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)

Second Year B.Tech

in

INFORMATION TECHNOLOGY

(Semester III and IV)

Revision: 3 (2023)

With effect from the Academic Year: 2024-2025

1st July 2024

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 Second Year Undergraduate Program in Information Technology: Semester III (Autonomous)
(Academic Year 2024-2025)
SEMESTER III

Sr. No.	Course Code	Course	Teaching Scheme				Semester End Examination (A)									Aggregate (A+B)	Credits Earned	
			Theory (hrs)	Practical (hrs)	Tut (hrs)	Credits	Duration (hrs)	Theory	Oral	Pract	Oral & Pract	SEE Total (A)	TT	Term Work Total	CA Total (B)			
1	DJS23ICPC301	Data Structures	3	--	--	**3**	2	60	--	--	--	**60**	40	--	**40**	**100**	**3**	**4**
	DJS23ILPC301	Data Structures Laboratory	--	2	--	**1**	--	--		--	25	**25**	--	25	**25**	**50**	**1**	
2	DJS23ICPC302	Database Management System	3	--	--	**3**	2	60	--	--	--	**60**	40	--	**40**	**100**	**3**	**4**
	DJS23ILPC302	Database Management System Laboratory	--	2	--	**1**	--	--		--	25	**25**	--	25	**25**	**50**	**1**	
3	DJS23ILPC303	Web Programming Laboratory	--	2	--	**1**	--	--	--	--	25	**25**	--	25	**25**	**50**	**1**	**1**
4	DJS23ICMD301	Operating System	2	--	--	**2**	2	60	--	--	--	**60**	40	--	**40**	**100**	**2**	**2**
5	DJS23IPSCX01	Innovative Product Development I	--	2	--	**1**	--	--	--	--	--	--	--	25	**25**	**25**	**1**	**1**
6	DJS23ILHSX06	Design Thinking Laboratory	--	2	--	**1**	--	--	--	--	--	--	--	25	**25**	**25**	**1**	**1**
7	DJS23ICHSX08	Universal Human Values	2	--	--	**2**	2	60	--	--	--	**60**	40	--	**40**	**100**	**2**	**2**
	DJS23ITHSX08	Universal Human Values Tutorial	--	--	1	**1**	--	--	--	--	--	--	--	25	**25**	**25**	**1**	**1**
8	DJS23ILELX11	Community Engagement Service	--	2	--	**1**	-	--	--	--	--	--	--	25	**25**	**25**	**1**	**1**
9	DJS23OCOE301	Product Lifecycle Management	3	--	--	**3**	2	60	--	--	--	**60**	40	--	**40**	**100**	**3**	**3**
	DJS23OCOE302	Management Information System	3	--	--	**3**	2	60	--	--	--	**60**	40	--	**40**	**100**		
	DJS23OCOE303	Operations Research	3	--	--	**3**	2	60	--	--	--	**60**	40	--	**40**	**100**		
	DJS23OCOE304	Personal Finance Management	3	--	--	**3**	2	60	--	--	--	**60**	40	--	**40**	**100**		
	DJS23OCOE305	Public Systems & Policies	3	--	--	**3**	2	60	--	--	--	**60**	40	--	**40**	**100**		
	DJS23OCOE306	Fundamentals of Biomedical Instruments	3	--	--	**3**	2	60	--	--	--	**60**	40	--	**40**	**100**		
	DJS23OCOE307	IPR & Patenting	3	--	--	**3**	2	60	--	--	--	**60**	40	--	**40**	**100**		
	DJS23OCOE308	Entrepreneurship and Startup Ecosystem	3	--	--	**3**	2	60	--	--	--	**60**	40	--	**40**	**100**		
		Total	**13**	**12**	**1**	**20**	**10**	**300**	**00**	**--**	**75**	**375**	**200**	**175**	**375**	**750**	**20**	

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Scheme for Second Year Undergraduate Program in Information Technology: Semester IV (Autonomous)

(Academic Year 2024-2025)

SEMESTER IV

Sr No.	Course Code	Course	Teaching Scheme				Semester End Examination (A)									Aggregate (A+B)	Credits Earned	
			Theory (hrs)	Practical (hrs)	Tut (hrs)	Credits	Duration (hrs)	Theory	Oral	Pract	Oral & Pract	SEE Total (A)	TT	Term Work Total	CA Total (B)			
1	DJS23ICPC401	Applied Mathematics	3	--	--	**3**	2	60	--	--	--	**60**	40	--	**40**	**100**	**3**	**4**
	DJS23ITPC401	Applied Mathematics Tutorial	--	--	1	**1**	--	--	--	--	--	**--**	--	25	**25**	**25**	**1**	
2	DJS23ICPC402	Design and Analysis of Algorithms	3	--	--	**3**	2	60	--	--	--	**60**	40	--	**40**	**100**	**3**	**4**
	DJS23ILPC402	Design and Analysis of Algorithms Laboratory	--	2	--	**1**	--	--	--	--	25	**25**	--	25	**25**	**50**	**1**	
3	DJS23ILPC403	Python Laboratory	--	2	--	**1**	--	--	--	--	25	**25**	--	25	**25**	**50**	**1**	**1**
4	DJS23ILPC404	Object Oriented Design Laboratory	--	2	--	**1**	--	--	--	--	25	**25**	--	25	**25**	**50**	**1**	**1**
5	DJS23ICMD401	Formal Language and Automata	2	--	--	**2**	2	60	--	--	--	**60**	40	--	**40**	**100**	**2**	**3**
	DJS23ITMD401	Formal Language and Automata Tutorial	--		1	**1**	--	--	--	--	--	**--**	--	25	**25**	**25**	**1**	
6	DJS23IPSCX02	Innovative Product Development II	--	2	--	**1**	--	--	--	--	--	**--**	--	25	**25**	**25**	**1**	**1**
7	DJS23ITHSX05	Professional Business Communication Tutorial	--	--	2	**2**	-	--	--	--	--	**--**	--	50	**50**	**50**	**2**	**2**
8	DJS23ICHSX07	Economics & Financial Management	2	--	--	**2**	2	60	--	--	--	**60**	40	--	**40**	**100**	**2**	**2**
9	DJS23OCOE401	Project Management	3	--	--	**3**	2	60	--	--	--	**60**	40	--	**40**	**100**	**3**	**3**
	DJS23OCOE402	Cyber Security, Policies and Laws	3	--	--	**3**	2	60	--	--	--	**60**	40	--	**40**	**100**		
	DJS23OCOE403	Advanced Operations Research	3	--	--	**3**	2	60	--	--	--	**60**	40	--	**40**	**100**		
	DJS23OCOE404	Corporate Finance	3	--	--	**3**	2	60	--	--	--	**60**	40	--	**40**	**100**		
	DJS23OCOE405	Corporate Social Responsibility	3	--	--	**3**	2	60	--	--	--	**60**	40	--	**40**	**100**		
	DJS23OCOE406	Bio Informatics	3	--	--	**3**	2	60	--	--	--	**60**	40	--	**40**	**100**		

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	DJS23OCOE407	Human Resource Management	3	--	--	**3**	2	60	--	--	--	**60**	40	--	**40**	**100**		
	DJS23OCOE408	Digital Marketing Management	3	--	--	**3**	2	60	--	--	--	**60**	40	--	**40**	**100**		
	DJS23OCOE409	Logistics & Supply Chain Management	3	--	--	**3**	2	60	--	--	--	**60**	40	--	**40**	**100**		
		Total	**13**	**08**	**04**	**21**	**10**	**300**	**--**	**--**	**75**	**375**	**200**		**400**	**775**	**21**	

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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 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	

Course	Assessment Tools	Marks	Time(hrs.)
Theory / * Computer based	Written paper based on the entire syllabus. / * Computer-based assessment in the college premises.	60	2
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

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Program: Information Technology **S.Y B.Tech Semester: III**

Course: Data Structures (DJS23ICPC301)
Course: Data Structures Laboratory (DJS23ILPC301)

Pre-requisite: Knowledge of C Programming

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

Course Outcomes: On successful completion of this course, student should be able to:

1. Analyze the algorithms based on time and space complexity.
2. Solve the problem using appropriate data structure.
3. Implement appropriate searching algorithm for a given problem.
4. Implement appropriate sorting algorithm for a given problem.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Basics of Algorithms:** Algorithms, Characteristics of an Algorithm, Time and Space Complexities, Order of Growth functions, Preliminary Asymptotic Notations. Data Structures: Introduction, Need of Data Structures, Types of Data Structures, Abstract Data Types (ADT)	04
2	**Linear Data Structures** – **LIST**: List as an ADT, Array-based implementation, Linked List implementation, Singly linked lists, Circularl linked lists, Doubly-linked lists, All operations (Insertion, Deletion, Merge, Traversal, etc.) and their analysis, Applications of linked lists - (Polynomial Addition).	06
3	**Linear Data Structure – STACK:** Stack as an ADT, Operations, Array and Linked List representation of Stack, Applications – Reversing data, Conversion of Infix to prefix and postfix expression, Evaluation of postfix and prefix expressions, Balanced parenthesis, etc. **Linear Data Structure – QUEUE:** Queue as an ADT, Operations, Implementation of Linear Queue, Circular and Priority Queue using arrays and Linked List, DEQueue **Applications** – Queue Simulation	07
4	**Non-Linear Data Structure – TREES**: Tree Terminologies, Tree as an ADT, Binary Tree - Operations, Tree Traversals, Binary Search Tree (BST) - Operations, Expression Trees **Height Balanced Tree:** AVL Tree: Creation, insertion and deletion. **Heap-** Various Operations on heap and it's applications.	08
5	**Non-Linear Data Structure – GRAPHS:** Graph Terminologies, Types of Graphs, Representation of Graph using arrays and Linked List, Breadth-First Search (BFS), Depth–First Search (DFS) **Applications of Graphs -**Topological sorting.	06
6	**Searching-** Linear Search, Binary Search and Fibonacci search. **Sorting**: Bubble Sort, Selection Sort, Heap Sort, Insertion Sort, Radix Sort, Merge Sort, Quick Sort. Analysis of Searching and Sorting Techniques. **Hashing**: Hash Functions, Overflow handling, Collision & Collision Resolution Techniques, Linear hashing, hashing with chaining, Separate Chaining, Open Addressing, Rehashing and Extendible hashing.	08

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List of Tutorials/ Experiments (Any 10 to 12)

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

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

Books Recommended:

Text books:

1. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, “Fundamentals of Data Structures in C”, 2nd Edition, W. H. Freeman and Company, 2008.
2. Narasimha Karumanchi, “Data Structures and Algorithms Made Easy”, 5th Edition, Careermonk Publications, 2023.
3. Reema Thareja, “Data Structures using C”, 2nd Edition, Oxford University Press, 2014.

Reference Books:

1. Mark A. Weiss, “Data Structures and Algorithm Analysis in C”, 4th Edition, Pearson, 2014.
2. R. F. Gilberg and B. A. Forouzan, “Data Structures – A Pseudocode Approach with C”, 2nd Edition, Cengage Learning, 2005.
3. M. T. Goodritch, R. Tamassia and D. Mount, “Data Structures and Algorithms in C++”, 2nd Edition, Wiley, 2011.
4. Kruse, Leung and Tondo, “Data Structures and Program Design in C”, 2nd Edition, Pearson Education, 2013.
5. Tenenbaum, Langsam and Augenstein, “Data Structures using C”, 2nd Edition, Pearson, 2015.
6. Seymour Lipschutz, “Data Structures”, Schaum's Outline Series, 1st Edition, Tata McGraw-Hill, 2014.

Program: Information Technology **S.Y B.Tech Semester: III**

Course: Database Management System (DJS23ICPC302)
Course: Database Management System Laboratory (DJS23ILPC302)

Pre-requisite: Computer Basics

Course Objectives: The course intends to introduce the students to the management of database systems, with an emphasis on how to design, organize, maintain and retrieve information efficiently and effectively from a database.

Course Outcomes: On successful completion of this course, student should be able to:

1. Design an optimized database.
2. Construct SQL queries to perform operations on the database.
3. Apply appropriate transaction management technique.
4. Use appropriate indexing technique.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Introduction Database Concepts:** Introduction, Characteristics of databases, File system v/s Database system, Users of Database system, Schema and Instance, Data Independence, DBMS system architecture, Database Administrator.	04
2	**Relational Data Model:** **Entity–Relationship Model:** The Entity-Relationship (ER) Model: Entity types: Weak and strong entity sets, Entity sets, Types of Attributes, Keys, Relationship constraints: Cardinality and Participation, Extended Entity-Relationship (EER) Model: Generalization, Specialization and Aggregation **Relational Model:** Introduction to the Relational Model, relational schema and concept of keys, Mapping the ER and EER Model to the Relational Model **Relational Algebra**: Unary and Set operations, Relational Algebra Queries.	10
3	**Structured Query Language (SQL):** Overview of SQL, Data Definition Commands, Data Manipulation commands, Integrity constraints - key constraints, Domain Constraints, Referential integrity, check constraints, Data Control commands, Transaction Control Commands, Set and String operations, aggregate function - group by, having, Views in SQL, joins, Nested and complex queries, Triggers, Security and authorization in SQL	10
4	**Relational–Database Design:** Pitfalls in Relational-Database designs, Concept of normalization, Function Dependencies, Normal Forms- 1NF, 2NF, 3NF, BCNF	05
5	**Transaction Management and Recovery:** Transaction Concept, ACID properties, Transaction States, Implementation of atomicity and durability, Concurrent Executions, Serializability, Concurrency Control Protocols: Lock-based, Timestamp based, Validation Based, Deadlock Handling, Recovery System: Failure classification, Log based recovery, Shadow Paging	07
6	**Indexing Mechanism:** Types of Indexes: Single Level Ordered Indexes, Multilevel Indexes, Overview of B-Trees and B+ Trees.	03

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List of Experiments:

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

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

Books Recommended:

Text books:

1. Korth, Silberschatz, Sudarshan, "Database System Concepts", 7th Edition, McGraw – Hill, 2021.
2. Elmasri and Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson Education, 2021.
3. G Peter Rob and Carlos Coronel, "Database Systems Design, Implementation and Management", 5th Revised Edition, Thomson, 2002
4. G. K. Gupta, "Database Management Systems", 3rd Edition, McGraw – Hill, 2018

Reference Books:

1. Dr. P.S. Deshpande, "SQL and PL/SQL for Oracle 10g, Black Book", Dreamtech Press, 2012
2. Sharanam Shah, Vaishali Shah, "Oracle for Professional", 1st Edition, Shroff Publishers & Distributers Private Limited, 2008
3. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", 3rd Edition, McGraw – Hill, 2014.
4. Patrick Dalton, "Microsoft SQL Server Black Book", 11th Edition, Coriolis Group, U.S., 1997
5. Lynn Beighley, "Head First SQL", 1st Edition, O'Reilly Media, (28 August 2007)

Program: Information Technology **S.Y B.Tech** **Semester: III**
Course: Web Programming Laboratory (DJS23ILPC303)

Course Objectives: The course aims to provide students with a comprehensive understanding of web programming fundamentals and the MERN (MongoDB, Express.js, React.js, Node.js) stack. By the end of the course, students will be able to design and develop interactive web applications. Specifically, they will learn the basics of HTML, CSS, and JavaScript for frontend development, gaining expertise in creating dynamic user interfaces with React.js. Through practical experimentation and projects, students will develop problem-solving skills and gain hands-on experience in building modern web applications.

Course Outcomes: On successful completion of this course, student should be able to:
1. Develop full-stack web application using the MERN stack.
2. Work effectively as a member of a team.

Unit	Description	Duration
1	**Introduction to Web Development:** Overview of web development and its importance, Introduction to HTML: Structure, tags, and attributes, creating a simple webpage using HTML. Basic CSS properties for styling elements.	04
2	**Introduction to JavaScript:** Syntax and data types. Variables, operators, and control flow statements. Loops and functions, DOM Manipulation with JavaScript, Introduction to the Document Object Model (DOM), Accessing and manipulating HTML elements with JavaScript, Event handling and listeners.	06
3	**Introduction to React.js:** Overview of React.js and its benefits. Setting up React.js development environment. Introduction to JSX syntax. Creating and rendering components in React. Building Single Page Applications (SPAs) with React.js Introduction to React Router for routing in SPAs. Fetching data from a server and rendering in React components. Handling user input with forms and managing state in React.	04
4	**Backend Development with Node.js and Express.js:** **Introduction to Node.js:** Introduction to Node.js and its features., Installation and setup of Node.js environment, Creating a simple Node.js server. **Building RESTful APIs with Node.js and Express.js:** Overview of RESTful APIs, setting up Express.js framework for building APIs, creating routes for CRUD operations (GET, POST, PUT, DELETE).	04
5	**Integrating MongoDB with Node.js:** Introduction to MongoDB and NoSQL databases, Connecting Node.js with MongoDB using MongoDB native driver or Mongoose, Implementing CRUD operations in Node.js with MongoDB.	04
6	**Integration and Authentication:** Integrating React.js and Node.js: Integrating React.js frontend with Node.js backend, communicating between frontend and backend using APIs. Authentication and Authorization: Implementing authentication and authorization using JSON Web Tokens (JWT), OIDC Protocols, Securing routes and resources in the application.	04

List of experiments

Use design thinking to work through a real, industry based or societal problem. Develop a design solution that addresses this problem, putting the user first. The result will be a prototype with accompanying design artifacts and a robust presentation to include it in your portfolio.

1. HTML: Design a website using only HTML/CSS.
2. Design a website using TailWind CSS.
3. Programs based on control flow statements and loops in JavaScript.
4. Develop and demonstrate JavaScript with Accessing HTML elements using JavaScript. Manipulating HTML elements dynamically. Event handling: onclick, onchange, etc.
5. Event Loop using JavaScript Visualizer.
6. Installation and setup of Node.js environment.
7. Create a simple React application that renders a “Hello, World!” message on the webpage.
8. Create a React application. (Counter, TODO List, Temperature Converter etc.)
9. Implement a simple HTTP server that listens on a specified port and responds with “Hello, World!” to incoming requests.
10. Create a RESTful API using Express.js that supports CRUD (Create, Read, Update, Delete) operations on a resource like users, products, or articles.
11. Implement a Node.js program to perform basic CRUD (Create, Read, Update, Delete) operations on MongoDB collections.
12. Mini-project.

Books Recommended:

1. Duckett, J., “HTML and CSS: Design and Build Websites”, 2nd Edition, Wiley, 2014.
2. Haverbeke, M, “Eloquent JavaScript: A Modern Introduction to Programming”, 3rd Edition, No Starch Press, 2021.
3. Chinnathambi, C., “Learning React: Modern Patterns for Developing React Apps”, Packt Publishing, 2023.
4. Casciaro, M., and Lavin, M., “Node.js Design Patterns” 2nd Edition, Packt Publishing, 2022.
5. Wilson, E., Cantelon, E., and Harter, M., “Express.js in Action” Manning Publications, 2016.
6. Chodorow, K., “MongoDB: The Definitive Guide”, 3rd Edition, O'Reilly Media, 2018.
7. Ho, A., and Prieto, A., “Fullstack React: The Complete Guide to ReactJS and Friends”, 2nd Edition, Fullstack.io, 2020.

List of Open Source Software/Learning Website:

1. Namaste JavaScript Online Available: https://www.youtube.com/playlistlist=PLlasXeu85E9cQ32gLCvAvr9vNaUccPVNP
2. JavaScript Visualizer: https://www.jsv9000.app/

Program: Information Technology **S.Y B.Tech** **Semester: III**

Course: Operating System (DJS23ICMD301)

Pre-requisite: Foundations of Information Technology

Course Objectives: The objective of this course is to familiarize students with the functionality of an Operating System, its basic components & interaction among them. The course will also expose students to analyze and evaluate different policies for scheduling, deadlocks, memory management, synchronization and I/O management techniques.

Course Outcomes: On successful completion of this course, student should be able to:

1. Explore operating system types and functions.
2. Apply appropriate schemes for memory and I/O management.
3. Apply appropriate techniques for concurrency control and process synchronization.
4. Analyze the performance of different process and disk scheduling algorithms.
5. Handle the deadlock.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Operating System Overview:** Operating System Objectives, basic functions and services, Types of Operating Systems, System Calls, Types of System Calls, Multiprocessor and multicore organization, OS Design Considerations for Multiprocessor and Multicore.	05
2	**Process Management:** Process Concept, Process states, Process control, Threads, Uni-processor Scheduling: Types of scheduling: Pre-emptive, Non pre-emptive, Scheduling algorithms: FCFS, SJF, RR, Priority.	06
3	**Concurrency control Concurrency:** Principles of Concurrency, Mutual Exclusion: S/W approaches, H/W Support, Semaphores, Monitors, Classical Problems of Synchronization: Readers-Writers and Producer Consumer problems and solutions.	04
4	**Memory Management:** Memory partitioning: Fixed and Variable Partitioning, Memory Allocation: Allocation Strategies (First Fit, Best Fit, and Worst Fit), Fragmentation, Swapping, Virtual Memory, Paging. Segmentation, Demand paging and Page replacement policies.	05
5	**Deadlock:** Principles of deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Dining Philosopher problem	04
6	**Peripheral devices management:** I/O transfers – program controlled, interrupt driven and DMA **Input /Output Management and Disk Scheduling:** I/O Devices, I/O Buffering, Disk Scheduling algorithm: FCFS, SSTF, SCAN, CSCAN, LOOK, C-LOOK. RAID	04

Books Recommended:

Textbooks:

1. Hamacher, C. V., Vranesic, Z. G., and Zaky, S. H. “Computer Organization and Architecture.” 10th Edition, McGraw-Hill Education, 2019.
2. Abraham Silberschatz, Greg Gagne, Peter Baer Galvin, “Operating System Concepts”, 10th Edition, Wiley, January 2018.
3. Tanenbaum, A. S., and Bos, H., “Modern Operating Systems”, 5th Edition, Pearson, 2022.
4. William Stallings, “Operating Systems: Internal and Design Principles”, 9th Edition, Pearson, 2021.
5. Mano, M. Morris, and Kime, Charles R., “Digital Logic and Computer Design”, 5th Edition, Pearson, 2014.

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Reference Books:

1. Hayes, J. "Computer Architecture and Organization", 7th Edition, McGraw-Hill, 2021.
2. Mano, M. Morris, "Computer System Architecture", Pearson, 2017.
3. A Tanenbaum, "Operating System Design and Implementation", 3rd Edition, Pearson, January 2015
4. Naresh Chauhan, "Principles of Operating Systems", Oxford University Press; 1st Edition, 2014.
5. Anand Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 4th Edition, 2016.

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<tr><td colspan="3">Semester End Examination Marks (A)</td><td colspan="4">Continuous Assessment Marks (B)</td><td rowspan="2">Total marks (A+ B)</td></tr>
<tr><td colspan="3">Theory</td><td>Term Test 1</td><td>Term Test 2</td><td colspan="2">Avg.</td></tr>
<tr><td rowspan="2">Lectures</td><td rowspan="2">Practical</td><td rowspan="2">Tutorial</td><td rowspan="2">Total Credits</td><td colspan="3">--</td><td>--</td><td>--</td><td colspan="2">--</td><td>--</td></tr>
<tr><td colspan="3">Laboratory Examination</td><td colspan="3">Semester review</td><td colspan="2" rowspan="2">Average</td><td rowspan="3">25</td></tr>
<tr><td rowspan="2">--</td><td rowspan="2">2</td><td rowspan="2">--</td><td rowspan="2">1</td><td>Oral</td><td>Practical</td><td>Oral & Practical</td><td>Review 1</td><td>Review 2</td></tr>
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Course Objectives:

1. To acquaint the students with the process of identifying the need (considering a societal requirement) andensuring that a solution is found 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 ofa team.
3. To acquaint the students with the process of applying basic engineering fundamentals, so as to attempt at thedesign 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 toconceptualize and create a successful product.

Course Outcome:

Learner will 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 whileworking 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 analyze the impact of the proposedmethod 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 them to be successful entrepreneurs.
7. Demonstrate product/project management principles during the design and development work and excel in written (Technical paper preparation) as well as oral communication.

Guidelines for the proposed product design and development:

- Students shall form a team of 3 to 4 students (max allowed: 5-6 in extraordinary cases, subject to the approvalof the department review committee and the Head of the department).
- Students should carry out a survey and identify the need, which shall be converted into conceptualization of aproduct, in consultation with the faculty supervisor/head of department/internal committee of faculty members.
- Students in the team shall understand the effective need for product development and accordingly select the bestpossible design in consultation with the faculty supervisor.

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- 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 logbook 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 aweekly basis.
- The design solution 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 a technical paper, at a suitable publication (National /International),approved by the department research committee/ Head of the department.
- The focus should be on self-learning, the 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, ie during the semesters III and IV.

Guidelines for Assessment of the work:

- The review/ progress monitoring committee shall be constituted by the Head of the Department. The progressof design and development of the product is to be evaluated on a continuous basis, holding a minimum of tworeviews in each semester.
- In the continuous assessment, the 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.

Review/Progress monitoring committee may consider the following points during the assessment.

The tentative rubrics that can be followed can be as follows:

Review 1:

i. Literature Review (Algorithms, Techniques, Methodologies) / Product Review (Review of atleast 5 technical papers).
ii. Presentation Quality
iii. Contribution as a team member and Punctuality

Review 2:

i. Analysis of Literature Review
ii. Problem Statement and proposed solution
iii. System Process flow Diagram
iv. Presentation Quality
v. Contribution as a team member and Punctuality
vi. Project Documentation

Program: Common to all Programs (Group A / B) **S.Y B. Tech. Semester: III**
Course: Design Thinking Laboratory (DJS23ILHSX06)

Pre-requisite:

1. Understanding of product / process / software / service development life cycle.
2. Knowledge of agile frameworks (or any similar iterative framework) would be an added advantage but will not be mandatory.

Course Objectives:

1. To instill an innovative mindset in students to solve the digital-age business, societal and wicked type of problems using design thinking methods and tools, and its application.
2. To equip students with techniques to empathize with users, ideate innovative and sustainable solutions for real world problems through iterative approach to design.

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

1. Understand the importance of Human-Centric design approach for developing a solution.
2. Generate innovative ideas to design sustainable solutions for real world problems.
3. Apply design thinking principles to solve the real-world problems
4. Collaborate creatively and effectively in interdisciplinary teams to apply design thinking principles to real world problems.

Design Thinking Laboratory (DJS23ILHSX06)		
Unit	**Syllabus Content**	**Duration**
1	**Introduction to Design Thinking** • Understanding the fundamentals of design thinking. • Exploring the history and evolution of design thinking. • The importance of empathy in the design thinking process. • Conduct market & industry research by observing and contextualizing various macro & micro trends. • Case Study - conduct their own research on how Design Thinking helped solve some of the biggest and critical problems of our time.	**06**
2	**Empathize Phase** • Techniques for conducting user research and gathering insights. • Creating user personas and empathy maps. • Practicing active listening and observation skills. • To apply various empathizing techniques on the problem statement selected. • Use walk-a-mile immersion and heuristic reviews to first empathize with end users and then to build empathy map and customer journey map.	**04**
3	**Define Phase** • Defining problem statements and reframing challenges. • Tools for synthesizing research findings. • Developing a clear and actionable problem statement. • Start building from Persona map and conduct interviews/ Gemba walk to plot user's journeys from start to end. • Define the problem space using HMW statement. Now highlight areas of opportunities in the journey map and enlist potential channels/touchpoints as well as stakeholders for proposed solution interventions.	**04**
4	**Ideate Phase** • Generating creative ideas through brainstorming sessions. • Techniques for divergent and convergent thinking. • Prototyping and experimenting with ideas. • Apply suitable ideation technique to quickly generate diverse ideas that could be applied to target problem space – either partially or in full. • Brain Writing – Build on each other's ideas and constructively & creatively develop better ideas using SCAMPER technique.	**04**

5	**Prototype and Validation** • Introduction to prototyping tools and techniques. • Rapid prototyping methods. • Testing prototypes with users and gathering feedback. • Refining solutions based on user insights. • Develop user storyboard to layout solution proposition in visual and easily explainable form. Run a quick peer validation. • peer-validated the storyboard. • Build an interactive digital prototype using any digital rapid prototyping platform and seek user validation.	**06**
6	**Design Thinking for Strategic Innovation**: • Types of innovations, strategic innovation. • Features of strategic innovation. • Design thinking and strategic innovation. • Practices of integrating design thinking in strategic innovation.	**02**

List of Experiments:

- Below is a list of assignments / activities / experiments that would be carried out by students as a mini project in groups of size not more than Three students in each group.
- Problem statement for these assignments/ activities/ experiments will be provided by facilitator/ instructor/ faculty to the groups/ teams/ batches within each class.
- This list of experiment will help students to learn various design thinking methods and practice corresponding tools available.

Sr. No.	Name of the Experiment
1	To conduct market and industry research and analyze case studies demonstrating the application of design thinking. (Increased understanding of how design thinking has been applied to solve critical problems in various contexts.)
2	To exercise empathizing techniques to understand the needs and pain points of a target audience.
3	Developing empathy maps and customer journey maps based on collected insights.
4	To exercise different tools and techniques (such as affinity diagrams, journey mapping, and user story mapping) for synthesizing research findings,
5	Develop user personas to represent different user archetypes and their needs concerning the problem at hand.
6	To practice SCAMPRE technique, Brainstorming and brain writing as a collaborative ideation technique to create multiple creative ideas / solution for the problem at hand.
7	Create a mind map to generate a wide range of solutions to a problem at hand
8	To explore different prototyping tools and platforms, such as Adobe XD, Figma, Sketch, and InVision.
9	To Conduct rapid prototyping sessions to build low fidelity / High fidelity prototype based on the ideas generated in Ideation phase and iterate based on feedback received.
10	Develop a plan for implementing the final solution, considering factors like scalability and feasibility
11	• Conduct usability testing to gather feedback on prototypes. • Use A/B testing to compare different versions of a solution and determine which performs better.

***Note** – A minimum of eight experiments from the above-suggested list (experiments 01 to 07) or any other assignment based on the syllabus will be included, which would help the learner to apply the concept. The mini-project is mandatory.*

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Books Recommended

Text books:

1. I. Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", Wiley, 2013.
2. M. Lewrick, P. Link, and L. Leifer, "The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems", Wiley, 2018.
3. T. Lockwood, "Design Thinking: Integrating Innovation, Customer Experience, and Brand Value", Allworth Press, 2010.
4. K. T. Ulrich and S. D. Eppinger, "Product Design and Development", McGraw-Hill Hill Education, 6th Edition, 2016.
5. C. J. Meadows and C. Parikh, "The Design Thinking Workbook: Essential Skills for Creativity and Business Growth", Emerald Publishing, 2022.

Reference books:

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

Online Reference:

1. **Design and Innovation:**
   a. https://openstax.org/books/entrepreneurship/pages/4-suggested-resources
2. **Overview of Design Thinking:**
   a. https://www.interaction-design.org/literature/topics/design-thinking
   b. 10 Models for Design Thinking. In 2004, business consultants Hasso… | by Libby Hoffman | Medium
   c. https://www.tcgen.com/design-thinking/#What_is_Design_Thinking_and_How_Does_it_Relate_to_Product_Development
3. **Understand, observe and define the problem:**
   a. https://www.nngroup.com/articles/empathy-mapping/
   b. https://uxdesign.cc/the-purpose-of-a-journey-map-and-how-can-it-galvanize-action-9a628b7ae6e
4. **Ideation and prototyping**:
   a. https://www.interaction-design.org/literature/topics/prototyping
   b. https://www.uxmatters.com/mt/archives/2019/01/prototyping-user-experience.php
5. **Testing and implementation:**
   a. https://www.nngroup.com/articles/usability-testing-101/
   b. https://www.interaction-design.org/literature/article/test-your-prototypes-how-to-gather-feedback-and-maximise-learning
6. **Design thinking in various sectors:**
   a. https://www.tutorialspoint.com/design_thinking/design_thinking_quick_guide.htm

Web References:

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

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Evaluation Scheme:

Continuous Assessment (A):

Term Work: - 25 marks

Shall comprise of:

Assignments (minimum 05): 15 marks

Mini Project (individual or in a group of 2-3 students): 10 marks

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Program: Common to all Programs (Group A / B) **S.Y B. Tech. Semester: III**
Course: Universal Human Values (DJS23ICHSX08)
Universal Human Values Tutorial (DJS23ITHSX08)

Course Objectives:

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

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

1. Understand the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society
2. Distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co-existence of Self and Body.
3. Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society
4. Understand the harmony in nature and existence and work out their mutually fulfilling participation in the nature.
5. Distinguish between ethical and unethical practices and start working out the strategy to actualize a harmonious environment wherever they work.

Universal Human Values (DJS23IHC1)		
Unit	**Description**	**Duration**
1	**Course Introduction - Need, Basic Guidelines, Content and Process for Value Education** Understanding the need, basic guidelines, content and process for Value Education, Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels	**04**
2	**Understanding Harmony in the Human Being - Harmony in Myself** Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body'. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Self-regulation and health.	**05**
3	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship** Understanding harmony in the Family- the basic unit of human interaction, understanding values in human-human relationship; meaning of Justice and program for its fulfilment. Trust and Respect as the foundational values of relationship,	**09**

	Understanding the meaning of Trust; Difference between intention and competence, Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family). Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family!	
4	**Understanding Harmony in the Nature and Existence - Whole existence as Co-existence** Understanding the harmony in the Nature, Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence	**04**
5	**Implications of the above Holistic Understanding of Harmony on Professional Ethics:** Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, b) At the level of society: as mutually enriching institutions and organizations	**04**

Tutorials: (Term work)

Term work shall consist of minimum 5 activities based on activities conducted.

The tutorials could be conducted as per the following topics: -

Activity No 1	Practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony, and co-existence) rather than as arbitrariness in choice based on liking-disliking.
Activity No 2	Practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.
Activity No 3	Practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.
Activity No 4	Practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.
Activity No 5	Practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions e.g. To discuss the conduct as an engineer or scientist etc.

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

Books Recommended:

Textbooks:

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

Reference Books:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi.

5. Small is Beautiful - E. F Schumacher. 6. Slow is Beautiful - Cecile Andrews.
6. Economy of Permanence - J C Kumarappa.
7. Bharat Mein Angreji Raj – Pandit Sunderlal.
8. Rediscovering India - by Dharampal.
9. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi.
10. India Wins Freedom - Maulana Abdul Kalam Azad.
11. Vivekananda - Romain Rolland. (English)
12. Gandhi - Romain Rolland. (English)
13. Gandhi - Romain Rolland. (English)

Evaluation Scheme:

Continuous Assessment (A):

Term Work: - 25 marks

Will consist of following three components:

1. Term Test 1 (based on 40 % syllabus) – 15 marks.
2. Term Test 2 (on next 40 % syllabus) – 15 marks.
3. Assignment / course project / group discussion / presentation / quiz – 10 marks
   Total summing up to 40 marks.

Semester End Examination (B):

Theory:

Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 60 marks.

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Program: Common to all Programs (Group A / B) **S.Y B. Tech. Semester: III**
Course: Community Engagement Service (DJS23ILELX11)

Pre-requisite:
1. Fundamentals of core branch
2. Communication Skills

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

Course Outcomes: On completion of the course, the learner will be able to:
1. Knowledge application: Applies knowledge understandings acquired from one's academic study/ field/ discipline for community level education, information dissemination by participation and engagement in community welfare activities.
2. Commitment for cause: Identify and experience commitment for community engagement activities that reinforce sense of belongingness and gratitude towards societal cause.
3. Diversity: Witness diversity in communities and cultures and demonstrate change in approach / attitude as, an evidence of unconditional acceptance.
4. Team: Recognise, experience and value, effectiveness of working in a team, demonstrating co-existence of the roles - sincere worker and effective leader.

Economics and Financial Management (DJS23ICHSX07)		
Unit	**Description**	
1	**Open Activities** • Participation in: blood donation camps organizer / donor, day-long tree plantation or afforestation / seed dispersal / cleanliness (water bodies, surrounding etc.) drives. • Literacy drives for children / youth / adults. One day hand holding activities in work-shop conduct for under privilege kids in the areas of – basic science, math, technical skill demonstration and building	
2	**Technical (Program core related)** • Cyber-crime, security awareness and vulnerabilities – sensitization, information dissemination and awareness sessions in indicated focus areas. Promotion and Sensitization for Sustainable living – focusing on solar power, water recycling, e-waste responsible disposal, waste recycling etc. in indicated focus areas. Focus areas: residential societies, schools, under-privileged areas, governments /private offices, and similar other establishments. **OR** **Field Survey** • Reporting on proactively conducted survey in the areas of resource management for – water, vegetables, electricity, crops etc.	

Activities to be performed
Among the listed activities students are expected to complete one open activity mandatorily, and one technical (program core) OR field survey activity. The activities mentioned are exemplary in nature and any other additional activity of similar nature too can be undertaken by the learners, provided it is approved and endorsed by the faculty mentor / head of the department.

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Suggested Activities

1. Undertaking cyber safety / security awareness sensitization drive / program especially for un-initiated students / individuals in schools / colleges / residential complex / offices etc. Typical suggested tabulation.

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

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

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

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

Sr. No.	Timestamp	Traffic Density	Traffic Light Status	Road Repair Status	Remarks

4. Help compute green footprint of select number of household (per member) - say 10 houses of 3+ members. This is for evaluating dependence upon non green energy sources and habits and changes in lifestyle for attempts at their reductions. Learners are encouraged to use typically available online carbon-footprint calculators. The table herewith maybe used for reference calculations.

House No.	House hold Name	Number of Members	Energy Usage (kWh)	Water Usage (liters)	Waste Production (kg)	Transportation Habits	Green Footprint

5. Compulsion of having a borewell for non-potable water supply in city residential complexes is a modern-day rule. Increased pace of re-development, as well as number of occupants in given area, has resulted in increased number of borewells being dug within and outside city limits.

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Reduced yield, quality and quantity of water adds to the recurring maintenance cost of borewells, especially in the city areas. Poor water recharge systems along-with depleting open soil cover area in wake of wall-to-wall of concrete carpet aggravate the problem. Study, analyse and report a residential society's – capacity of water requirement, present day borewells in action, approximate yield, maintenance cost and frequency, borewell flushing iterations in wake of redevelopment in neighborhood. A typical tabulation mechanism for inferences can be as below:

Borewell No.	Location	Depth (ft)	Yield (Liters/Day)	Water Quality	Maintenance Cost (Rs.)	Remarks

6. Detection of Adulteration in food / fruits / vegetables / milk / mava /saffron etc. or contamination of potable drinking water.

Ex. Adulteration in fruits could be apple waxing, injecting chemicals in watermelon, pomegranate etc. to give it a bright red color, artificial ripening of mangos etc.

For a given activity, samples from more than one area, specifically from mofussil /interiors / 'gaothans' etc, may be obtained, to evaluate sample purity or extent of adulteration. Learners are encouraged to use online resources provided by 'Food Safety and Standards Authority of India' (*fssai*), for handholding in requisite procedures.

YouTube link:

Food Safety and Standards Authority of India: goo.gl/Y8Lzbu

Ex. 1 Milk Adulteration: https://www.youtube.com/watch?v=pbnmeRUBxKk

Ex.2 Watermelon Adulteration: https://www.youtube.com/watch?v=yrLAj7oJies

Product	Adulterant	Testing Method	Result	Remarks

Certificates and Formats:

Activity Endorsement Certificate

Date:

Community engagement service is a mandatory course, of two credits, introduced at second year of engineering under the autonomous structure of the institute.

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

Course outcomes:

1. Knowledge application: Applies knowledge understandings acquired from one's academic study/ field/ discipline for community level education, information dissemination by participation and engagement in community welfare activities.
2. Commitment for cause: Identify and experience commitment for community engagement activities that reinforce sense of belongingness and gratitude towards societal cause.
3. Diversity: Witness diversity in communities and cultures and demonstrate change in approach / attitude as an evidence of unconditional acceptance.
4. Team: Recognise, experience and value effectiveness of working in a team, demonstrating co-existence of the roles - sincere worker and effective leader.

This is to certify that Mr./Ms. _____ bearing SAP ID _____ is a student of S.Y. B.Tech., _____ branch of engineering. He / She is a bonafide student of SVKM's Dwarkadas J. Sanghvi College of Engineering, Mumbai. He / She is reliable, sincere, hardworking and capable of conducting _____ activity in your premises. We request you to kindly allow for the conduction of the activity and we also solicit your earnest co-operation in the same.

Signature

Name of Department Head:

Disclaimer

(This form must be read, signed, and submitted prior to the beginning of the community service activity.)

Student Details	**Activity Details**
Name	
SAPID	Date
Program	Time
Class/Div	Address

I, the undersigned _____ accept the following terms and conditions unconditionally:

1. I accept and understand that the community activity identification and selection has been done willingly by me.
2. I undertake to convey that, I am apparently in good health and well-being, and suffer no physical impairment that would or should prevent my participation in the activity.
3. I undertake to bear all related expenses and risk of travel related to the activity and shall not hold any personnel from the institute responsible with regards to claims and / or loss in the process of conduct of activity.
4. I undertake that my parents or legal/local guardians are aware of said activity and agree to above mentioned terms and conditions.

Student's name & signature: _____

Parent or Guardian's name & signature: _____

Guidelines for Assessment of the work

- The review/progress monitoring committee shall be constituted by the Head of the Department. The progress of selected/assigned activities is to be evaluated on a continuous basis, holding at-least one review in the semester.
- In the continuous assessment, focus shall also be on each individual student's contribution to the team activity, their understanding and involvement as well as responses to the questions being raised at all points in time.
- Each group needs to submit following forms to respective supervisor after conducting both the activities,

1. Activity Conduction Report
2. Participant Feedback (online / offline)
3. Participant Attendance (online / offline)
4. Survey Report
5. Participation certification

Forms for Technical Activity:

1. Activity Conduction Report

Sr. No.	**Name of the Activity**	
1	Date of Activity	`
2	Activity type Open / Technical	
3	Activity objectives	
4	Place of Activity	
5	SAP id and Names of students	
6	Name of the Association	
7	Activity description	
8	No. of participants	
9	Photos (Geo tagged)	

2. Participant feedback (online / offline):

Sr. No.	**Indicators**	**Scale: 1 (Lowest) to 5 (Highest)**
1	The objectives of the training were clearly defined.	
2	The content was organized and easy to follow.	
3	This training experience will be useful to me.	
4	The trainer was knowledgeable about the training topics.	
5	The training objectives were met	

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Evaluation Scheme:

Continuous Assessment (A):

Term Work: - 25 marks, distribution as herewith:

1. **Rubric for Open Ended Activity (10 marks)**
   - Participation certificate/proof

2. **Rubric for Technical Activity (15 marks)**

Sr. No.	Performance Indicators (Maximum marks per indicator are given in bracket)	Marks
1	Pre-requisite documents (permission letter, presentation material, permission letters, etc.) [05 marks]	
2	Participant Feedback [05 marks]	
3	Participant attendance [05 marks]	
	TOTAL	

OR

3. **Rubric for Field Survey Activity:**

Sr. No.	Performance Indicators (Maximum 03 marks per indicator)	Marks
1	Topic selection	
2	Survey preparation	
3	Field work	
4	Analysis	
5	Report writing	
	TOTAL	

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Program: Information Technology **S Y. B. Tech Semester: IV**

Course: Applied Mathematics (DJS23ICPC401)

Course: Applied Mathematics Tutorial (DJS23ITP401)

Pre-requisite: Engineering Mathematics – I and Engineering Mathematics – II

Course Objectives: The objective of this course is to inculcate an ability to relate engineering problems to mathematical contexts. To introduce students to the concepts of Number Theory by using different theorems. To cover the basic principles of matrices, probability and random variables. The course also familiarizes students with different methods of solving Linear Programming problems.

Course Outcomes: On successful completion of this course, student should be able to:

1. Reduce the matrices using various techniques.
2. Relate the role of number theory in the domain of information technology.
3. Model various processes using appropriate probability distribution.
4. Use the appropriate simplex method to solve linear programming models.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Matrices:** Eigenvalues, Eigenvectors, Algebraic and Geometric multiplicity of an eigenvalue, Similar matrices, diagonalizable matrix, Cayley-Hamilton theorem (without proof), Functions of square matrix, Singular Value Decomposition (SVD).	**08**
2	**Divisibility and primes:** Divisibility, Euclid's algorithm, greatest common divisors, linear Diophantine equation, primes, testing of primes, Sieve of Eratosthenes, prime number theorem,	**04**
3	**Congruences:** congruences, Fermat's little theorem, Euler's theorem, linear congruence, computing inverse in congruence, Chinese remainder theorem, quadratic congruences, Legendre symbol.	**04**
4	**Probability:** Bayes' theorem, random variables, discrete and continuous, expectation and variance of random variable, probability mass function, probability density function and cumulative distribution function, moments, moment generating function, standard probability distribution: Binomial, Poisson and Normal (for detail study).	**08**
5	**Operations on One and Multiple Random Variable:** Functions of a random variable and their distribution and density functions. Pairs of random variables, Joint CDF, Joint PDF, Independence, Conditional CDF and PDF, Conditional Expectation. One function of two random variables, two functions of two random variables; joint moments, joint characteristic function, covariance and correlation-independent, uncorrelated and orthogonal random variables.	**07**
6	**Mathematical programming: -** Types of solution, standard and canonical form of Linear programming problem (LPP), basic and feasible solutions, simplex method, artificial variables, Big M-method (method of penalty), duality, dual simplex method	**08**

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List of Tutorials:

1. Eigenvalues and eigenvectors
2. Function of square matrix
3. Primes and linear congruences
4. Quadratic congruences
5. Bayes' theorem and Random variables
6. Standard distributions
7. Joint Distribution
8. Function of Random Variable
9. Simplex and Big-M
10. Duality and Dual Simplex

Tutorials:

A minimum of eight tutorials based on syllabus will be conducted. Mini projects relevant to the subject may be included, which would help the learner to apply the concept learnt.

Books Recommended:

Textbooks:

1. Seymour Lipschutz and Marc Lipson, "Linear Algebra", 4th Edition, Schaum's outlines, 2008.
2. S. C. Gupta and V. K. Kapoor, "Fundamentals of Mathematical Statistics", 10th Edition, Sultan Chand and Sons, 2020.
3. David M. Burton, "Elementary Number Theory", 7th Edition, Mc Graw Hill, 2017.

Reference Books:

1. Gilbert Strang, "Linear Algebra and its Applications", 4th Edition, Cengage, 2005.
2. Ward Cheney and David Kincaid, "Linear Algebra Theory and Applications", 2nd Edition, Jones & Bartlett Learning, 2011.
3. Seymour Lipschutz and John Schiller, "Introduction to Probability and Statistics", Indian Edition, Schaum's outlines, 2017.
4. Ivan Niven, Herbert S. Zuckerman and Hugh L. Montgomery, "An Introduction to the Theory of Numbers", 5th Edition, Wiley, 2008.
5. Er. Prem Kumar Gupta, Dr. D. S. Hira, "Operations Research", 7th Edition, S. Chand and Company, 2014.

Program: Information Technology **S.Y B.Tech Semester: IV**
Course: Design and Analysis of Algorithms (DJS23ICPC402)
Course: Design and Analysis of Algorithms Laboratory (DJS23ILPC402)

Pre-requisite: Computer Programming, Data structures

Course Objectives: The objective of the course is to introduce important algorithmic design paradigms and approaches for effective problem solving. To analyze the algorithm for its efficiency to show its effectiveness over the others. In addition, the concepts of tractable and intractable problems and the classes P, NP and NP-complete problems will be introduced.

Course Outcomes: On successful completion of this course, student should be able to:
1. Analyze the performance of algorithms asymptotically.
2. Solve the problem using appropriate algorithmic design techniques.
3. Prove that certain problems are NP-Complete.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Introduction:** Introduction to Asymptotic Analysis, Analysis of control statements and loops, solving recurrence relations using tree, substitution, master method, analysis of quick sort and merge sort. Problem Solving using divide and conquer algorithm - Max-Min problem, Strassen's Matrix Multiplication.	08
2	**Greedy Method:** Introduction, control abstraction, Problem solving using - fractional knapsack problem, job sequencing with deadline, find and union, Graph: Minimum Spanning trees (Kruskal's algorithm, Prim's algorithm), Single source shortest path (Dijkstra's algorithm), coin change problem, Analysis of all Algorithms.	07
3	**Dynamic Programming:** Introduction, principle of optimality, Components of dynamic programming, characteristics of dynamic programming, Fibonacci problem, Coin Changing problem, 0/1 knapsack, Matrix Chain Multiplication, Longest Common Subsequence (LCS), all pairs shortest paths (Floyd Warshall Algorithm), Single source shortest path (Bellman-Ford Algorithm), Travelling salesperson problem, Multistage graphs, Optimal binary search tree (OBST-successful and unsuccessful search), Analysis of all Algorithms	10
4	**Backtracking:** Introduction, Basics of backtracking, N–queen problem, Sum of subsets, Graph coloring, Hamiltonian cycles, Analysis of all Algorithms. **Branch-and-Bound:** Introduction, Control abstraction-LC BB, FIFO BB, LIFO BB, Properties FIFO BB, LIFO BB, LC BB, Fifteen Puzzle problem, 0/1 Knapsack problem, Travelling Salesman problem, Job Sequencing with Deadline	07
5	**String Matching Algorithms**: Introduction, The naive string-matching algorithm, The Rabin Karp algorithm, The Knuth Morris Pratt algorithm, Analysis of all Algorithms.	03
6	**Basics of Computational Complexity**: Complexity classes: The class P and NP, Reduction, NP-Hard and NP Complete, Proving certain set of problems as NP Complete.	04

Suggested List of Experiments (any 10 to 12):

1. Implementation of Min Max algorithm
2. Implementation of Strassen's Matrix Multiplication.
3. Implementation of Karatsuba algorithm for long integer multiplication
4. Fractional Knapsack implementation using greedy approach
5. Implementation of Activity selection using greedy approach

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6. Implementation of Kruskal's/ Prim's algorithm using greedy approach
7. Implementation of job sequencing with deadline using greedy approach
8. Implementation of other greedy algorithms eg: tree vertex split, subset cover, container loading, coin changing, optimal; merge patterns (Huffman tree)
9. Implementation of Single source shortest path (Dijkstra's algorithm)
10. Implementation of Bellman Ford algorithm using Dynamic programming
11. Implementation of Longest Common Subsequence algorithm using Dynamic programming
12. Implementation of Travelling Salesperson problem using Dynamic programming
13. Implementation of multistage graphs/ all pair shortest path using dynamic programming.
14. Implementation of N-queen problem using Backtracking
15. Implementation of 15 Puzzle problem using Backtracking
16. Implementation of Knuth Morris Pratt string matching algorithm

Books Recommended:

Textbooks:

1. S. Sridhar, Design and Analysis of Algorithms, 1st Edition, Oxford Education, 2018.
2. Ellis Horowitz, Sartaj Sahni, S. Rajsekaran. "Fundamentals of computer algorithms" University Press

Reference Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, "Introduction to Algorithms", 3rd Edition, The MIT Press, 2009.
2. Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, "Algorithms", Tata McGraw- Hill Edition.
3. S. K. Basu, "Design Methods and Analysis of Algorithm", PHI.
4. John Kleinberg, Eva Tardos, "Algorithm Design", Pearson.
5. Michael T. Goodrich, Roberto Tamassia, "Algorithm Design", Wiley Publication.

Program: Information Technology **S.Y B.Tech Semester: IV**

Course: Python Laboratory (DJS23ILPC403)

Pre-requisite:

1. Structured Programming Approach
2. Java Programming

Course Objectives: The objective of the course is to expose students to a new programming language "Python3", thereby making them familiarized with the sequence data types and their interoperability, various control structures and object-oriented programming in Python. To enable students, to develop GUI Applications and Web Applications with database connectivity. To lay the foundation of Machine Learning and Data Science Techniques with visualizations

Course Outcomes: On successful completion of this course, student should be able to:

1. Develop python programs to solve real-world problems.
2. Apply different visualizations on a given dataset.
3. Create GUI applications using Flask.
4. Work effectively as a member of a team.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Basics of Python**: Numbers in Python, Basic & Built-in Math functions, Number Formats, Strings, Quotes, print () Function, range() function, Assigning Values to Names & Changing Data Through Names, Copying Data, Tuples, Lists, Dictionaries, Sets, Numpy Arrays, Strings	**04**
2	**Control Statements and Functions:** If statement, if-elif-else, Repetition using while loop, for loop, Defining a Function, Checking & Setting Your Parameters, Default arguments, Variable length arguments, Defining and calling functions within a function, Layers of Functions, Lambda and Filter, Zip(), Map(), Reduce() function, recursion, Function Decorators	**04**
3	**Object Oriented Programming:** Creating a Class, Self-Variables, Constructors, Types of Methods, Constructors in Inheritance, Polymorphism, the super () Method, Method Resolution Order (MRO), Operator Overloading, Method Overloading & Overriding, Interfaces in Python. **Exceptions Handling**: Exceptions, Exception Handling, Types of Exceptions, The Except Block, The assert Statement, User Defined Exceptions	**06**
4	**Introduction To Data Science Packages:** Creating Modules and Packages, Documenting & Viewing Module, Basics of Testing Your Modules and Packages, Importing & exporting Modules, Random, Matplotlib, Pandas, SciPy, scikit learn Modules	**06**
5	**Files Handling:** Types of Files in Python, opening a File, closing a File, Writing Text Files, File content manipulation, working with Binary Files, Appending Text to a File, Reading Text Files, File Exceptions, The with Statement Pickle in Python, Zip File Module.	**02**
6	**GUI Programming with Database Connectivity:** GUI Programming Toolkits, Creating GUI Widgets with Tkinter, Creating Layouts, Form Components, Dialog Boxes. Types of Databases Used with Python, MySQL database Connectivity with Python, Performing DML operations on database. **Web Development Framework:** Flask -Templates, Flask Template Engine: Jinga, Flask-Jinga, Template creation, Rendering a web-based application.	**04**

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List of Tutorials/ Experiments:

1. Write python programs to understand Expressions, Variables, Quotes, Basic Math operations.
2. Write a Python program to implement Basic String Operations & String Methods.
3. Write a Python program to implement functions of List, Tuples, Dictionaries.
4. Write a Python program to implement Arrays / Numpy Array (1D, 2D) applications.
5. Write python programs to demonstrate applications of different decision making statements.
6. Write a Python program to implement Functions and Recursion.
7. Write a Python program to implement Programs based on Lambda, Map, Reduce Functions.
8. Write a Python program to implement program to implement concept of Function decorators.
9. Write python programs to implement Classes & objects, Constructors
10. Write python programs to implement Inheritance & Polymorphism.
11. Write a Python program to implement data analysis using pandas.
12. Write a Python program to implement basic scientific operations using scipy.
13. Write a Python program to implement data visualizations using matplotlib.
14. Write python programs to implement Exception handling.
15. Write python programs to understand different File handling operations with exception handling.
16. Write python programs to understand GUI designing and database operations (Programs based on GUI designing using Tkinter, Mysql database creation & Database connectivity with DML).
17. Write a Python program to implement Web based application with Flask Framework.

Books Recommended:

Text books:

1. Dr. R. Nageswara Rao, "Core Python Programming", Dreamtech Press, Wiley Publication
2. M. T. Savaliya, R. K. Maurya, "Programming through Python", StarEdu Solutions.
3. E Balagurusamy, "Introduction to computing and problem-solving using python", McGraw Hill Publication.

Reference Books:

1. Zed A. Shaw, "Learn Python 3 the Hard Way", Zed Shaw's Hard Way Series.
2. Martin C. Brown, "Python: The Complete Reference", McGraw-Hill Publication.
3. Paul Barry, "Head first Python", 2nd Edition, O'Reilly Media, Inc.

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Program: Information Technology **S.Y B.Tech Semester: IV**

Course: Object Oriented Design Laboratory (DJS23ILPC404)

Pre-requisite: Java Programming

Course Objectives: The course intends to introduce the students with practical skills in applying object-oriented design principles to software development. Through hands-on projects, they learn key concepts like classes, objects, inheritance, and polymorphism, alongside advanced topics such as design patterns, UML modeling, and SOLID principles.

Course Outcomes: On successful completion of this course, student should be able to:

1. Analyze real-world problems using object-oriented design principles.
2. Design UML diagrams for a real-world systems.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Introduction to Object-Oriented Design:** Understanding the principles of object-oriented design. Exploring the benefits and applications of object-oriented design. Understanding the fundamentals of Object-Oriented Development, Reviewing basic object-oriented concepts (classes, objects, inheritance, polymorphism). Implementing basic object-oriented principles in a chosen programming language (e.g., Java, C++) Exercises on encapsulation, abstraction, inheritance, and polymorphism	02
2	**Fundamentals of Unified Modeling Language:** Introduction to Design phase of Software Development Life Cycle. Introduction to Design Specifications in software design process. Introduction to Unified Modelling Language (UML). Understanding the Classification of UML diagrams. Identifying the Problem Statement to exercise UML diagrams. Introduction to online design tools / portals viz. LucidChart, Draw.io, Creatly, Smartdraw etc.	02
3	**Structured UML Diagrams:** Detailed study of Class diagrams: Class structure, associations, attributes, and methods Object diagrams: Representing instances of classes and their relationships Package diagrams: Organizing and managing large-scale software systems Component diagrams: Representing the components of a system and their dependencies Deployment diagrams: Illustrating the physical deployment of software components on hardware nodes. Practical exercises and case studies to create and interpret structured UML diagrams	08
4	**Behavioral UML Diagrams:** Introduction to behavioral diagrams: Use case diagrams: Identifying system actors, use cases, and their relationships Activity diagrams: Modeling workflow and business processes, representing sequential and parallel activities using activity diagrams. Visualizing complex scenarios like decision-making processes or system workflows Sequence diagrams: Modelling the flow of interactions between objects in a system. Illustrating the sequence of method calls and messages exchanged between objects. State Diagram: Modelling the lifecycle of an object or system states. Defining states, transitions, and events triggering state changes. Illustrating state transitions based on user actions or system events. Practical exercises and case studies to apply behavioral UML diagrams	08

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5	**Design Principles:** Overview of design principles: SOLID principles (Single Responsibility, Open/Closed, Liskov Substitution, Interface Segregation, Dependency Inversion) Understanding the importance of design principles in object-oriented design Practical examples and discussions on applying design principles to software design	**04**
6	**Design Patterns**: Introduction to design patterns: Creational, Structural, Behavioral patterns Exploring common design patterns such as Singleton, Factory, Observer, Strategy. When and how to use design patterns effectively Practical exercises and case studies to apply design patterns in software design	**02**

List of Experiments:

1. Implement a simple object-oriented program using classes, objects, and inheritance.
2. Identify a real-world problem statement and apply SOLID principles (Single Responsibility, Open/Closed, Liskov Substitution, Interface Segregation, Dependency Inversion).
3. Develop a use case diagram for a software system, identifying system actors, use cases, and their relationships.
4. Create a class diagram for a given problem domain, including class structure, associations, and attributes.
5. Develop an object diagram based on the class diagram, representing instances of classes and their relationships.
6. Create an activity diagram to model a workflow or business process in a software system.
7. Design a sequence diagram to represent interactions between objects in a specific scenario.
8. Create a package diagram to organize and manage the components of a software system.
9. Design a component diagram for a software system, identifying the components and their dependencies.
10. Construct a deployment diagram illustrating the physical deployment of software components on hardware nodes.
11. Identify and apply design patterns (e.g., Singleton, Factory, Observer, Strategy) in a given software problem.

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

Books Recommended:

Text books:

1. Grady Booch. James Rambaugh, Ivar Jacobson, “The Unified Modeling Language User Guide”, 2nd Edition, Pearson, 2005.
2. Martin Fowler, “Distilled – A Brief Guide to The Standard Object Modelling Language”,3rd Edition, Addison-Wesley Professional, 2018
3. Russ Miles, Kim Hamilton, “Learning UML 2.0”, O'Reilly Media, Inc., 2006.

Program: Information Technology **S.Y B.Tech** **Semester: IV**
Course: Formal Language and Automata (DJS23ICMD401)
Course: Formal Language and Automata Tutorial (DJS23ITMD401)

*Batch wise tutorials are to be conducted.

Pre-requisite: Knowledge of Basic Mathematical Fundamentals: Sets, Logic, Relations, Functions.

Course Objectives: The objective of the course is to introduce students to the mathematical foundations of computability theory including automata theory & its applications; the theory of formal languages and grammars; the notions of decidability and computability. The course also enables students to develop the ability to design formal grammar & abstract computing models for formal languages and appreciate the power and limitations of these models.

Course Outcomes: On successful completion of this course, student should be able to:

1. Design formal grammar
2. Design computational model
3. Apply rigorously formal mathematical methods to prove properties of formal languages
4. Prove that the certain languages are undecidable

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Formal Languages:** Introduction, Chomsky Hierarchy. **Regular Language:** Basic Definition, alphabets and strings. **Regular Expression (RE):** Definition, RE operators, operation on regular language such as concatenation, closure, union, interaction, etc. Construction of RE for Regular Language, Pumping lemma for regular language, closure properties of regular language. **Regular Grammar:** Definition, notations, grammar constituents, Left and Right Linear grammar, construction of LL & RL grammar, equivalence of regular grammar and finite automata.	**04**
2	**Finite Automata (FA):** Basic definition, representation, FA as a language acceptor and verifier, different models such as Deterministic FA (DFA) and Non-deterministic FA (NFA). **DFA:** Formal definition, construction of DFA. **NFA:** Formal definition, construction of NFA. Equivalence of DFA's and NFA's **NFA with ε-moves:** Formal definition, ε -CLOSURE of a state, construction of NFA with ε -moves. Equivalence of NFA's with and without ε -moves, Equivalence of NFA's with ε -moves and DFA, Construction of NFA with ε -moves for RE and Construction of RE from FA. **Minimal State Finite Automata:** necessity and advantages of minimization, minimization algorithm. **Finite Automata with output:** Basic concept, advantages, different models such as Moore and Mealy machines. **Moore m/c:** formal definition, construction of different Moore m/c models. **Mealy m/c:** formal definition, construction of Mealy m/c models (examples). Equivalence of Moore and Mealy m/c. Applications of finite automata: lexical analyzer, text editor.	**06**
3	**Context Free Language (CFL) & Context Free Grammar (CFG):** Definition, notations, construction of CFG for CFL. **Derivation:** Left most derivation, right most derivation, derivation tree, ambiguous context free grammar, and removal of ambiguity from CFG.	**05**

	Simplification of CFG: live variable, reachable variable, useful variable, useful and useless production, removal of useless variables and useless productions, Nullable variable, ε-production, removal of ε-productions, unit production, removal of unit productions. **Normal Forms:** Chomsky normal form, Greibach normal forms.	
4	**Push Down Automata (PDA):** Formal definition, instantaneous description, accepted languages, PDA acceptance by Final State and by Empty Stack, deterministic and non-deterministic PDA, construction of PDA for CFG and CFL, construction of CFG for PDA.	**04**
5	**Turing Machine (TM):** Formal definition, instantaneous description, construction of TM. Variations of Turing machine: Two-way infinite tapes, Multi-tape, Multiple tracks, non-deterministic, multidimensional, Multi-head, Church-Turing thesis.	**05**
6	**Undecidability:** Decidable and undecidable problem. Recursive and recursively enumerable language: definition, properties. Universal Turing Machine (UTM) and an undecidable problem. A non-recursive enumerable language, halting problems, other unsolvable problems about TM. Post's correspondence problems: An instance of PCP, modified version of PCP, Undecidability of PCP, applications of PCP.	**02**

List of Tutorials/ Experiments:

1. Designing RE, RG, RLG and LLG for given Regular Language.
2. Converting RE to NFA, NFA to DFA to Reduced DFA, FA to RE.
3. Designing Moore and Mealy machines.
4. Designing CFG and getting Leftmost and Rightmost derivations from it.
5. Simplification of CFG.
6. Converting CFG to CNF & GNF.
7. Designing Push Down Automata for CFL and CFG.
8. Getting CFG from PDA.
9. Designing Turing Machine.
10. Demonstration of JFLAP tool.

Books Recommended:

Text books:

1. John C. Martin, "Introduction to Languages and Theory of Computation", 4th Edition, Tata McGraw Hill,2011.
2. Kavi Mahesh, "Theory of Computation A Problem Solving Approach", 1st Edition, Wiley India, 2011.

Reference Books:

1. John E. Hopcroft, Jeffrey D. Ullman, Motwani, "Introduction to Automata Theory, Languages and Computation",3rd Edition, Pearson, 2007.
2. Peter Linz, "An Introduction to Formal Languages and Automata", 3rd Edition, Jones and Bartlett Learning, 2001.
3. Harry R. Lewis, Christos H. Papadimitriou, "Elements of the Theory of Computation", 2nd Edition, PHI, 1998.
4. Michael Sipser, "Introduction to the Theory of Computation", 2nd Edition, Thomson Learning, 2006.
5. Bernard M. Moret, "The Theory of Computation", 1st Edition, Pearson Education, 2002.
6. Daniel I. A. Cohen, "Introduction to Computer Theory", 2nd Edition, Wiley, 2014.
7. J. Richard Buchi, "Finite Automata, Their Algebras and Grammars: Towards a Theory of Formal Expressions", 1st Edition, Springer-Verlag, 1989.
8. McNaughton R, "Elementary Computability, Formal Languages and Automata", Prentice-Hall, 1982.
9. K. L. P. Mishra, N. Chandrasekaran, "Theory of Computer Science", 3rd Edition, PHI, 2008.

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Objectives:

1. To acquaint the students with the process of identifying the need (considering a societal requirement) and ensuring that a solution is found 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.

Outcome:

Learner will 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 analyze 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 them 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 best design solution into a working model, using various components drawn from their domain as well as related interdisciplinary areas.
- Faculty supervisor may provide input to students during the entire span of the activity, spread over 2 semesters, wherein the focus shall be on self-learning.
- A record in the form of an activity logbook 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.

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- The design solution 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 a 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.
- The focus should be on self-learning, the 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 yearlong 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 III and IV.

Guidelines for Assessment of the work:

- The review/ progress monitoring committee shall be constituted by a panel of faculty members. 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, the 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.

Review/Progress monitoring committee may consider the following points during the assessment.

The tentative rubrics that can be followed can be as follows:

Review 1:

i. Revisiting the proposed solution
ii. System Design and Specification
iii. Presentation Quality
iv. Contribution as a team member and Punctuality

Review 2:

i. Implementation Details & Status (30% project implementation)
ii. Design & System Specifications
iii. Presentation Quality
iv. Contribution as a team member and Punctuality
v. Project Documentation

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 Examiners.

Program: Common to all Programs (Group A / B) **S.Y B. Tech. Semester: IV**
Course: Professional and Business Communication Tutorial (DJS23ITHSX05)

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

Course Outcomes: On completion of the course, the learner will be able to:
1. Apply group discussion techniques in professional situations
2. Use employability skills to optimize career opportunities
3. Employ storytelling techniques for effective presentation
4. Prepare technical documents using appropriate style, format, and language
5. Analyze the concept of professional ethics
6. Demonstrate interpersonal skills in professional and personal situations

Professional and Business Communication (DJS23ITHSX05)

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

Unit	Description of Tutorial Activities	No of Assignments
1	**Group Discussion:** Purpose of a GD, types of GD, criteria for evaluating GD, Dos and Don'ts of GD **Activity:** *The students will be divided into groups of 8-12 and each group will be given a topic/case to discuss within a given time frame. Each student will submit a write-up on their observations of the GD.*	**01**
2	**Employment Skills** **Resume Writing:** Types of resumes, structure, content, and formatting of resume **Activity:** *The students will prepare and submit their individual resume according to the professional requirements.* **Interview Skills:** Types and modes of interview, Preparation for interview, Dos and Don'ts of interview, frequently asked questions during interview **Activity:** *The students will submit a write-up on the FAQs and participate in mock interviews*	**02**
3	**Corporate Story Telling:** Elevator pitch, product stories, event stories, stories in presentations, storytelling in SOPs and interviews, storytelling to manage conflict or to motivate. **Activity:** *The students will be divided into groups of 8-12 and asked to give a team presentation using storytelling technique and submit the hardcopy of the ppt.*	**01**

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4	**Technical Writing and Documentation** **Business Proposal Writing:** Types of business proposals, format of proposal, language and style, presentation of proposal **Meeting Documentation:** Planning layout of meetings, observing meeting decorum, drafting notice, agenda, and minutes of meeting **Activity:** *The students will be divided into groups of 8-12 and each group will conduct a mock meeting based on an agenda and submit a writeup of the meeting documentation.*	**01**
5	**Professional Ethics:** Effective work habits, accountability, integrity, and excellence **Activity:** *The students will be divided into groups of 8-12 and each group will analyse a case involving an ethical issue and submit the writeup.*	**01**
6	**Interpersonal Skills** **Team Building:** Difference between group and team, importance of teamwork, strategies to be a good team player **Activity:** *The students will be divided into groups of 8-12 and each group will be assigned a task to be accomplished as a team, for which they will submit the writeup.* **Leadership:** Types of leadership, leadership styles, case studies **Activity:** *Each student will submit a writeup involving a leader they admire, analysing various aspects of his leadership style.* **Time Management:** Importance of time management, cultural views of time, 80/20 rule, time wasters, setting priorities and goals **Activity:** *Each student will submit a writeup about a case involving time management.*	**02**

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

Books Recommended:

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

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Evaluation Scheme:

Continuous Assessment (A):

Term Work: - 50 marks.

Term Work shall comprise of:

Minimum 8 assignments: 25 marks.

Business Proposal presentation: 25 marks.

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Program: Common to all Programs (Group A / B) **S.Y B. Tech. Semester: IV**
Course: Economics and Financial Management (DJS23ICHSX07)

Pre-requisite: Knowledge of Economics and Finance domain current affairs.

Course Objectives:

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

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

1. Analyse individual decision making, how prices and quantities are determined in product and factor markets, microeconomic and macroeconomic outcomes
2. Analyse the performance and functioning of government, RBI, markets, and institutions in the context of social and economic problems.
3. Analyse the current economic status of India at global levels and provision in budget to address economic issues at national level.
4. Describe an understanding of the overall role and importance of the finance function.
5. Analyse financial performance and make appropriate inferences.

Economics and Financial Management (DJS23ICHSX07)		
Module	**Syllabus Content**	**Duration**
1	**Introduction to Economics:** Fundamentals of Economics, Definition and scope of economics, the nature of the economic problem, finite resources and unlimited wants, definitions of the factors of production and their rewards, definition of opportunity cost, the influence of opportunity cost on decision making. **Microeconomics and Macroeconomics:** The role of markets in allocating resources, the market system, introduction to the price mechanism, Demand, Supply and Price determination, Price elasticity of demand and supply (PED),	**06**
2	**Role of Government and RBI:** Money, Banking, Households, Firms, economies and diseconomies of scale, Market Structure, Fiscal Policy, Monetary Policy, Economic Growth, causes and consequences of recession, causes of economic growth, measurement of economic growth **i**nflation and deflation, living standards, indicators of living standards	**04**
3	**Government Policies:** Last 20 years Journey of Indian Economy, Measures taken to grow Indian Economy, Meaning of India is the world's fifth-largest economy by nominal GDP and the third-largest by purchasing power parity (PPP), On a per capita income basis, India ranked 139th by GDP (nominal) and 127th by GDP (PPP) (Data reference year 2023), Comparison of top 5 largest economies in world, Discuss key points of India latest union budget and its impact on Indian economy and citizens, Meaning of Initiatives like Make in India, Digital India, Skill India etc. and expected impact on Indian Economy	**04**
4	**Overview of Financial Management:** Fundamentals of financial management, principles and functions of the financial management, Strategy, methods, and techniques of the financial management, Overview of financial instruments, financial markets, financial Institutions	**04**
5	**Overview of Financial Statements:** Balance Sheet, Profit and Loss Account, and Cash Flow Statement; Purpose of Financial Ratio Analysis; Liquidity Ratios; Efficiency or Activity Ratios; Profitability Ratios; Capital Structure Ratios; Stock Market Ratios;	**08**

Books Recommended

Text books:

1. Datt & Sundharam, "Indian Economy by Gaurav Datt & Biswajit Nag", 73rd Edition, S. Chand Publications, 2024
2. Prasanna Chandra, "Fundamentals of Financial Management", 7th Edition, McGraw Hill Publications, 2020

Reference Books:

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

Evaluation Scheme:

Continuous Assessment (A):

Will consist of following three components:

1. Term Test 1 (based on 40 % syllabus) – 15 marks.
2. Term Test 2 (on next 40 % syllabus) – 15 marks.
3. Assignment / course project / group discussion / presentation / quiz – 10 marks
   Total summing up to 40 marks.

Semester End Examination (B):

Theory:

Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 60 marks.

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