# Shri Vile Parle Kelavani Mandal's

# Dwarkadas J. Sanghvi College of Engineering

*(Autonomous College Affiliated to the University of Mumbai)*

Scheme and Detailed Syllabus (DJS23)

# Third Year B. Tech

in

# INFORMATION TECHNOLOGY

(Semester V)

# Shri Vile Parle Kelavani Mandal's
# DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
(Autonomous College Affiliated to the University of Mumbai)
NAAC Accredited with "A" Grade (CGPA : 3.18)

**Scheme for Third Year Undergraduate Program in Information Technology: Semester V (Autonomous)**
**(Academic Year 2025-2026)**
**SEMESTER V**

| Sr. No. | Course Code | Course | Teaching Scheme | | | | Semester End Examination (A) | | | | | | Continuous Assessment (B) | | | Aggregate (A+B) | Credits Earned | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory (hrs) | Practical (hrs) | Tutorial (hrs) | Credits | Duration (hrs) | Theory | Oral | Practical | Oral & Practical | SEE Total (A) | TT | Term Work Total | CA Total (B) | | | |
| 1 | DJS23ICPC501 | Computer Networks | 3 | -- | -- | **3** | 2 | 60 | -- | -- | -- | **60** | 40 | -- | **40** | **100** | **3** | 4 |
| | DJS23ILPC501 | Computer Networks Laboratory | -- | 2 | -- | **1** | -- | -- | 25 | -- | -- | **25** | -- | 25 | **25** | **50** | **1** | |
| 2 | DJS23ICPC502 | Artificial Intelligence | 3 | -- | -- | **3** | 2 | 60 | -- | -- | -- | **60** | 40 | -- | **40** | **100** | **3** | 4 |
| | DJS23ILPC502 | Artificial Intelligence Laboratory | -- | 2 | -- | **1** | -- | -- | 25 | -- | -- | **25** | -- | 25 | **25** | **50** | **1** | |
| 3 | DJS23ICPC503 | Data Warehousing and Mining | 3 | -- | -- | **3** | 2 | 60 | -- | -- | -- | **60** | 40 | -- | **40** | **100** | **3** | 4 |
| | DJS23ILPC503 | Data Warehousing and Mining Laboratory | -- | 2 | -- | **1** | -- | -- | 25 | -- | -- | **25** | -- | 25 | **25** | **50** | **1** | |
| 4 | DJS23ICMD501 | Statistical Analysis | 3 | -- | -- | **3** | 2 | 60 | -- | -- | -- | **60** | 40 | -- | **40** | **100** | **3** | 4 |
| | DJS23ILMD501 | Statistical Analysis Laboratory | -- | 2 | -- | **1** | -- | -- | 25 | -- | -- | **25** | -- | 25 | **25** | **50** | **1** | |
| 5@ | DJS23ICPE501 | Advanced Data Structures and Algorithms | 3 | -- | -- | **3** | 2 | 60 | -- | -- | -- | **60** | 40 | -- | **40** | **100** | **3** | 4 |
| | DJS23ILPE501 | Advanced Data Structures and Algorithms Laboratory | -- | 2 | -- | **1** | -- | -- | 25 | -- | -- | **25** | -- | 25 | **25** | **50** | **1** | |
| | DJS23ICPE502 | Computer Graphics | 3 | -- | -- | **3** | 2 | 60 | -- | -- | -- | **60** | 40 | -- | **40** | **100** | **3** | |
| | DJS23ILPE502 | Computer Graphics Laboratory | -- | 2 | -- | **1** | -- | -- | 25 | -- | -- | **25** | -- | 25 | **25** | **50** | **1** | |
| | DJS23ICPE503 | Microcontroller and Embedded System | 3 | -- | -- | **3** | | 60 | -- | -- | -- | **60** | 40 | -- | **40** | **100** | **3** | |
| | DJS23ILPE503 | Microcontroller and Embedded System Laboratory | -- | 2 | -- | **1** | | -- | 25 | -- | -- | **25** | -- | 25 | **25** | **50** | **1** | |
| | DJS23ICPE504 | User-Centered Design | 3 | -- | -- | **3** | | 60 | -- | -- | -- | **60** | 40 | -- | **40** | **100** | **3** | |
| | DJS23ILPE504 | User-Centered Design Laboratory | -- | 2 | -- | **1** | | -- | 25 | -- | -- | **25** | -- | 25 | **25** | **50** | **1** | |
| 6 | DJS23IPSCX03 | Innovative Product Development III | -- | 2 | -- | **1** | -- | -- | -- | -- | 25 | **25** | -- | 25 | **25** | **50** | **1** | 1 |
| 7 | DJS23ICHSX09 | Constitution of India | 1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | - |
| | | **Total** | **16** | **12** | **--** | **21** | **10** | **300** | **125** | **--** | **25** | **450** | **200** | **150** | **350** | **800** | **21** | |

@ Any 1 elective course

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*Continuous Assessment (A):*

| Course | Assessment Tools | Marks | Time (mins) |
|---|---|---|---|
| Theory | a. Term Test 1 (based on 40 % syllabus) | 15 | 45 |
| | b. Term Test 2 (on the next 40 % syllabus) | 15 | 45 |
| | c. Assignment / course project / group discussion / presentation / quiz/ any other. | 10 | -- |
| | Total marks (a + b + c) | 40 | -- |
| Audit course | Performance in the assignments / quiz / power point presentation / poster presentation / group project / any other tool. | -- | As applicable |
| Laboratory | Performance in the laboratory and documentation. | 25 | |
| Tutorial | Performance in each tutorial & / assignment. | 25 | |
| Laboratory &Tutorial | Performance in the laboratory and tutorial. | 50 | |

The final certification and acceptance of term work will be subject to satisfactory performance upon fulfilling minimum passing criteria in the term work / completion of audit course.

*Semester End Assessment (B):*

| Course | Assessment Tools | Marks | Time(hrs.) |
|---|---|---|---|
| Theory / * Computer based | Written paper based on the entire syllabus. | 60 | 2 |
| | * Computer based assessment in the college premises. | | |
| Oral | Questions based on the entire syllabus. | 25 | As applicable |
| Practical | Performance of the practical assigned during the examination and the output / results obtained. | 25 | 2 |
| Oral & Practical | Project based courses - Performance of the practical assigned during the examination and the output / results obtained. Based on the practical performed during the examination and on the entire syllabus. | As per the scheme | 2 |

**Program: B. Tech**  **Information Technology**  **T.Y B. Tech  Semester: V**

**Course: Computer Networks (DJS23ICPC501)**
**Course: Computer Networks Laboratory (DJS23ILPC501)**

**Pre-requisite:** 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:** On successful completion of this course, students should be able to:

1. Describe the fundamental components of computer networks and layered reference models.
2. Analyse various concerns at different layers in reference models using suitable techniques.

| Detailed Syllabus: (unit wise) | | |
|---|---|---|
| **Unit** | **Description** | **Duration** |
| 1 | **Introduction:** Network devices, Network Types: LAN, MAN, WAN, Network topology, OSI Reference model, TCP/IP suite, Comparison of OSI and TCP/IP. | **03** |
| 2 | **Physical Layer:** Transmission Media: Guided Media- Twisted pair, Coaxial, Fiber optics, Unguided Media (Wireless): Radio Waves, Microwave, Bluetooth and Infrared. | **02** |
| 3 | **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. | **09** |
| 4 | **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. | **09** |
| 5 | **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. | **10** |
| 6 | **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. | **06** |

**List of Laboratory 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 errors free codeword transmission.
10. Implement Hamming code implementation.

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

**Books Recommended:**

*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, Forouzan Mosharrat, "Computer Networks A Top down Approach", Special Indian Edition, McGraw Hill education, 2017.
2. James F. Kurose, 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, 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

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**Course: Artificial Intelligence (DJS23ICPC502)**
**Course: Artificial Intelligence Laboratory (DJS23ILPC502)**

**Pre-requisite:** 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:** On successful completion of this course, students should be able to:

1. Apply search strategies for solving problems.
2. Draw inferences using knowledge.
3. Analyse various learning models.
4. Interpret intelligent systems for problem solving.

| Detailed Syllabus: (unit wise) | | |
|---|---|---|
| **Unit** | **Description** | **Duration** |
| 1 | **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. <br> **Agents and Environments:** Concept of rationality, Nature of Environment, Structure of Agents, Types of Agents, PEAS representation for an Agent. <br> **Problem Solving:** Problem Solving Agent, Representing and formulating real-world problems as state spaces for AI-driven problem solving. | 05 |
| 2 | **Uninformed Search:** Breadth First Search (BFS), Depth First Search (DFS), Depth Limited Search, Depth First Iterative Deepening (DFID). <br> **Informed Search:** Uniform Cost Search, Greedy Best First Search, A* Search, AO* Search, Memory bounded heuristic Search. | 08 |
| 3 | **Local Search Algorithms and Optimization:** Hill Climbing search and its variations: simple, steepest ascent, stochastic; Genetic algorithms: Basic GA operators, working, GA applications. <br> **Adversarial Search:** Examples of games as search problems, Minimax algorithm, Alpha-Beta Pruning. <br> **Planning:** Planning problems, Algorithms for Classical Planning, Heuristics for Planning, Hierarchical Planning, Planning and Acting in Nondeterministic Domains. | 08 |
| 4 | **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. <br> **Uncertain Knowledge and Reasoning:** Representing knowledge in an uncertain domain, The semantics of Bayesian Belief Network, Inference in Belief Network. | 08 |
| 5 | **Types of Learning:** Supervised, Unsupervised, Reinforcement and Inductive Learning. <br> **Artificial Neural Networks:** Supervised and unsupervised Neural networks, Perceptron, Feed Forward Network, Backpropagation Algorithm. | 06 |
| 6 | **Expert System:** Knowledge Representation in ES, Expert System Shells, ES Architecture, Phases in building Expert Systems, Knowledge Acquisition of an Expert System, Applications of Expert Systems, Examples of Expert Systems, Case Study on MYCIN Rule based system. | 04 |

**List of Laboratory 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/Python).
11. Implementation on any AI game: Wumpus world, Tic-tac-toe, 8-Queens Problem.
12. Case study of an AI Application.

Any 8 experiments based on syllabus may be included, which would help the learner to understand topic/concept

**Books Recommended:**

*Textbooks:*

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. Principles of Soft Computing, 3rd Edition by S.N. Sivanandam and S.N. Deepa, published by Wiley in 2019.
3. Han Kamber, "Data Mining Concepts and Techniques", 3rd Edition, Morgann 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

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**Program: B. Tech**   **Information Technology**   **T.Y B. Tech  Semester: V**

**Course: Data Warehousing and Mining (DJS23ICPC503)**
**Course: Data Warehousing and Mining Laboratory (DJS23ILPC503)**

**Pre-requisite: Databases 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:** On successful completion of this course, students should be able to:
1. Design data warehouse models using dimension-modeling techniques.
2. Analyze the data using appropriate Online Analytical Processing (OLAP) model.
3. Apply appropriate data mining techniques on data sets to retrieve relevant information

| Detailed Syllabus: (unit wise) | | |
|---|---|---|
| **Unit** | **Description** | **Duration** |
| 1 | **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. | 08 |
| 2 | **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, Roll-up, Slice, Dice, Pivot (Rotation), OLAP Models: MOLAP, ROLAP, HOLAP – Comparative Analysis. | 06 |
| 3 | **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, E-Commerce, Data Exploration Techniques: Attribute Types, Statistical Summaries, Visualization Tools: Matplotlib, Seaborn, Tableau, Data Preprocessing: Data Cleaning, Integration, Reduction, Transformation, Discretization. | 06 |
| 4 | **Classification and Clustering 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), Cross-validation, Bootstrapping, Holdout, Ensemble Methods: Bagging, Boosting, AdaBoost, Random Forests, Gradient Boosting, XGBoost, LightGBM. **Clustering:** K-means, K-medoids, Hierarchical (Agglomerative, Divisive), Clustering Evaluation. | 08 |

| 5 | **Mining Frequent Patterns, Association, and Correlations:**<br>Market Basket Analysis, Frequent, Closed, Maximal Itemsets, Support, Confidence, Apriori Algorithm and Optimizations.<br>**Association Rule Mining**: Lift, FP-Growth Algorithm. | **05** |
|---|---|---|
| 6 | **Spatial and Web Mining:**<br>Spatial vs. Traditional Data Mining, Spatial Data Types and Structures: Raster, Vector, Quad-trees, R-trees.<br>Spatial Association Rules and Clustering: DBSCAN, CLARANS.<br>**Web Mining:** Content, Structure, Usage, Web Mining Tools: Beautiful Soup, Scrapy, Google Analytics, Applications in Search Engine Optimization (SEO), Personalization, Social Network Analysis. | **06** |

**List of Laboratory 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, sklearn) 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), Naïve Bayes classifier
   - Use tools like scikit-learn or WEKA for comparison.
7. Clustering Algorithm Implementation
   - Implement: K-Means, Hierarchical Clustering (Single/Complete/Average Linkage, DBSCAN
8. Association Rule Mining Implementation
   - Implement Apriori Algorithm, FP-Growth Algorithm
9. Advanced Web Mining Algorithms
   - Implement PageRank Algorithm to simulate web page importance, 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.
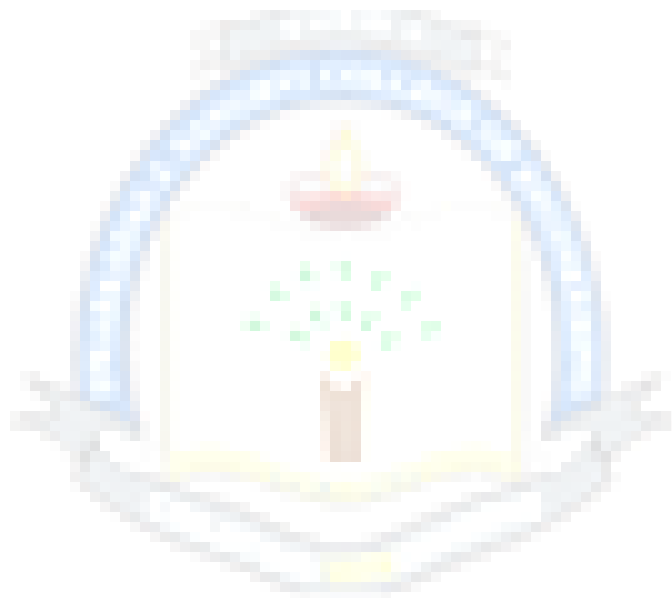
**Books Recommended:**

*Text Books:*

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

*Reference Books:*

1. P. N. Tan, M. Steinbach, 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

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**Course: Statistical Analysis (DJS23ICMD501)**
**Course: Statistical Analysis Laboratory (DJS23ILMD501)**

**Pre-requisite:** 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:** On successful completion of this course, student should be able to:

1. Interpret data using Descriptive Statistics.
2. Draw the inferences by applying appropriate statistical test on the given data.

| Detailed Syllabus: (unit wise) | | |
|---|---|---|
| **Unit** | **Description** | **Duration** |
| 1 | **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. | **02** |
| 2 | **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. | **03** |
| 3 | **Statistical Inference About One population:** 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. | **06** |
| 4 | **Statistical Inference About Two Population:** 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. | **06** |
| 5 | **Analysis of Variance:** Introduction to Design of Experiments, One-way ANOVA, The Randomized Block Design, Two-way ANOVA, MANOVA (one way). | **10** |
| 6 | **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. | **12** |

**List of Laboratory Experiments:**

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

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, 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 analysing 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 method for comparing the central tendency of two groups (either related or independent).
10. To determine randomness of length of data using Runs test.

**Books Recommended:**

*Textbooks:*
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, 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, & Friedman, J., "The Element of Statistical Learning, Data mining, Inference and Prediction",3rd Edition, New York: Springer Series in Statistics, 2011.

**NPTEL Courses:**

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

| Prepared by | Checked by | Head of the Department | Vice Principal | Principal |

**Course: Advanced Data Structures and Algorithms (DJS23ICPE501)**
**Course: Advanced Data Structures and Algorithms Laboratory (DJS23ILPE501)**

**Pre-requisite:** 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:** On successful completion of this course, the student should be able to:
1. Solve a problem using appropriate data structure and algorithm.
2. Perform performance analysis of the chosen algorithm.

**Detailed Syllabus: (unit wise)**

| Unit | Description | Duration |
|------|-------------|----------|
| 1 | **Analysis of Data Structures:** Amortized Complexity- Aggregate Method, Accounting Method, Potential Method. <br> **Data Structures for String:** Tries and Compressed Tries, Suffix Tree and Suffix array. <br> **Spatial Data Structures:** Interval, Segment, Range, Priority Search Tree, KD Tree, R Tree with application. | 08 |
| 2 | **Heaps:** Heap ordered Tree, Leftist Heap, Skew Heap, Binomial Heap, Fibonacci Heaps, Treap. <br> **Balanced Search Tree:** Height Balance and Weight Balance Trees, Red-Black Tree, Splay Tree, Skip List, Randomized BST, Tango Tree with application. | 10 |
| 3 | **Hash Tables:** Universal Families of Hash Functions, Perfect Hash Functions, Cuckoo Hashing, <br> **Probabilistic Data Structures:** Bloom filters, Count-Min Sketch, HyperLogLog. Locality Sensitive Hashing, Hash Tree (Merkle Tree) with application. | 06 |
| 4 | **Probabilistic and Randomized Algorithm:** Probabilistic approach to algorithm and Randomized Analysis, Indicator Random Variable (IRV), Randomized Quick Sort, Analysis of Hiring Problem, Las Vegas and Monte Carlo algorithm. | 05 |
| 5 | **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. | 06 |
| 6 | **Computational Geometry:** Line Segment Properties, Convex Hull Graham's scan algorithm, Conic Programming <br> **Online Algorithms:** Competitive Ratio, K-Server. | 04 |

**List of Laboratory Experiments:**

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.
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 like k-d tree or quadtree to store and search multidimensional points.

3. Experiment to implement a balanced search tree such as Red-Black Tree performing various operations like insertion and deletion.
4. Experiment to perform various operations like insert, delete, and extract-min/max on heap data structure.
5. Experiment to explore and implement data structures like Trie, Suffix Array, or Suffix Trees for efficient string manipulation and 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.

**Books Recommended:**

*Text books:*
1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, "Introduction to Algorithms", 3rd Edition, The MIT Press, 2009.
2. Peter Brass, "Advanced Data Structures", 1st Edition, Cambridge University Press, 2008.
3. Suman Saha, 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, Prabhakar Raghavan, Randomized Algorithm, Cambridge University
4. Harsh Bhasin, Algorithms Design and Analysis, Oxford, 2015.

**NPTEL Courses:**

1. http://nsm.iitm.ac.in/cse/services/adv_dsa/
2. https://nptel.ac.in/courses/106102064
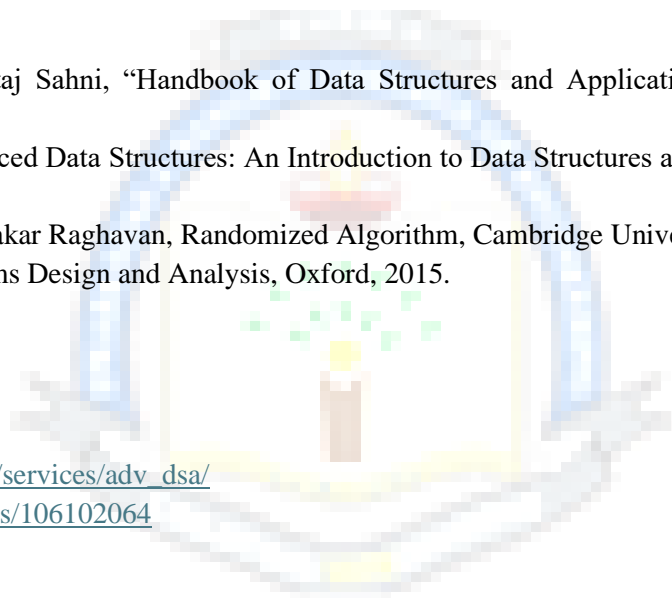
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**Program: B. Tech**     **Information Technology**     **T.Y B. Tech  Semester V**

**Course: Computer Graphics (DJS23ICPE502)**
**Course: Computer Graphics Laboratory (DJS23ILPE502)**

**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:** On successful completion of this course, student should be able to:
1. Implement scan conversion algorithms for lines, circles, curves and polygon.
2. Apply appropriate Transformations on a given object.
3. Design an animation sequence.

| Detailed Syllabus: (unit wise) | | |
|---|---|---|
| **Unit** | **Description** | **Duration** |
| 1 | **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. <br> Scan Conversion of - point, line using Digital differential analyser & Bresenham's algorithm, circle using midpoint approach and Bresenham. <br> **Polygons:** Concave, Convex, Inside/Outside Test <br> **Area Filling:** Scan line Polygon Fill Algorithm, Boundary Fill and Flood Fill algorithm | **08** |
| 2 | **Two Dimensional Transformations:** Basic Geometrical 2D transformations- Translation, Rotation, Scaling, Reflection, Shear, their homogeneous Matrix representation, and Composite transformation. <br> **Three Dimensional Transformations:** Translation, Rotation, Scaling, Rotation about an arbitrary axis | **07** |
| 3 | **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. <br> Three-Dimensional Viewing Pipeline, Viewing Transformation, Projections: Parallel (Oblique and Orthographic), Perspective (one Point, two point and three point) | **07** |
| 4 | **Light, Color, Shading and Hidden Surfaces:** Properties of Light, Color Models - CIE chromaticity diagram, RGB, HSV, CMY <br> **Illumination Models:** Ambient Light, Diffuse reflection, specular reflection, Phong Model, combined diffuse and specular reflections with multiple light sources, Warn Model <br> **Shading Algorithms:** Introduction to Rendering, Halftone, Gouraud and Phong Shading <br> **Hidden Surfaces:** Introduction, Back face detection and removal, Algorithms: z buffer, Painter's algorithm, Area Subdivision (Warnock) | **08** |
| 5 | **Curves:** Introduction to curves, interpolation and approximation, Blending Function, Bezier and B-spline curves <br> **Fractals:** Introduction, Classification, Fractal Generation- Snowflake, Sierpinski Gasket, Koch Curve, Cantor Middle-Thirds Set, Hilbert Curve, Applications of Fractals. | **05** |

| 6 | **Introduction to Animation:** Key Frame Animation, Animation Sequence, Motion Control Methods, Morphing, Warping (only Mesh Warping). | **04** |

**List of Laboratory Experiments:**
1. Implementation of Line Drawing algorithms: DDA, Bresenham and using them generate line with different styles like dotted, dashed, centered and thick line.
2. Implementation of Circle generation algorithms and using it generate concentric circles.
3. Implementation of Area Filling Algorithm: 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. Implement Line clipping algorithms.
7. Implementation of Polygon Clipping Algorithm
8. Generate a snowflake using fractals.
9. 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.

**Books Recommended:**

*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, 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 Open GL", 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, Stephen M. Kelley, "Computer Graphics using Open GL", 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

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**Course: Microcontroller and Embedded System (DJS23ICPE503)**
**Course: Microcontroller and Embedded System Laboratory (DJS23ILPE503)**

**Pre-requisite:** 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:** On successful completion of this course, students should be able to:
1. Develop embedded applications using 8051 and ARM7 microcontrollers.
2. Develop real-time systems using RTOS principles.
3. Develop real-world sensor-based applications using embedded target boards.

| Detailed Syllabus: (unit wise) | | |
|---|---|---|
| Unit | Description | Duration |
| 1 | **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. | 08 |
| 2 | **Interfacing with 8051 Microcontroller:** Interfacing ADC, DAC, Stepper motor, LCD, KBD matrix, 8255 PPI | 05 |
| 3 | **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 | 06 |
| 4 | **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 | 10 |
| 5 | **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 | 07 |
| 6 | **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; | 03 |

| | Raspberry pi; ARM Cortex Processors; Intel Galileo boards; Sensors and Interfacing: Temperature, Pressure, Humidity | |
|---|---|---|

**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, Finding the largest element in an array.
3. Arithmetic Instructions - Addition/subtraction, multiplication and division, Boolean & Logical Instructions (Bit manipulations).
4. Conditional CALL & RETURN.
5. Simple Calculator using 6 digits seven segment displays and Hex Keyboard interface to 8051.
6. Alphanumeric LCD panel and Hex keypad input 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, 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 Stacks.
14. Any practical application using Arduino.
15. Any practical application using Raspberry Pi.
16. Case Study on RTOS.

**Books Recommended:**

*Textbooks:*

1. M. A. Mazidi, J. G. Mazidi, 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", Reprint Edition, 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 Cookbok", 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

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**Course: User Centered Design (DJS23ICPE504)**
**Course: User Centered Design Laboratory (DJS23ILPE504)**

**Pre-requisite:** 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:** On successful completion of this course, students should be able to:

1. Identify user requirements.
2. Design UI/UX using appropriate methods.
3. Generate test reports using usability testing.

| Detailed Syllabus: (unit wise) | | |
|---|---|---|
| **Unit** | **Description** | **Duration** |
| 1 | **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. <br> **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. | **04** |
| 2 | **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. <br> **Understanding User Problem**: 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). <br> **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. <br> **User research methodologies**: Qualitative and Quantitative analysis, user interviews, focused group discussion, expert reviews, tools for user research. | **08** |
| 3 | **Interaction Design:** What is Ideation? How to ideate the problem definition? Ideation Techniques (mind map, SCAMPER, Crazy-8, Brain-writing, NABC). <br> **Cognitive Psychology Basics:** How users perceive and process information, Mental models and their impact on design. <br> **Visual Hierarchy & 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. <br> **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). <br> **Functional Layout Design:** Z-Pattern, F-Pattern, and Browsing vs. Searching vs. Discovery, Page Framework, The Fold, The Axis of Interaction Forms | **08** |

| | | |
|---|---|---|
| 4 | **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.<br>**Usability Testing:** Learning the process of conducting usability tests for digital products, Usability testing methodologies – task-based user testing, A/B testing, lab-based user testing, remote user testing, moderated & unmoderated user testing. | **07** |
| 5 | **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.<br>**UX Writing: Language, Directives, & Jargon:** Microcopy & User Guidance: Writing clear, actionable, and concise copy for buttons, instructions, and error messages.<br>**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. | **08** |
| 6 | **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 | **04** |

**List of Laboratory Experiments:**

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

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 their behaviors, needs, and feelings.
3. User Personas Creation: Develop detailed user personas based on collected data to represent the core user groups.
4. Identify the root causes of user pain points by analyzing data collected during the empathy phase and develop clear problem statements based on user needs and insights.
5. Ideate: Conduct a brainstorming session where team members ideate and share ideas without restrictions.
6. Apply the Scamper method to enhance idea generation.
7. Prototyping: Create low and high-fidelity prototypes to represent the proposed solution and gather early feedback.
8. Conduct usability testing on the prototype to identify potential improvements.
9. Validation through User Feedback: Validate the prototype's effectiveness and user satisfaction by testing in real-world conditions.
10. Assess the ethical considerations in design projects and explore leadership strategies in managing design teams.

**Books Recommended:**

*Textbooks:*

1. Garrett and J. J., "The Elements of User Experience: User-Centered Design for the Web and Beyond", 2nd edition New Riders Publishing, 2011.
2. Yablonski and J., "Laws of UX: Using Psychology to Design Better Products & Services", 2nd edition, O'Reilly Media, 2020.
3. Rosenfeld, L., Morville and 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., 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

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**Course: Innovative ProductDevelopment III (DJS23IPSCX03)**

**Pre-requisite:** NA

**Course Objectives**:
1. To acquaint the students with the process of identifying the need (considering a societal requirement) and ensuring that a solution is found out to address the same by designing and developing an innovative product.
2. To familiarize the students with the process of designing and developing a product while they work as part of a team.
3. To acquaint the students with the process of applying basic engineering fundamentals, so as to attempt at the design and development of a successful value-added product.
4. To inculcate the basic concepts of entrepreneurship and the process of self-learning and research required to conceptualize and create a successful product.

**Course Outcomes:** On successful completion of this course, student should be able to:
1. Identify the requirement for a product based on societal/research needs.
2. Apply knowledge and skills required to solve a societal need by conceptualizing a product, especially while working in a team.
3. Use standard norms of engineering concepts/practices in the design and development of an innovative product.
4. Draw proper inferences through theoretical/experimental/simulations and analyses the impact of the proposed method of design and development of the product.
5. Develop interpersonal skills, while working as a member of the team or as the leader.
6. Demonstrate capabilities of self-learning as part of the team, leading to life-long learning, which could eventually prepare themselves to be successful entrepreneurs.
7. Demonstrate product/project management principles during the design and development work and also excel in written (Technical paper preparation) as well as oral communication.

**Guidelines for the proposed product design and development:**
- Students shall convert the solution designed in semester 3 and 4 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 try and publish the extended technical paper, either in the institute journal, "Techno Focus: Journal for Budding Engineers" or at a suitable publication, approved by the department research committee/ Head of the department.
- Faculty supervisor may provide inputs to students during the entire span of the activity, spread over 2 semesters, wherein the main focus shall be on self-learning.
- A record in the form of an activity log-book is to be prepared by each team, wherein the team can record weekly progress of work. The guide/supervisor should verify the recorded notes/comments and approve the same on a weekly basis.
- The focus should be on self-learning, capability to design and innovate new products as well as on developing the ability to address societal problems. Advancement of entrepreneurial capabilities and quality development of the students through the year long course should ensure that the design and development of a product of appropriate level and quality is carried out, spread over two semesters, i.e. during the semesters V and VI.

**Guidelines for Assessment of the work:**

- The review/ progress monitoring committee shall be constituted by the Head of the Department. The progress of design and development of the product is to be evaluated on a continuous basis, holding a minimum of two reviews in each semester.
- In the continuous assessment, focus shall also be on each individual student's contribution to the team activity, their understanding and involvement as well as responses to the questions being raised at all points in time.
- Oral examination should be conducted by Internal and External examiners. Students have to give presentation and demonstration on their working model
- The distribution of marks for term work shall be as follows:
    1. Marks awarded by the supervisor based on log-book: 10
    2. Marks awarded by review committee: 10
    3. Quality of the write-up: 05

The overall work done by the team shall be assessed based on the following criteria;

1. Quality of survey/ need identification of the product.
2. Clarity of Problem definition (design and development) based on need.
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 member or the team leader.
10. Clarity on the write-up and the technical paper prepared.

- The semester reviews (V and VI) may be based on relevant points listed above, as applicable.

**Guidelines for Assessment of Semester Reviews:**

- The write-up should be prepared as per the guidelines given by the department.
- The design and the development of the product shall be assessed through a presentation and demonstration of the working model by the student team to a panel of Internal and External Examiners, preferably from industry or any research organizations having an experience of more than five years, approved by the Head of the Institution. The presence of the external examiner is desirable only for the 2nd 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.

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**Course: Constitution of India (Non-credit) (DJS23ICHSX09)**

**Pre-requisite:** 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:** On successful completion of this course, student should be able to:
1. Have general knowledge and legal literacy and thereby to take up competitive examinations.
2. Understand state and central policies, fundamental duties.
3. Understand Electoral Process, special provisions.
4. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies.
5. Understand Engineering ethics and responsibilities of Engineers.
6. Understand Engineering Integrity & Reliability.

| Constitution of India (DJS23ICHSX09) | | |
|---|---|---|
| **Unit** | **Syllabus Content** | **Duration** |
| 1 | **Introduction to the Constitution of India** <br> The Making of the Constitution and Salient features of the Constitution. <br> Preamble to the Indian Constitution. <br> Fundamental Rights & its limitations. | **02** |
| 2 | **Directive Principles of State Policy:** <br> Relevance of Directive Principles, State Policy, Fundamental Duties. <br> Union Executives – President, Prime Minister, Parliament, Supreme Court of India. | **02** |
| 3 | **State Executives:** <br> Governor, Chief Minister, State Legislature, High Court of State. <br> Electoral Process in India, Amendment Procedures, $42^{nd}$, $44^{th}$, $74^{th}$, $76^{th}$, $86^{th}$ & $91^{st}$ Amendments. | **03** |
| 4 | **Special Provisions:** <br> For SC & ST, Special Provision for Women, Children & Backward Classes, Emergency Provisions. | **02** |
| 5 | **Human Rights:** <br> 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. | **02** |
| 6 | **Scope & Aims of Engineering Ethics**: <br> Responsibility of Engineers and Impediments to Responsibility. <br> Risks, Safety and liability of Engineers. <br> Honesty, Integrity & Reliability in Engineering. | **02** |
| | **Total hours** | **13** |

**Books Recommended:**

*Text books:*
1. Durga Das Basu, *"Introduction to the Constitution on India",* (Students Edition) Prentice Hall EEE, 19th / 20th Edition, 2001.
2. Charles E. Haries, Michael S. Pritchard and Michael J. Robins, *"Engineering Ethics",* Thompson Asia, 2003.

*Reference Books:*
1. M. V. Pylee, *"An Introduction to Constitution of India",* Vikas Publishing, 3rd Edition, 2003.
2. M. Govindarajan, S. Natarajan, 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

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