8. Generate a Snowflake using Fractals.
9. Implement Implement Illumination and shading apply on sphere using two light sources in OpenGL
10. Develop a scene in Unity that includes:
    (a) A cube, plane and sphere, apply transformations on the 3 game objects.
    (b) Add a video and audio source.

Text Books

1. Donald Hearn and M. Pauline Baker, *Computer Graphics C Version*, 2nd Edition, Pearson Education, 2018.
2. James D. Foley, Andries van Dam, Steven K. Feiner and John F. Hughes, *Computer Graphics Principles and Practice in C*, 3rd Edition, Pearson Publication, 2013.
3. Rajesh K. Maurya, *Computer Graphics*, Wiley India Publication, 2018.

Reference Books

1. Donald Hearn and M. Pauline Baker, *Computer Graphics with OpenGL*, 4th Edition, Pearson Education, 2010.
2. Steven Harrington, *Computer Graphics*, 2nd Edition, McGraw Hill, 2017.
3. Rogers, *Procedural Elements of Computer Graphics*, 2nd Edition, Tata McGraw Hill, 1997.
4. F.S. Hill and Stephen M. Kelley, *Computer Graphics using OpenGL*, 3rd Edition, Prentice Hall, 2006.
5. Samit Bhattacharya, *Computer Graphics*, Oxford Publication, 2018.

NPTEL Courses

1. `https://nptel.ac.in/courses/106103224`
2. `https://nptel.ac.in/courses/106102063`

Program: Information Technology	T.Y. B.Tech.	Semester: V
Microcontroller and Embedded System (RCP23IPE313)		
Microcontroller and Embedded System Laboratory (RCP23IPE313L)		

Prerequisite: Knowledge of Microprocessors and Assembly Language Programming

Course Objectives: The objective of this course is to provide a comprehensive introduction to the architecture and assembly language programming of 8051 and ARM 7 microcontrollers. It provides an overview of the difference between microprocessors and microcontrollers. The course familiarizes students with different peripheral devices & their interfacing to 8051, memory organization, interrupts, instruction set, addressing modes of both 8051 and ARM 7 microcontroller. The student will implement middle level programming and interfacing concepts in 8051 and write assembly language program in 8051 and ARM 7 for various applications.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Develop embedded applications using 8051 and ARM7 microcontrollers.	L3	Apply
CO2	Develop real-time systems using RTOS principles.	L3	Apply
CO3	Develop real-world sensor-based applications using embedded target boards.	L3	Apply

Microcontroller and Embedded System (RCP23IPE313)
Course Contents

Unit-I — 08 Hrs.

The Microcontroller Architecture and Programming of 8051: Introduction to 8051 Microcontroller, Architecture, Pin configuration, Memory organization, Input /Output Ports, Counter and Timers, Serial communication, Interrupts. Instruction set, addressing modes, Development tools, Assembler Directives, Programming based on Arithmetic & Logical Operations, I/O parallel and serial ports, Timers & Counters, and ISR; Introduction to 8031 Microcontroller, Architecture, Memory Organization, and Interrupts.

Unit-II — 04 Hrs.

Interfacing with 8051 Microcontroller: Interfacing ADC, DAC, Stepper motor, LCD, KBD matrix, 8255 PPI.

Unit-III — 06 Hrs.

ARM 7 Architecture: Architectural Inheritance, Data Path Design, Flag Register / CPSR, SPSR, Mode Bits, Condition Flags, Programmer's Model, Pipelining, Operating Modes: User, FIQ, IRQ, Supervisor, Abort, Undefined, System mode.

Unit-IV — 12 Hrs.

ARM 7 Interrupts and Programming: ARM Development tools, ARM 7 Interrupts: Reset, Undefined, SWI, Prefetch Abort, Data Abort, IRQ, FIQ; Multiple Exceptions, ARM 7 Addressing Modes: Immediate, Register, Direct, and Indirect; Instruction set: Branch, Data Movement, Load and Store, Arithmetic, Multiply, Long Multiply, Logical, Compare, Stack operations; Writing simple assembly language programs.

Unit-V — 08 Hrs.

Real Time Operating System: Basics of RTOS, Real-time concepts, Hard Real Time System, Soft Real Time System, Firm Real Time System, Differences between general purpose OS RTOS, Basic Architecture of RTOS, Features of RTOS, Scheduling algorithms in RTOS - Clock Driven, Weighted Round Robin, Priority Scheduling (Earliest Deadline First, Least Slack Time, Rate Monotonic Scheduling), Priority Inversion Problem, Solutions to Priority Inversion – Non Blocking Critical Section, Priority Ceiling, Priority Inheritance, Interrupt management in RTOS environment, Memory

management, Selecting a Real Time Operating System, RTOS comparative study.

Unit-VI 04 Hrs.

Introduction to Embedded Target Boards: Introduction to Arduino, Raspberry Pi, ARM Cortex, Intel Galileo etc. Open-source prototyping platforms. Basic Arduino programming; Extended Arduino libraries; Arduino-based Internet communication; Raspberry pi; ARM Cortex Processors; Intel Galileo boards; Sensors and Interfacing: Temperature, Pressure, Humidity.

Microcontroller and Embedded System Laboratory (RCP23IPE313L)

List of Laboratory Experiments

Suggested List: (Any 4 from 8051, Any 4 from ARM, 2 based on Arduino/Raspberry Pi)

1. Data Transfer – Block Move, Exchange.
2. Sorting and Finding the Largest Element in an Array.
3. Arithmetic Instructions – Addition, Subtraction, Multiplication, Division, Boolean and Logical Instructions.
4. Conditional CALL and RETURN.
5. Simple Calculator using 6-Digit Seven Segment Display and Hex Keyboard Interface to 8051.
6. Alphanumeric LCD Panel and Hex Keypad Interface to 8051.
7. External ADC and Temperature Control Interface to 8051.
8. Data Transfer (16-bit, 32-bit, 64-bit).
9. One's Complement, Addition, Subtraction and Bit Shifting.
10. Largest and Smallest of 2, 3 nos.
11. Loops (Series addition, largest, smallest, etc.)
12. Multiplication and Division Programs.
13. Programs on Stack.
14. Practical Application using Arduino.
15. Practical Application using Raspberry Pi.

16. Case Study on RTOS.

Text Books

1. M.A. Mazidi, J.G. Mazidi and R.D. McKinlay, *The 8051 Microcontroller & Embedded Systems Using Assembly and C*, 3rd Edition, Pearson, 2013.
2. Dr. K.V.K.K. Prasad, *Embedded / Real-Time Systems: Concepts, Design & Programming Black Book*, Dreamtech Press, 2013.
3. Shibu K.V., *Introduction to Embedded Systems*, 2nd Edition, McGraw Hill, 2017.
4. Massimo Banzi, *Getting Started with Arduino*, 2nd Edition, O'Reilly, 2011.
5. Simon Monk, *Raspberry Pi Cookbook*, 3rd Edition, O'Reilly, 2019.

Reference Books

1. Laya B. Das, *Embedded Systems: An Integrated Approach*, 3rd Edition, Pearson, 2013.
2. Steve Furber, *ARM System on Chip Architecture*, 2nd Edition, Pearson, 2001.
3. Raj Kamal, *Embedded Systems*, 3rd Edition, McGraw Hill, 2017.

NPTEL Courses

1. . https://onlinecourses.nptel.ac.in/noc22_ee12/preview
2. https://archive.nptel.ac.in/courses/106/105/106105193/
3. https://onlinecourses.nptel.ac.in/noc25_cs78/preview

Program: Information Technology	T.Y. B.Tech.	Semester: V
User Centered Design (RCP23IPE314)		
User Centered Design Laboratory (RCP23IPE314L)		

Prerequisite: Knowledge of Web Programming

Course Objectives: The objective of the course is to explore various user research methods and information architecture and to use them in interaction design, visual design and functional Layout Design. The course also introduces students to usability testing which is performed on various designs.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Identify user requirements.	L1	Remember
CO2	Design UI/UX using appropriate methods.	L6	Create
CO3	Generate test reports using usability testing.	L3	Apply

User Centered Design (RCP23IPE314)
Course Contents

Unit-I

04 Hrs.

Introduction: What is UX Design? What is UI Design? UX Design Deliverables, seven factors that influence user experience, UX design laws and their uses, Elements used in User Experience Design, and How it works together.

Design Thinking Overview: What is Design Thinking; Design Mindset; Brief History; Various Models; Design Thinking Life Cycle, how it connects with other methods & Key Stages; 10 commandments.

Unit-II

09 Hrs.

User Research and Analysis: What is UX research? What's the difference between good and bad UX research? What are the five steps of UX research? User research importance, KPIs in User Experience.

Understanding User Problems: Involves identifying the stages of problem solving, applying the IDEAL framework for problem-solving, and recognizing the different types of problems: Known-Known (KK), Known-Unknown (KU), and Unknown-Unknown (UU). What is empathy; Sympathy vs Empathy; how to empathize, various tools. Empathy Map. Web Content Accessibility Guidelines (WCAG 2.2).

Root Cause Analysis for Problem Definition: AEIOU, Questions Builder, 6-WH, Persona Types, Building a Persona, Journey Map (why, benefits, how to, types of key components), HMW Statement.

User Research Methodologies: Qualitative and Quantitative analysis, user interviews, focused group discussion, expert reviews, tools for user research.

Unit-III

09 Hrs.

Interaction Design: What is Ideation? How to ideate the problem definition? Ideation Techniques (mind map, SCAMPER, Crazy-8, Brain-writing, NABC).

Cognitive Psychology Basics: How users perceive and process information, Mental models and their impact on design.

Visual Hierarchy and Information Architecture: Introduction to Information architecture, card sorting, open card sorting, semi-closed card sorting, closed card sorting, using excel as a tool for card

sorting, Understanding Information architecture, creating IA for different industries, IA types and structures.

Emotional Design: Using colors, typography, Use of imagery and iconography and visual elements to evoke trust, excitement, or calmness depending on the product type (e.g., urgency for flash sales in e-commerce, serenity for meditation apps).

Functional Layout Design: Z-Pattern, F-Pattern, and Browsing vs. Searching vs. Discovery, Page Framework, The Fold, The Axis of Interaction Forms.

Unit-IV

07 Hrs.

Wireframing and Prototyping: Paper Prototyping, Low fidelity & High-Fidelity Prototypes, build your own Prototyping, Prototyping Tools for UI/UX Designers — How to Choose the Right One? Designing a Web / Mobile App.

Usability Testing: Learning the process of conducting usability tests for digital products, Usability testing methodologies – task-based user testing, A/B testing, labbased user testing, remote user testing, moderated & unmoderated user testing.

Unit-V

09 Hrs.

Product Design and Analytics: Types of products & solutions, an overview of using analytics tools, such as Google Analytics, to measure performance goals on your website or application.

UX Writing: Language, Directives, & Jargon: Microcopy & User Guidance: Writing clear, actionable, and concise copy for buttons, instructions, and error messages.

Interaction with Development Team: Understand how to collaborate and communicate with Developers, prepare for handing off designs, how to effectively present your ideas, and collaborate with internal and external stakeholders (clients, business analysts, project manager), and Different ways to share the intangible, receive feedback in critiques and make modifications based on feedback.

Unit-VI

04 Hrs.

UX Design for Futuristic Technologies: UX processes for AR/VR, what is Imagineering? What are the various tools & devices used to design? Field of view for AR/VR, the difference in Designing for 2D & 3D interfaces, Gesture, gaze, and voice control, getting familiar with AR is, Challenges of 3D interaction design, conversational UI design.

User Centered Design Laboratory (RCP23IPE314L)

List of Laboratory Experiments

Suggested Experiments:

1. Understanding the User Needs: Conduct interviews with potential users to gather insights into their pain points, needs, and desires.
2. Create Empathy Maps based on user interviews to identify behaviors, needs and feelings.
3. User Personas Creation: Develop detailed user personas based on collected data to represent the core user groups.
4. Identify Root Causes of User Problems and formulate clear Problem Statements.
5. Conduct Brainstorming Sessions for Ideation and Solution Generation.
6. Apply the SCAMPER Technique for Creative Idea Generation.
7. Create Low-Fidelity and High-Fidelity Prototypes and gather user feedback.
8. Conduct Usability Testing to identify design improvements.
9. Validate Prototype Effectiveness and User Satisfaction through Real-World Testing.
10. Assess Ethical Considerations in Design Projects and Explore Leadership Strategies in Design Teams.

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

Text Books

1. Garrett J.J., *The Elements of User Experience: User-Centered Design for the Web and Beyond*, 2nd Edition, New Riders Publishing, 2011.
2. Yablonski J., *Laws of UX: Using Psychology to Design Better Products & Services*, 2nd Edition, O'Reilly Media, 2020.
3. Rosenfeld L. and Morville P., *Information Architecture: For the Web and Beyond*, 4th Edition, O'Reilly Media, 2015.
4. Krug S., *Don't Make Me Think: A Common-Sense Approach to Web Usability*, 2nd Edition, New Riders Publishing, 2014.

5. Cypher A., *Designing for Augmented Reality and Virtual Reality: UX for a New Medium*, Springer, 2018.

Reference Books

1. Brown T., *Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation*, HarperBusiness, 2009.

2. Kuniavsky M., *Observing the User Experience: A Practitioner's Guide to User Research*, 2nd Edition, Morgan Kaufmann, 2003.

3. Gothelf J. and Seiden J., *Lean UX: Applying Lean Principles to Improve User Experience*, O'Reilly Media, 2013.

NPTEL Courses

1. `https://nptel.ac.in/courses/106103220`

2. `https://nptel.ac.in/courses/124107008`

Program: Information Technology	T.Y. B.Tech.	Semester: V
Semester Project-III (RCP23XSC301P)		

Course Objectives:

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

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

Semester Project III (RCP23XSC301P) Guidelines

Guidelines for Proposed Product Design and Development

- Students shall convert the solution designed in Semester III and IV into a working model using various components drawn from their domain as well as related interdisciplinary areas.
- The working model is to be validated with proper justification and the report is to be compiled in a standard format and submitted to the department. Efforts are to be made by the students to publish the extended technical paper either in the institute journal, *Techno Focus: Journal for Budding Engineers*, or in a suitable publication approved by the Department Research Committee / Head of the Department.
- Faculty supervisors may provide inputs to students during the entire span of the activity spread over two semesters, wherein the main focus shall be on self-learning.
- A record in the form of an activity log-book shall be maintained by each team to record weekly progress. The guide/supervisor should verify the recorded notes/comments and approve them on a weekly basis.
- The focus should be on self-learning, innovation, entrepreneurship, and development of solutions to societal problems. The year-long activity should ensure the design and development of a quality product during Semesters V and VI.

Guidelines for Assessment of the Work

- The Review/Progress Monitoring Committee shall be constituted by the Head of the Department. Progress of the product design and development shall be evaluated continuously with a minimum of two reviews in each semester.
- Continuous assessment shall focus on each student's contribution to the team activity, understanding, involvement, and responses during reviews.
- Oral examination shall be conducted by Internal and External Examiners. Students shall present and demonstrate their working model.

Distribution of Term Work Marks

2. Marks awarded by the Review Committee : 10 Marks

3. Quality of the Write-up : 05 Marks

Assessment Criteria

The overall work carried out by the team shall be assessed based on the following criteria:

1. Quality of survey and need identification of the product.
2. Clarity of problem definition based on identified needs.
3. Innovativeness in the proposed design.
4. Feasibility of the proposed design and selection of the best solution.
5. Cost effectiveness of the product.
6. Societal impact of the product.
7. Functioning of the working model as per stated requirements.
8. Effective use of standard engineering norms.
9. Contribution of each individual as a team member or team leader.
10. Clarity and quality of the write-up and technical paper prepared.

Guidelines for Assessment of Semester Reviews

- The write-up shall be prepared as per the guidelines prescribed by the department.
- The design and development of the product shall be assessed through presentation and demonstration of the working model before a panel of Internal and External Examiners, preferably from industry or research organizations having more than five years of experience and approved by the Head of the Institution.
- The presence of the External Examiner is desirable only during the second presentation in Semester VI.
- Students are compulsorily required to present the outline of the extended technical paper prepared by them during the final review in Semester VI.

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

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

Program: Common to all Programs (Group A / B)	T.Y. B.Tech.	Semester: V
Constitution of India (Non-credit) (RCP23XHS331)		

Prerequisite: NA

Course Objectives:

1. To provide basic information about Indian constitution.
2. To identify individual role and ethical responsibility towards society.
3. To understand human rights and its implications.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Have general knowledge and legal literacy and thereby to take up competitive examinations.	L1	Remember
CO2	Understand state and central policies, fundamental duties.	L2	Understand
CO3	Understand Electoral Process, special provisions.	L2	Understand
CO4	Understand powers and functions of Municipalities, Panchayats and Co-operative Societies.	L2	Understand
CO5	Understand Engineering ethics and responsibilities of Engineers.	L2	Understand
CO6	Understand Engineering Integrity & Reliability.	L2	Understand

Constitution of India (RCP23XHS331)
Course Contents

Unit-I — 02 Hrs.

Introduction to the Constitution of India: The Making of the Constitution and Salient features of the Constitution. Preamble to the Indian Constitution. Fundamental Rights its limitations.

Unit-II — 02 Hrs.

Directive Principles of State Policy: Relevance of Directive Principles, State Policy, Fundamental Duties. Union Executives – President, Prime Minister, Parliament, Supreme Court of India.

Unit-III — 03 Hrs.

State Executives: Governor, Chief Minister, State Legislature, High Court of State. Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86th & 91st Amendments.

Unit-IV — 02 Hrs.

Special Provisions: For SC ST, Special Provision for Women, Children & Backward Classes, Emergency Provisions.

Unit-V — 02 Hrs.

Human Rights: Meaning and Definitions, Legislation Specific Themes in Human Rights, Working of National Human Rights Commission in India, Powers and functions of Municipalities, Panchayats and Co-Operative Societies.

Unit-VI — 02 Hrs.

Scope and Aims of Engineering Ethics: Responsibility of Engineers and Impediments to Responsibility. Risks, Safety and liability of Engineers. Honesty, Integrity & Reliability in Engineering.

Text Books

1. Durga Das Basu, *Introduction to the Constitution of India* (Students Edition), Prentice Hall EEE, 19th/20th Edition, 2001.

Asia, 2003.

Reference Books

1. M.V. Pylee, *An Introduction to Constitution of India*, Vikas Publishing, 3rd Edition, 2003.
2. M. Govindarajan, S. Natarajan and V.S. Senthilkumar, *Engineering Ethics*, Prentice Hall of India Pvt. Ltd., New Delhi, 2013.
3. Brij Kishore Sharma, *Introduction to the Constitution of India*, PHI Learning Pvt. Ltd., New Delhi, 7th Edition, 2015.
4. Latest Publications of Indian Institute of Human Rights, New Delhi.

Website Resources

1. `www.nptel.ac.in`
2. `www.hnlu.ac.in`
3. `www.nspe.org`
4. `www.preservearticles.com`

Program: Information Technology	T.Y. B.Tech.	Semester: V
Data Processing and Optimization with Generative AI (RCP23ISC301)		

Coursera Course: Data Processing and Optimization with Generative AI

Link: **Data Processing and Optimization with Generative AI**

Number of hours: 20 Hrs., Intermediate level

About the Course:

This course focuses on advanced methods for data cleaning, preparation, and optimization using AI-assisted tools. You'll learn to generate synthetic data, address privacy concerns and data limitations in your projects. Discover how to leverage AI to identify and resolve complex data quality issues, ensuring your datasets are primed for analysis.

Course Outcomes:

COs	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Generate synthetic data using generative AI models.	L6	Create
CO2	Implement advanced data cleaning techniques with AI assistance.	L3	Apply
CO3	Optimize datasets for improved analysis efficiency.	L4	Analyze
CO4	Apply ethical considerations in data processing and synthetic data generation.	L3	Apply

Data Processing and Optimization with Generative AI (RCP23ISC301)
Course Contents

Unit-I Foundations of Data Processing 05 Hrs.

Introduction to Generative AI in data workflows, Data lifecycle – collection, cleaning, preprocessing, Feature engineering and dimensionality reduction, Data pipelines and workflow automation, Case study: end-to-end preprocessing in enterprise systems.

Unit-II Generative AI for Data Transformation 05 Hrs.

Generative models for synthetic data creation, Text-to-structured data conversion (LLMs for tabular tasks), Embeddings and vectorization for optimization tasks, Case study: augmenting datasets with generative AI, Discussion: benefits and limitations of generative preprocessing.

Unit-III Optimization Techniques with AI 05 Hrs.

Fundamentals of optimization (linear, nonlinear, heuristic), AI-driven optimization frameworks (reinforcement learning, metaheuristics), Resource allocation and scheduling with generative AI, Case study: optimizing cloud/network workloads, Comparative analysis: traditional vs AI-driven optimization.

Unit-IV Integration and Ethics 05 Hrs.

Integrating generative AI into enterprise workflows, Performance evaluation and monitoring of AI-driven pipelines, Ethical considerations: bias, transparency, and responsible AI, Best practices for scalable deployment, Reflection session – lessons learned & future directions.

Evaluation Scheme:

1. The identified courses shall focus on developing AI-related competencies and skills among students. Each selected course shall carry one (1) credit.
2. Faculty members shall act as mentors for the Coursera courses identified for various semesters of the program.
3. One faculty mentor shall be assigned to each division of the program for effective coordination and monitoring of this activity.
4. The assigned faculty mentor shall complete and review the course content before assigning the

5. The term work for these one-credit courses shall form a part of the Internal Continuous Assessment (ICA) component.

6. The Term work (ICA) component shall carry 40 marks.