Shri Vile Parle Kelavani
Mandal's

Dwarkadas J. Sanghvi College of Engineering

(Autonomous College Affiliated to the University of Mumbai)

Scheme and detailed syllabus

Second Year B.Tech

in

Artificial Intelligence and Machine Learning

(Semester IV)

Academic Year 2024-25

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)

Proposed Scheme for Second Year Undergraduate Program in Artificial Intelligence and Machine Learning: Semester IV (Autonomous)
Academic Year (2024-25)

Sr No	Course Code	Course	Teaching Scheme(hrs)				Continuous Assessment (A)(marks)			Semester End Assessment (B) (marks)					Aggregate (A+B)	Total Credits
			Th	P	T	Credits	Th	T/W	Total CA (A)	Th	O	P	O &P	Total SEA (B)		
1	DJS23ACPC401	Statistics for Engineers	2	--	--	2	40	--	40	60	--	--	--	60	100	3
	DJS23ATPC401	Statistics for Engineers Tutorial	--	--	1	1	--	25	25	--	--	--	--	--	25	
2	DJS23ACPC402	Artificial Intelligence	2	--	--	2	40	--	40	60	--	--	--	60	100	3
	DJS23ALPC402	Artificial Intelligence Laboratory	--	2	--	1	--	25	25	--	--	--	25	25	50	
3	DJS23ACPC403	Design and Analysis of Algorithms	2	--	--	2	40	--	40	60	--	--	--	60	100	3
	DJS23ALPC403	Design and Analysis of Algorithms Laboratory	--	2	--	1	--	25	25	--	--	--	25	25	50	
4	DJS23ALPC404	Programming Laboratory-II (Web Development)	--	2	--	1	--	25	25	--	--	--	25	25	50	1
5	DJS23ACMD401	Database Management Systems	2	--	--	2	40	--	40	60	--	--	--	60	100	3
	DJS23ALMD401	Database Management Systems Laboratory	--	2	--	1	--	25	25	--	--	--	25	25	50	
6	DJS23OCOE401	Project Management	3	--	--	3	40	--	40	60	--	--	--	60	100	3
	DJS23OCOE402	Cyber Security, Policies and Laws	3	--	--		40	--	40	60	--	--	--	60	100	
	DJS23OCOE403	Advanced Operations Research	3	--	--		40	--	40	60	--	--	--	60	100	
	DJS23OCOE404	Corporate Finance Management	3	--	--		40	--	40	60	--	--	--	60	100	
	DJS23OCOE405	Corporate Social Responsibility	3	--	--		40	--	40	60	--	--	--	60	100	
	DJS23OCOE406	Bioinformatics	3	--	--		40	--	40	60	--	--	--	60	100	
	DJS23OCOE407	Human Resource Management	3	--	--		40	--	40	60	--	--	--	60	100	
	DJS23OCOE408	Digital Marketing Management	3	--	--		40	--	40	60	--	--	--	60	100	
	DJS23OCOE409	Logistics & Supply Chain Management	3	--	--		40	--	40	60	--	--	--	60	100	
7	DJS23IPSCX	Innovative Product Development II	--	2	--	1	--	25	25	--	--	--	--	--	25	1
8	DJS23ITHSX05	Design Thinking Laboratory	--	2	--	1	--	25	25	--	--	--	--	--	25	1
9	DJS23ICHSX08	Universal Human Values	2	--	--	2	40	--	40	60	--	--	--	60	100	3
	DJS23ITHSX08	Universal Human Values Tutorial	--	--	1	1	--	25	25	--	--	--	--	--	25	
		Total	**13**	**12**	**2**	**21**	**240**	**200**	**440**	**360**	**--**	**--**	**100**	**400**	**900**	**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.	60	2
	* Computer-based assessment in the college premises.		
Oral	Questions based on the entire syllabus.	25	As applicable
Practical	Performance of the practical assigned during the Examination and the output / results obtained.	25	2
Oral & Practical	Project based courses - Performance of the practical assigned during the examination and the output / results obtained. Based on the practical performed during the Examination and on the entire syllabus.	As per the scheme	2

Program: Artificial Intelligence & Machine Learning	S.Y. B.Tech.	Semester: IV
Course: Statistics for Engineers (DJS23ACPC401)		
Course: Statistics for Engineers Tutorial (DJS23ATPC401)		

Prerequisite:

1. Calculus
2. Descriptive Statistics
3. Basics of probability

Objectives:

The course aims:

1. To understand random variables with their distribution and expectation.
2. To estimate population parameters from random samples and perform error analyses.
3. To understand and apply the basic concepts of statistical inference, confidence limits and hypothesis testing.
4. To understand and apply the concepts of analysis of variance.

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

1. Apply the concepts of probability and distributions to some case studies.
2. Demonstrate sampling distributions and estimate statistical parameters.
3. Develop hypothesis based on data and perform testing using various statistical techniques.
4. Perform analysis of variance on data.

Statistics for Engineers: (DJS23ACPC401)		
Unit	**Description**	**Duration**
1	**Random Variables and Probability Distributions:** Concept of a Random Variable, Discrete Probability Distributions, Continuous Probability Distributions, Mathematical Expectation, Statistical Independence. **Discrete Probability Distributions:** Binomial Distribution, Poisson distribution. **Continuous Probability Distributions**: Normal Distribution, Areas under the Normal Curve, Applications of the Normal Distribution, Normal Approximation to the Binomial.	08
2	**Sampling distribution**: Random Sampling, Sampling Distributions, Sampling Distribution of Means and the Central limit theorem, population distribution, Z - distribution, Student's t-distribution, F-Distribution, Chi-square distribution. **Statistical Estimation Theory**: Characteristics of estimators, consistency,	06

	unbiasedness, unbiased estimates, efficient estimates, sufficient estimators, point estimates, interval estimates, determination of sample size for estimating mean and proportions, estimates of population parameters, probable error. **Confidence interval**: Population mean, difference between two population means, population proportion, difference between two population proportions, variance, ratio of variances of two populations.	
3	**Test of Hypothesis**: Test of significance, null and alternative hypothesis, type I and type II error, factors affecting Type II error, probability of Type II error, power of test, p Value, critical region, level of significance. **Parametric Test:** Test the difference between sample proportion and population proportion, difference between two sample proportion, difference between sample mean and population mean with known σ and unknown σ, difference between two sample means, one tailed and two tailed tests using z-statistics and t-statistics. Test the equality of population variance using F-statistics. **Non-parametric Test**: Test of independence, goodness of fit using chi- square statistics.	**7**
4	**Analysis of Variance (ANOVA) for data analysis:** Sample size calculation, one way ANOVA, POST-HOC Analysis (Tukey's Test), randomized block design, two-way ANOVA.	**5**
	Total	**26**

Books Recommended:

Text books:

1. Statistical Methods, S. P. Gupta, Sultan Chand, 2021, 46th revised edition.
2. Probability - Statistics and Random Processes by T. Veerarajan, McGraw Hill Education. 3rd edition, 2017.
3. Think Stats: Probability and Statistics for Programmers, Allen B. Downey, Green Tea Press, 2011.
4. Testing Statistical Hypotheses, E. L. Lehmann, Joseph P. Romano, Springer, 2008, third edition.
5. An Introduction to Statistics with Python, Thomas Hasalwanter, Springer, 2016.

Reference Books:

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

Suggested Tutorials:

Statistics for Engineers Tutorial (DJS23ATPC401)	
Sr. No.	Title of Tutorial
1	Random Variables and Probability Distributions
2	Discrete Probability Distributions
3	Continuous Probability Distributions
4	Central Limit Theorem
5	Statistical Estimation Theory
6	Confidence interval
7	Parametric Test
8	Non-parametric Test
9	One way ANOVA, POST-HOC Analysis (Tukey's Test)
10	Two-way ANOVA.

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

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Program: Artificial Intelligence & Machine Learning	S.Y. B.Tech.	Semester: IV
Course: Artificial Intelligence (DJS23ACPC402)		
Course: Artificial Intelligence Laboratory (DJS23ALPC402)		

Pre-requisite: Foundation of Artificial Intelligence

Objectives:

1. The course aims to introduce the concepts of artificial intelligence, search algorithms, knowledge representation, and data analysis.
2. To apply various AI techniques, including search algorithms, knowledge representation methods, and data mining techniques, to solve real-world problems.

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

1. Apply various search algorithms (uninformed and informed) to solve a wide range of problems, from simple puzzles to complex optimization tasks. Represent knowledge using logical and probabilistic models and perform reasoning tasks effectively.
2. Discover local search and optimization problem.
3. Develop intelligent agents that can play games optimally or near-optimally using techniques
4. Inference techniques like forward chaining, backward chaining, and resolution to solve problems and draw conclusions from given knowledge bases as well as planning.

Artificial Intelligence (DJS23ACPC402)		
Unit	**Description**	**Duration**
1	**Uninformed Search Algorithms:** Best-first search, Search data structures, Redundant paths, Measuring problem-solving performance, Uninformed Search Strategies: Breadth-first search, Uniform-cost search, Depth-first search and the problem of memory, Depth-limited and iterative deepening search, Bidirectional search, Comparing uninformed search algorithms.	**05**
2	**Informed Search Algorithms:** Greedy best-first search, A* search, Search contours, Satisficing search: Inadmissible heuristics and weighted A*, Memory-bounded search, Bidirectional heuristic search, The effect of heuristic accuracy on performance, Generating heuristics from- relaxed problems, sub problems and landmarks.	**05**
3	**Local Search and Optimization Problems:** Hill-climbing search, Simulated annealing, Local beam search, Evolutionary algorithms- Genetics Algorithm, Ant Colony Optimization, Particle Swarm Optimization.	**05**
4	**Adversarial Search and Games:** Game Theory, Optimal Decisions in Games- The minimax search algorithm, Alpha--Beta Pruning, Monte Carlo Tree Search, Stochastic Games, Limitations of Game Search Algorithms.	**06**

5	**Inference in FOL and Planning:** Unification and First-Order Inference, Forward Chaining, Backward Chaining, Resolution, Practical uses of resolution theorem provers. Definition of Classical Planning, Algorithms, Heuristics for Planning, Hierarchical Planning.	05
	TOTAL	26

Books Recommended:

Textbooks:

1. AI for Everyone: a beginner's Handbook for AI, Saptarsi Goswami, Pearson Publication, 2024.
2. ARTIFICIAL INTELLIGENCE: A MODERN APPROACH, 4TH EDITION, Russell/Norvig, 2022.
3. Artificial intelligence a modern approach, Mikan Ltd ISBN- No 978-1914063183, 2020.
4. Deepak Khemani." A First Course in Artificial Intelligence", McGraw Hill Education (India), 2013.

Reference Books:

1. Nils J. Nilsson, Principles of Artificial Intelligence, Narosa Publication.
2. Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill Publication
3. Patrick H. Winston, Artificial Intelligence, 3rd edition, Pearson Education.

Online References:

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

Suggested List of Laboratory Experiments:

Artificial Intelligence Laboratory (DJS23ALPC402)	
Sr No	**Title of Experiment**
1	One case study on AI applications published in IEEE/ACM/Springer or any prominent journal.
2	Implement breadth-first, depth-first, uniform-cost, and iterative deepening search on various problem domains (e.g., 8-puzzle, sliding tile puzzle, maze solving). Compare their performance in terms of nodes expanded, solution path length, and execution time.
3	Implement BFS/DFS/DFID search algorithms to reach goal state.
4	Implement A* search algorithm to reach the goal state.
5	Implement iterative deepening A* or recursive best-first search to handle memory constraints. Compare their performance on large problem instances.
6	Implement steepest ascent, hill climbing with random restarts, and simulated annealing. Test them on optimization problems like the traveling salesman problem or the knapsack problem.

7	Explore different genetic operators (e.g., crossover, mutation) and their impact on the convergence rate and solution quality of genetic algorithms.
8	Implement a minimax algorithm for a two-player game.
9	Experiment with different exploration and exploitation strategies in Monte Carlos Tree Search. Test its effectiveness on games like Go or chess.
10	Implement a resolution-based theorem prover and test it on various logical problems.
11	Implement forward and backward chaining planning algorithms. Compare their performance on planning domains like the blocks world or the logistics domain.
12	Case study on AI applications: A. Introduction to NLP- Language models, Grammars, Parsing. B. Robotics - Robots, Robot hardware, Problems Robotics can solve. C. AI applications in Healthcare, Retail, Banking.

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

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Program: Artificial Intelligence & Machine Learning	S.Y. B.Tech.	Semester: IV
Course: Design and Analysis of Algorithms (DJS23ACPC403)		
Course: Design and Analysis of Algorithms Laboratory (DJS23ALPC403)		

Prerequisite: Computer Programming, Data structure

Course Objectives: The Objective of the course is

1. To provide mathematical approach for Analysis of Algorithms.
2. To solve problems using various algorithmic strategies.
3. To analyze algorithms for solving problems.

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

1. Analyze the performance of algorithms using asymptotic analysis.
2. Apply the concept of Greedy method to solve all feasible solutions of problems
3. Find optimal solution of problem by applying the concept of dynamic programming strategy.
4. Understand the concepts of backtracking, branch and bound to represent solution by state space tree.
5. Implement string matching techniques.

Design and Analysis of Algorithms (DJS23ACPC403)		
Unit	**Description**	**Duration**
1	**Introduction:** Analysis of control statements and loops, solving recurrence relations using tree, substitution, master method, analysis of quick sort and merge sort Problem Solvingusing divide and conquer algorithm - Max-Min problem, Strassen's Matrix Multiplication	05
2	**Greedy Method:** Introduction, Problem solving using - fractional knapsack problem, activity selection problem, job sequencing with deadline, Graph: Minimum Spanning trees(Kruskal's algorithm (Use find and union concept, Prim's algorithm), Single source shortest path (Dijkstra's algorithm), coin change problem.	06
3	**Dynamic Programming:** Introduction, principle of optimality, Components of dynamic programming, characteristics of dynamic programming, Fibonacci problem, Coin Changing problem, 0/1 knapsack (table method), All pairs shortest paths (Floyd Warshall Algorithm), Single source shortest path (Bellman-Ford Algorithm), Matrix Chain Multiplication, Travelling salesperson problem, Longest Common Subsequence (LCS), Analysis of all Algorithms.	08
4	**Backtracking and Branch-and-Bound:** Basics of backtracking, N–queen problem, Sum of subsets, Graph coloring, Analysis of all Algorithms. Branch-and-Bound : Introduction, Types of BB and its properties, Fifteen Puzzle problem.	04
5	**String Matching Algorithms** The naive string-matching algorithm, The Rabin Karp algorithm,String matching with finite automata, The Knuth Morris Pratt algorithm	03
TOTAL		26

Books Recommended:

Text Books:

1. S. Sridhar, Design and Analysis of Algorithms, 1st Edition, Oxford Education, 2018.
2. Design and Analysis of Algorithms, Goodrich M T, Wiley, New Delhi, 2021
3. Ellis Horowitz, Sartaj Sahni, S. Rajsekaran. "Fundamentals of computer algorithms" University Press

Reference Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, "Introduction to Algorithms", 4TH Edition, The MIT Press, 2022.
2. Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, "Algorithms", Tata McGraw-Hill Edition. 2. S.
K. Basu, "Design Methods and Analysis of Algorithm", PHI.
3. John Kleinberg, Eva Tardos, "Algorithm Design", Pearson. 4. Michael T. Goodrich, Roberto Tamassia, "Algorithm Design", Wiley Publication.
4. Michael T. Goodrich, Roberto Tamassia, "Algorithm Design", Wiley Publication.

Suggested List of Experiments:

Design and Analysis of Algorithms Laboratory (DJS23ALPC403)	
Sr. No.	**Title of the Experiment**
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
6	Implementation of Kruskal's/ Prim's algorithm using greedy approach
7	Implementation of job sequencing with deadline using greedy approach
8	Implementation of other greedy algorithms eg: tree vertex split, subset cover, container loading, coin changing, optimal; merge patterns (Huffman tree)
9	Implementation of Single source shortest path (Dijkstra's algorithm)
10	Implementation of Bellman Ford algorithm using Dynamic programming
11	Implementation of Longest Common Subsequence algorithm using Dynamic programming
12	Implementation of Travelling Salesperson problem using Dynamic programming
13	Implementation of all pair shortest path using dynamic programming
14	Implementation of N-queen problem using Backtracking
15	Implementation of 15 Puzzle problem using Backtracking
16	Implementation of Knuth Morris Pratt string matching algorithm

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

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Program: Artificial Intelligence & Machine Learning	S.Y. B.Tech.	Semester: IV
Course: Programming Laboratory-II (Web Development) (DJS23ALPC404)		

Pre-requisite: Basics of programming

Course Objectives:

1. To get familiar with the basics of Web Programming.
2. To expose students to Basics and Advanced concepts in REACT.
3. To orient students to Fundamentals of node.js and express framework.
4. To understand REST API and MongoDB for Frontend and Backend Connectivity. validation, and security measures to protect sensitive information within a database.

Course Outcomes: Students will be able to

1. Implement interactive web page(s) using HTML5, CSS3 and JavaScript.
2. Implement Single Page Application using React.js and Node.js Framework.
3. Construct web based Node.js applications using Express.
4. Apply MongoDB for frontend and backend connectivity using REST API.

Programming Laboratory-II (Web Development) (DJS23ALPC404)		
Unit	**Description**	**Duration**
01	**HTML5, CSS3 and Bootstrap5:** **HTML5:** Introduction and Advantages of HTML5, HTML formatting, Hyperlinks, Images, tables, Lists, Elements (Block & Inline), Attributes, Page Layout, Semantic Elements, HTML5 Web Forms, HTML5 Media (Video & Audio). **CSS3:** Introducing CSS3, Selectors, Border, Box Model, Margin & Padding, Background Images & Colors and Other Decorative (Texts, Fonts, Links, Lists, Tables), Positioning, Combinators, Pseudo-class and Pseudo-element, CSS Attribute Selectors, 2D and 3D Transformations, Transitions and Animations, @property, Flexbox, CSS3-Multi Column Layout, Media Queries. **Bootstrap5:** Introduction to Bootstrap, Containers, Bootstrap Grids, Bootstrap Cards, Bootstrap JS (Navbar, Offcanvas, Collapse, Modal, Carousel), Flex, Bootstrap Forms.	04
2	**JavaScript** Introduction to JavaScript, JavaScript DOM Model, var, let, const, Operators, primitive data types & strings, conditional, loop, for each loop, operators, ternary operators, RegExp. Arrow functions, normal functions - Lexical this - Events, Handling events - Spread operator, Destructuring - named imports, default import, map,	06

	filter, reduce, Date and Objects. Call back system, Asynchronous, promises - Async, await, JSON Introduction, Syntax.	
3	**React Fundamental** Installation, installing libraries, Folder and file structure, Components, Component lifecycle, Props, State, Events, React Conditional, map, keys, React Router and Single page applications, Forms, Form Handling. **Advance React** Refs, Use effects, Hooks, Flow architecture, Model View Controller(MVC) framework, Flux	**06**
4	**Node.js** Node.js, Setup Development Environment: Installation of Node.js, Working in REPL, NodeJS Console, Event Loop, working with an MVC framework, apply concepts like data types, objects, methods, object- oriented programming, and classes in the context of backend development, Creating simple Node Server, Request and Response, Routing responses, NPM JavaScript Build Processes, Event Loop and Emitters, File System Interaction, Modules, Native Node drivers.	**06**
5	**Express.js** Introduction, Installation, Express router, REST API, Generator, Authentication, sessions, Integrating with React, Commercial deployment.	**04**
6	**Database Connectivity** MongoDB Installation, connecting to MongoDB, CRUD Operations, Frontend Integration with React (Fetching data, State Management, Displaying Data), User Authentication (JWT), Role-based Access Control. Hosting Backend (e.g., Heroku, Vercel), Hosting Frontend (e.g., Netlify, Vercel)	**02**
	TOTAL	**26**

Books Recommended:

Text Books:

1. John Dean, "Web Programming with HTML5, CSS3 and JavaScript", Jones & Bartlett Learning, 2019.
2. Glenn Johnson, "Programming in HTML5 with JavaScript and CSS3", Microsoft Press, 2013 Edition.
3. Adam Bretz and Colin J. Ihrig, "Full Stack JavaScript Development with MEAN", SitePoint Pty. Ltd., 2015.
4. Simon Holmes Clive Harber, "Getting MEAN with Mongo, Express, Angular, and Node", Manning Publications, 2015.
5. Venkat Subramaniam, "Rediscovering JavaScript, Master ES6, ES7, and ES8", The Pragmatic Bookshelf, 2018.
6. Alex Banks and Eve Porcello, "Learning React Functional Web Development with React and Redux", O'Reilly, 1st Edition, 2017 Edition 5.

7. Andrew Mead, "Learning Node.js Development", Packt Publishing, 2018 Edition 6.
8. Valentin Bojinov, "RESTful Web API Design with Node.js 10", Packt Publication, 2018.

Reference Books:

1. Ethan Brown, "Web Development with Node and Express", O'Reilly, 2019.
2. Shama Hoque "Full-Stack React Projects: Learn MERN stack development by building modern web apps using MongoDB, Express, React, and Node.js", 2nd Edition Packt Publication, 2020.

Suggested List of Experiments:

Programming Laboratory-II (Web Development) (DJS23ALPC404)	
Sr. No.	**Title of the Experiment**
1	Using HTML5 layout tags develop informative page with sections which include various images, links to other pages for navigation, make use of all possible formatting (for example font, color etc.).
2	Create form in HTML5 with all form elements. Apply form validations (e.g., Email, mobile, Pin code, Password) using JavaScript.
3	Apply CSS properties, Border, margins, Padding, Navigation, dropdown list to page created in First and Second Experiments.
4	Create an application to implement a counter application in JavaScript.
5	Create an application to demonstrate JSX, Components, Props, State in React.
6	Create an application to demonstrate Forms, Events, Routers, Refs, Keys in React.
7	Create an application to demonstrate use of Conditional rendering in React JS.
8	Create an application to build a simple web server that serves static content. They can learn how to use the http module to create a server, and how to handle requests and responses.
9	Create an application to demonstrate the implementation of Call back system, Asynchronous, promises - Async, await in node js.
10	Build a RESTful API using MongoDB.

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

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Program: Artificial Intelligence & Machine Learning	S.Y. B.Tech.	Semester: IV
Course: Database Management Systems (DJS23ACMD401)		
Course: Database Management Systems Laboratory(DJS23ALMD401)		

Pre-requisite: Computer Basics

Course Objectives:

1. Understanding Database Fundamentals.
2. Develop Structured Query Language (SQL) for data definition, manipulation, and retrieval, including complex queries and transactions
3. Learn how to design efficient and normalized database schemas using Entity-Relationship (ER) modeling and normalization techniques.
4. Understand the principles of data integrity, validation, and security measures to protect sensitive information within a database.

Course Outcomes: Students will be able to

1. Design an optimized database.
2. Construct SQL queries to perform operations on the database.
3. Demonstrate appropriate transaction management and recovery techniques for a given problem.
4. Apply indexing mechanisms for efficient retrieval of information from database.

Database Management Systems (DJS23ACMD401)		
Unit	**Description**	**Duration**
1	**Introduction to Database Concepts and Relational Data Model** Introduction, Characteristics of databases, File system v/s Database system, Users of Database system, Schema and Instance, Data Independence, DBMS system architecture, Database Administrator The Entity-Relationship (ER) Model: Entity types: Weak and strong entity sets, Entity sets, Types of Attributes, Keys, Relationship constraints: Cardinality and Participation, Extended Entity-Relationship (EER) Model: Generalization, Specialization and Aggregation Introduction to the Relational Model, relational schema and concept of keys, Mapping the ER and EER Model to the Relational Model	6
2	**Structured Query Language** Overview of SQL, Data Definition Commands, Data Manipulation commands, Integrity constraints - key constraints, Domain Constraints, Referential integrity, check constraints, Data Control commands, Transaction Control Commands, Set and String operations, group by, having, Views in SQL, joins, Nested and complex queries	5

3	**Relational–Database Design** Pitfalls in Relational-Database designs, Concept of normalization, Function Dependencies, Normal Forms- 1NF, 2NF, 3NF	4
4	**Transaction Management and Recovery** Transaction Concept, ACID properties, Transaction States, Concurrent Executions, Serializability, Concurrency Control Protocols: Lock-based, Deadlock Handling, Recovery System: Failure classification, Log based recovery	7
5	**Indexing Mechanism** Hashing techniques, Types of Indexes: Single Level Ordered Indexes, Multilevel Indexes, Overview of B-Trees and B+ Trees.	4
TOTAL		**26**

Books Recommended:

Text Books:

1. Korth, Silberchatz, Sudarshan, —Database System Concepts, 7th Edition, McGraw – Hill,2019.
2. Elmasri and Navathe, —Fundamentals of Database Systems, 7th Edition, Pearson education,2016.
3. Peter Rob and Carlos Coronel, —Database Systems Design, Implementation and Management, Thomson Learning, 5th Revised Edition, 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. Sharaman Shah, —Oracle for Professional, Shroff Publishers & Distributers Private Limited,1st edition, 2008
3. Raghu Ramakrishnan and Johannes Gehrke, — Database Management Systems, 3rd Edition, McGraw – Hill, 2014.
4. Patrick Dalton, "Microsoft SQL Server Black Book", Coriolis Group,U.S., 11th ed. edition (1 July 1997)
5. Lynn Beighley, "Head First SQL", O'Reilly Media, 1st edition (28 August 2007)

Suggested List of Experiments:

Database Management Systems Laboratory (DJS23ALMD401)	
Sr. No.	**Title of the Experiment**
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 aggregate functions
6	To implement Joins and Views
7	To implement Subqueries.
8	To implement triggers
9	To implement security and authorization in SQL
10	Examine the consistency of database using concurrency control technique (Locks)
11	To implement B-trees/B+ trees.

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

DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
Estd. 1994
CREATING ENGINEERS

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

Program: Open Elective for all Programs	**S.Y B.Tech.**	**Semester: IV**
Course: Project Management (DJS23OCOE401)		

Pre-requisite:

1. Basic concepts of Management.

Objectives:

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

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

1. Explain project management life cycle and the various project phases as well as the role of project manager.
2. Apply selection criteria and select an appropriate project from different options.
3. Create a work break down structure for a project and develop a schedule based on it. Manage project risk strategically.
4. Use Earned value technique and determine & predict status of the project. Capture lessons learned during project phases and document them for future reference.
5. Differentiate between traditional waterfall approach and agile scrum methodology for software development projects.

Project Management (DJS23OCOE401)		
Unit	**Description**	**Duration**
1	**Project Management Foundation:** Definition of a project, Project Vs Operations, Necessity of project management, Triple constraints, Project life cycles (typical & atypical). Project phases and stage gate process. Role of project manager, Negotiations and resolving conflicts, Introduction to project leadership, ethics in projects, Multicultural and virtual projects, Project management in various organization structures, PM knowledge areas as per Project Management Institute (PMI).	07
2	**Initiating Projects:** How to get a project started, selecting project strategically, Project selection models (Numeric /Scoring Models and Non-numeric models), Project portfolio process, Project sponsor and creating charter, Effective project team, Stages of team development & growth (forming, storming, norming &performing), team dynamics.	08
3	**Project Planning:** Work Breakdown structure (WBS) and linear responsibility chart, Project cost estimation and budgeting, Top down and bottoms up budgeting, Networking and Scheduling techniques, PERT, CPM. Crashing project time & Resource loading and levelling (Only Theory), Project Stakeholders and Communication plan.	08

	Risk Management in projects: Risk management planning, Risk identification and risk register, Qualitative and quantitative risk assessment, Probability, and impact matrix. Risk response strategies for positive and negative risks.	
4	**Monitoring and Controlling Projects**: Planning monitoring and controlling cycle, Information needs and reporting, engaging with all stakeholders of the projects, communication and project meetings. Earned Value Management techniques for measuring value of work completed, using milestones for measurement, change requests and scope creep, Project audit, Project Contracting: Project procurement management, contracting and outsourcing. **Closing the Project:** Customer acceptance, Reasons of project termination, Various types of project terminations (Extinction, Addition, Integration, Starvation), Process of project termination, completing a final report, doing a lessons learned analysis, acknowledging successes and failures.	08
5	**Agile project management:** Agile principle, Agile Manifesto, Agile process framework, Characteristics of Agile Approaches and Scrum, Benefits of Agile project management, Implementing Agile project management. **Agile Project Planning:** Comparison of Agile Project Management with Traditional Waterfall Approach, Project Planning with Scrum, Scrum Artifacts Supporting Project Planning, Scrum Events for Project Planning. Scheduling with scrum, Techniques for scrum scheduling- Poker estimation. **Agile Tools for Tracking Project Progress:** Task Boards, Burnup and Burndown Charts.	08
	Total	**39**

Books Recommended:

Text Books:

1. Project Management: A managerial approach, Jack Meredith & Samuel Mantel, 11th Edition, Wiley India.
2. Project Management: The Managerial Process, 8th edition, Erik Larson, Clifford Gray, McGraw Hill Education.
3. Agile Project Management, Jim Highsmith, Pearson Education, Low Price Edition, India.

Reference Books:

1. A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 7th Ed, Project Management Institute PA, USA.

2. Project Management, Gido Clements, Cengage Learning.
3. Project Management, Gopalan, Wiley India.
4. Project Management, Dennis Lock, 9th Edition, Gower Publishing England.
5. Agile Essentials You Always Wanted to Know, Kalpesh Ashar, Vibrant Publishers U.S.A.

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Program: Open Elective for all Programs	S.Y B.Tech.	Semester: IV
Course: Cyber Security, Policies and Laws (DJS23OCOE402)		

Pre-requisite:

1. Fundamentals of Computers.

Objectives:

1. Familiarize with the provisions and implications of the Digital Personal and Data Protection Act, the obligations of data fiduciaries, the rights and duties of data principals, and mechanisms for resolving breaches.
2. Equip individuals and organizations with the knowledge and tools to create secure cyber ecosystems, strengthen regulatory frameworks, and develop incident response plans.

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

1. Understand and describe the major types of cybercrime and navigate legal frameworks and regulations concerning digital personal and data protection.
2. Implement strategies for cybersecurity outlined in the National Cyber Security Policy.
3. Apply appropriate law enforcement strategies to both, prevent and control cybercrime.
4. Comprehend regulations and strategies pertaining to AI (Artificial Intelligence) and large language models.

Cyber Security, Policies and Laws (DJS23OCOE402)		
Unit	**Description**	**Duration**
1	**Cyber Crime:** Definition and Origin of the Word, Cyber Crime and Information Security, who are Cyber Criminals, Classification of Cybercrimes, E-mail Spoofing, Spamming, Cyber Defamation, Internet TimeTheft, Salami Attack, Salami technique Data Diddling, Forgery, Newsgroup Spam, Online Frauds, Pornographic Offenders, Email Bombing, Password Sniffing, Credit Card Frauds.	08
2	**Cyber Offenses:** How Criminals plan them, Categories of Cyber Crimes, How Criminal Plans the Attack: Active Attacks, Passive Attacks, Social Engineering, Classification of Social Engineering, Cyber Stalking: types of Stalkers, Cyber Cafe and Cyber Crimes, Botnets, Attack Vectors, Cyber Crime and Cloud Computing.	08
3	**Indian IT Act** Cyber Crime and Criminal Justice, Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments Security aspect in Cyber-Law, The Contract Aspects in Cyber Law, The Security Aspect of Cyber Law, Security Standards: SOX,	08

	GLBA, HIPAA, NIST Cyber Security Framework (CSF).	
4	**India's Digital Personal and Data Protection Act (2023)** Preliminary, Obligations of Data Fiduciary, Rights and Duties of Data Principal, Special Provisions, Data Protection Board of India, Powers, Functions and Procedure to Be Followed by Board, Appeal and Alternate Dispute Resolution, Penalties and Adjudication.	07
5	**India's AI Regulation and Strategy** Privacy, Security and Artificial Intelligence, Differential Privacy, Security in AI. National Artificial Intelligence Strategy, Principles for Responsible AI, Information Technology (Intermediary Guidelines and Digital Media Ethics Code-2021), Draft National Data Governance Framework Policy (NDGFP), Rules against Deepfakes, Due diligence advisory for AI, AI regulations framework (June 2024).	08
	Total	**39**

Books Recommended:

Text Books:

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

Reference Books:

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

References (Web Resources):

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

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Program: Open Elective for all Programs	S.Y B.Tech.	Semester: IV
Course: Advanced Operations Research (DJS23OCOE403)		

Pre-requisite:

1. Operation Research
2. Mathematics (Calculus)

Objectives:

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

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

1. Apply Duality theory to solve linear programming problem and analyse optimum solution.
2. Construct linear integer programming models and apply the O.R. algorithms and techniques to solve linear integer programming problems.
3. Determine best satisfying solution under a varying quantity of resources and priorities of the goals.
4. Set up decision models and solve nonlinear programming- unconstrained optimization problems.
5. Set up decision models and solve nonlinear programming- constrained optimization problems.

Advanced Operations Research (DJS23OCOE403)		
Module	**Description**	**Hours**
1.	**Dual Linear Programs** Primal, dual, and duality theory - The dual simplex method , The primal-dual algorithm-Duality applications. Post optimization problems: Sensitivity analysis.	06
2.	**Integer Programming** Pure and mixed integer programming problems, Solution of Integer programming problems – Gomory's all integer cutting plane method and mixed integer method, branch and bound method, Zero-one programming.	06
3.	**Goal Programming** Concept of Goal Programming, GP model formulations, Graphical methodof GP, The simplex method of GP, Application areas of GP.	05
4.	**Nonlinear Programming-Unconstrained optimization:** Minimization and maximization of convex functions- Local & Global optimum-Convergence-Speed of convergence. one-dimensional unconstrained optimization – Newton's method – Golden-section search	11

	method , multidimensional unconstrained optimization –Gradient method — steepest ascent (descent) method – Newton's method.	
5.	**Nonlinear Programming- Constrained optimization** Constrained optimization with equality and inequality constraints. Lagrangian method - Sufficiency conditions - Kuhn-Tucker optimality conditions Rate of convergence - Engineering Applications Quadratic programming problems-convex programming problems.	11
		39

Books Recommended:

Text Books:

1. Operations Research, Gupta, P. K. and Hira, D. S., S. Chand Publications, 2014.
2. Operations research: Principles and applications, Srinivasan, G., Prentice Hallof India, 2007.
3. Non-Linear Programming-A Basic Introduction, Nita H. Shah, Poonam Prakash Mishra, CRC Press, 2020.

Reference Books:

1. Introduction to Operations Research, Frederick S. Hillier & Gerald J. Lieberman, McGraw-Hill: Boston MA; 8th. (International) Edition, 2005.
2. Operations Research – Principle and Practice Ravindran, Philips and Soleberg, Second
   Edition, John Wiley, and sons, 2007.
3. Operations Research - An Introduction: Taha, H. A., Pearson Education, 2022.
4. Operations Research: models and methods, Paul A. Jensen, Jonathan F. Bard, Wiley Publications, 2003
5. Optimization Techniques in Operation Research, C. B Gupta, I.K. International Publishing House Pvt. Limited, 2008.

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Program: Open Elective for all Programs	S.Y B.Tech.	Semester: IV
Course: Corporate Finance Management (DJS23OCOE404)		

Pre-requisite:

1. Nil

Objectives:

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

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

1. Understand Indian finance system.
2. Apply concepts of time value money and risk returns to product, services and business.
3. Understand corporate finance and working capital management.
4. Take Investment and finance decisions.
5. Take dividend decisions.

Corporate Finance Management (DJS23OCOE404)		
Unit	**Description**	**Duration**
1	**Overview of Indian Financial System:** Characteristics, Components and Functions of Financial System. Financial Instruments: Meaning, Characteristics and Classificationof Basic Financial Instruments — Equity Shares, Preference Shares, Bonds-Debentures, Certificates of Deposit, and Treasury Bills. Financial Markets: Meaning, Characteristics and Classification of Financial Markets — Capital Market, Money Market and Foreign Currency Market. Financial Institutions: Meaning, Characteristics and Classification of Financial Institutions — Commercial Banks, Investment-Merchant Banks and Stock Exchanges.	08
2	**Concepts of Returns and Risks:** Measurement of Historical Returns and Expected Returns of a Single Security and a Two-security Portfolio; Measurement of Historical Risk and Expected Risk of a Single Security and a Two-security Portfolio. **Time Value of Money:** Future Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Present Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Continuous Compounding and Continuous Discounting.	08

3	**Overview of Corporate Finance:** Objectives of Corporate Finance; Functions of Corporate Finance-investment Decision, Financing Decision, and Dividend Decision.: **Working Capital Management:** Concepts of Meaning Working Capital; Importance of Working Capital Management; Factors Affecting an Entity's Working Capital Needs; Estimation of Working Capital Requirements; Management of Inventories; Management of Receivables; and Management of Cash and Marketable Securities.	07
4	**Capital Budgeting:** Meaning and Importance of Capital Budgeting; Inputs for Capital Budgeting Decisions; Investment Appraisal Criterion—Accounting Rate of Return, Payback Period, Discounted Payback Period, Net Present Value (NPV), Profitability Index, Internal Rate of Return (IRR), and Modified Internal Rate of Return (MIRR)	08
5	**Capital Structure:** Factors Affecting an Entity's Capital Structure; Overview of Capital Structure Theories and Approaches — Net Income Approach, Net Operating Income Approach; Traditional Approach, and Modigliani-Miller Approach. Relation between Capital Structure and Corporate Value; Concept of Optimal Capital Structure **Dividend Policy:** Meaning and Importance of Dividend Policy; Factors Affecting an Entity's Dividend Decision; Overview of Dividend Policy Theories and Approaches — Gordon's Approach, Walter's Approach, and Modigliani-Miller Approach	08
	Total	**39**

Books Recommended:

Textbooks:

1. Financial Management, Theory & Practice 8th Edition (2011), by Prasanna Chandra: Tata McGraw Hill Education Private Limited, New Delhi.
2. Indian Financial System, 9th Edition (2015) by M. Y. Khan; Publisher: McGraw Hill Education, New Delhi.
3. Financial Management, 11th Edition (2015) by I. M. Pandey; Publisher: S. Chand (G/L) & Company Limited, New Delhi.

Reference Books:

1. Fundamentals of Financial Management, 13th Edition (2015) by Eugene F. Brigham and Joel F. Houston; Publisher: Cengage Publications, New Delhi.
2. Analysis for Financial Management, 10th Edition (2013) by Robert C. Higgins; Publishers: McGraw Hill Education, New Delhi.

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

Program: Open Elective for all Programs	S.Y B.Tech.	Semester: IV
Course: Corporate Social Responsibility (DJS23OCOE405)		

Pre-requisite:

1. Nil

Objectives:

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

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

1. Upon completion of this course, students will be able to analyse and critique the ethical dimensions of Corporate Social Responsibility initiatives, demonstrating a comprehensive understanding of CSR principles and their ethical underpinnings.
2. Upon completion of this course, students will demonstrate an understanding of the legislative frameworks shaping Corporate Social Responsibility both in India and globally, alongside recognizing the key drivers fostering CSR practices within the Indian context.
3. Upon completion of this course, students will be able to identify and discuss the significance of social responsibility and community engagement initiatives, demonstrating an understanding of their impact on both businesses and society.

Corporate Social Responsibility (DJS23OCOE405)		
Unit	**Description**	**Duration**
1	**Introduction to Corporate Social Responsibility (CSR)** - Understanding the concept of CSR - Historical evolution and development of CSR - Importance and benefits of CSR for businesses and society - Stakeholder theory and its relevance to CSR	07
2	**Ethical Foundations of CSR** - Ethical theories relevant to CSR (Utilitarianism, Deontology, Virtue Ethics) - Ethical decision-making frameworks in business - Corporate governance and ethics - Ethical issues in supply chain management	08
3	**CSR-Legislation in India and the World** Section 135 of Companies Act 2013.Scope for CSR Activities under Schedule VII, Appointment of Independent Directors on the Board, and Computation of Net Profit's Implementing Process in India	08
4	**The Drivers of CSR in India** Market based pressure and incentives, civil society pressure, the regulatory environment in India Counter trends, Review of current trends and opportunities in CSR, Review of successful corporate initiatives and challenges of CSR. Case Studies of Major CSR Initiatives Corporate Social Responsibility and Public-Private Partnership (PPP)	08

5	**Social Responsibility and Community Engagement** - Social issues and challenges in contemporary society - Corporate philanthropy and community development initiatives - Stakeholder engagement strategies - Corporate volunteering and employee engagement programs - CSR as a strategic business tool vital for sustainable development	08
	Total	**39**

Books Recommended:

Text Books:

1. Andrew Crane, Dirk Matten , "Corporate Social Responsibility: Definition, Core Issues, and Recent Developments" Oxford University Press.
2. O. C. Ferrell, John Fraedrich, Linda Ferrell , "Business Ethics: Ethical Decision Making & Cases", Cengage Learning
3. Corporate Social Responsibility in India, Sanjay K Agarwal, Sage Publications, 2008
4. Corporate Social Responsibility in India, Bidyut Chakrabarty, Routledge, New Delhi, 2015

Reference Books:

1. Corporate Social Responsibility: An Ethical Approach, Mark S. Schwartz, Broadview Press, 2011
2. Attaining Sustainable Growth through Corporate Social Responsibility, George Pohle and Jeff Hittner, IBA Global Business Services, 2008
3. Strategic Corporate Social Responsibility: Stakeholders in a Global Environment, William B. Werther Jr. and David Chandler, 2nd Edition, Sage Publications, 2011

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Program: Open Elective for all Programs	**S.Y B.Tech.**	**Semester: IV**
Course: Bioinformatics (DJS23OCOE406)		

Pre-requisite:

1. Nil

Course Objectives:

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

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Understand the structure and function of cells, organelles, and biomolecules.
2. Understand the types of data stored in bioinformatics databases and their relevance to biological research.
3. Explore genomic databases and understand the structure and content of protein databases.
4. Understand system biology concepts and molecular evolution.
5. Apply knowledge of cellular and molecular biology concepts to analyze a biological problem.

Bioinformatics (DJS23OCOE406)		
Unit	**Description**	**Duration**
1	**Module 1: Foundations of Molecular and Cellular Biology** **Introduction to molecular biology:** DNA, RNA, proteins, and their roles in cellular processes **Cell structure and function:** Organelles, membrane structure, and cellular transport **Cell cycle regulation:** phases of the cell cycle, checkpoints, and cell cycle control mechanisms	08
2	**Module 2: Genetics and Genomics** **Mendelian genetics:** Inheritance patterns, Punnett squares, and genetic crosses **Chromosome structure and organization:** karyotyping, gene mapping, and genetic linkage **Introduction to genomics:** genome structure, organization, and variation Techniques in molecular genetics: PCR, DNA sequencing, and gene cloning	08

3	**Module 3: Genomic and Protein Databases** Types of genomic databases such as GenBank, Ensemble, and UCSC Genome Browser, Understand the structure and content of protein databases such as UniProt and Protein Data Bank (PDB), Searching, Retrieving, and Analysing Genomic and Protein data from online databases.	08
4	**Module 4: Systems Biology** **Introduction to Systems Biology**: Modeling biological systems and network analysis, Bioinformatics tools for systems biology and modeling complex biological processes. **Principles of molecular evolution**: Mutation, Selection, and genetic drift. **Phylogenetic analysis**: Tree construction, sequence alignment, and molecular clock.	08
5	**Module 5: Applications and Case Studies** Applications of Bioinformatics in Medicine, Agriculture, and Biotechnology, Case Studies (Integrating Cellular and Molecular Biology with Bioinformatics) and Research Examples, Ethical and Legal Issues in Bioinformatics, Future Trends and Emerging Technologies in Bioinformatics.	07
	Total	**39**

Books Recommended:

Textbooks:

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

Reference Books:

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

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Program: Open Elective for all Programs	S.Y B.Tech.	Semester: IV
Course: Human Resource Management (DJS23OCOE407)		

Pre-requisite:

1. Nil

Objectives:

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

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

1. Understand and distinguish the changing environment of the HRM and the role of the HR managers.
2. Understand and analyse the recruitment process and the application of the IT.
3. Understand and examine the importance of the training and development.
4. Understand and determine the pay plans, performance appraisal and compensation.
5. Understand and explain the importance of the labour relation, the employee security and collective bargaining.

Human Resource Management (DJS23OCOE407)		
Unit	**Description**	**Duration**
1	**Human Resource Function** Human Resource Philosophy – Changing environments of HRM – Strategic human resource management – Using HRM to attain competitive advantage – Trends in HRM – Organisation of HR departments – Line and staff functions – Role of HR Managers.	07
2	**Recruitment & Placement** Job analysis: Methods - IT and computerised skill inventory - Writingjob specification - HR and the responsive organisation. Recruitment and selection process: Employment planning and forecasting - Building employee commitment: Promotion from within - Sources, Developing and Using application forms - IT and recruiting on the internet. Employee Testing & selection: Selection process, basic testing concepts, types of test, work samples & simulation, selection techniques, interview, common interviewing mistakes, Designing &conducting the effective interview, small business applications, computer aided interview.	10

3	**Training & Development** Orientation & Training: Orienting the employees, the training process, need analysis, Training techniques, special purpose training, Training via the internet. Developing Managers: Management Development - The responsive managers - On-the-job and off the-job Development techniques usingHR to build a responsive organisation. Performance appraisal: Methods - Problem and solutions - MBO approach - The appraisal interviews - Performance appraisal in practice.Managing careers: Career planning and development - Managing promotions and transfers.	08
4	**Compensation & Managing Quality** Establishing Pay plans: Basics of compensation - factors determiningpay rate - Current trends in compensation - Job evaluation - pricing managerial and professional jobs - Computerised job evaluation. Pay for performance and Financial incentives: Money and motivation - incentives for operations employees and executives - Organisation wide incentive plans - Practices in Indian organisations. Benefits and services : Statutory benefits - non-statutory (voluntary) benefits - Insurance benefits -retirement benefits and other welfare measures to build employee commitment.	08
5	**Labour relations and employee security** Industrial relation and collective bargaining: Trade unions - Collective bargaining - future of trade unionism. Discipline administration - grievances handling - managing dismissals and separation. Labour Welfare: Importance & Implications of labour legislations - Employee health - Auditing HR functions, Future of HRM function.	06
	Total	**39**

Books Recommended:

Text Books:

1. Pattanayak, Biswajeet, Human Resource Management, 6th Ed,PHI Learning Pvt. Ltd., 1 Jul 2020
2. Gary Dessler, Human Resource Management, 16th Ed, Pearson Publications, 2020

Reference Books:

1. Stephen Robbins, Organizational Behavior, 16th Ed, 2013
2. Aswathapa, Human resource management: Text & cases, 6th edition, 2011
3. C. B. Mamoria and S V Gankar, Dynamics of Industrial Relations in India, 15th Ed, 2015, Himalaya Publishing, 15thedition, 2015
4. P. Subba Rao, Essentials of Human Resource management and Industrial relations, 5th Ed, 2013, Himalaya Publishing
5. Laurie Mullins, Management & Organizational Behavior, Latest Ed, 2016, Pearson Publications.

6. Raymond J. Stone, Anne Cox, Mihajla Gavin, Human Resource Management, 10th Ed,John Wiley & Sons, 14 Dec 2020.
7. V S P Rao, Human Resource Management, 3rd Ed, 2010, Excel publishing.

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Program: Open Elective for all Programs	S.Y B.Tech.	Semester: IV
Course: Digital Marketing Management (DJS23OCOE408)		

Pre-requisite:

1. Nil

Objectives:

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

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

1. Understand the digital marketing framework & model and consumer behaviour.
2. Develop digital marketing strategy roadmap.
3. Explain the terminology and concepts for developing web-specific media plans.
4. Understand concepts related to digital campaign management and revenue generation models.
5. Get a perspective on global digital marketing technology/tools and future trends.

Digital Marketing Management (DJS23OCOE408)		
Unit	**Description**	**Duration**
1	**Introduction to Digital Marketing** Emergence of Digital Marketing as a tool, media consumption drivers for new marketing environment, applications and benefits of digital marketing. **Digital Marketing Framework** Delivering enhanced customer value, market opportunity analysis and digital services development, ASCOR framework **Digital Marketing Models Creation** Factors impacting digital marketplace, value chain digitization,business models. **The Consumer for Digital Marketing** • Consumer behavior on the internet, evolution of consumer behavior models, managing consumer demand, integrated marketing communications (IMC)	**06**
2	**Digital marketing Strategy Development** Elements of assessment phase, macro-micro environmental analysis, marketing situation analysis. **Digital Marketing Internal Assessment and Objectives Planning** Analyzing present offerings mix, marketing mix, core competencies analysis and internal resource mapping. Digital	**12**

	presence analysis, digital marketing objectives development and review. **Digital Marketing Strategy Definition** Understanding digital business strategy and structures, consumer development strategy, offering mix for Digital, digital pricing models, managing promotional channels and developing the extended Ps- People, process, programs and performance. **Digital marketing Strategy Roadmap** Developing digital marketing strategy roadmap, the 6s digital marketing implementation strategy, marketing across the product life cycle.	
3	**Digital Marketing Planning and Setup** Understanding digital media planning terminology and stages, steps to creating marketing communications strategy, introduction to search marketing, display marketing, social media marketing. **Digital Marketing Operations Setup** Basics of lead generation and conversion marketing, website content development and management, elements of user experience, web usability and evaluation.	**08**
4	**Digital marketing Execution** Basic elements of digital campaign management, search execution, display execution, social media execution, content marketing. **Digital marketing Execution Elements** Digital revenue generation models, managing service delivery and payments, managing digital implementation challenges like e commerce, internal & external and consumer specific challenges.	**08**
5	**Digital Business – Present and Future** Digital Marketing – Global Landscape, digital marketing overview – global spend, advertising spend, and technology/tools landscape. Data technologies (Big data and IOT) impacting marketing, segment based digital marketing and SoLoMo – the next level of hyperlocal marketing.	**05**
	Total	**39**

Books Recommended:

Text Books:

1. Fundamentals of Digital Marketing by Puneet Singh Bhatia, Pearson Education Limited,2017
2. Digital Marketing by Seema Gupta- McGraw Hill Education, 2022

Reference Books:

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

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Program: Open Elective for all Programs	S.Y B.Tech.	Semester: IV
Course: Logistics & Supply Chain Management (DJS23OCOE409)		

Pre-requisite:

1. Latest trend of information technology in retail industry and logistic applications.

Objectives:

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

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

1. Develop a sound understanding of the important role of supply chain management in today's business environment.
2. Develop criteria and standards to achieve improved business performance by integrating and optimizing the total logistics and supply-chain process.
3. Summarize the value of focusing on information business logistics systems which drives improved accuracy and decision-making at all levels of management.
4. Become familiar with current supply chain information technology management trends.
5. Use available technologies to enhance work performance and support supply chain functions, processes, transactions, and communications.

Logistics & Supply Chain Management (DJS23OCOE409)		
Module	**Description**	**Hours**
1	**Introduction** What Is Supply Chain Management? The Development Chain, Global Optimization, Managing Uncertainty and Risk, The Complexity in Supply Chain Management, Key Issues in Supply Chain Management .	05
2	**Network planning** Introduction, Network Design- Data Collection, Data Aggregation, Transportation Rates, Mileage Estimation, Warehouse Costs, Warehouse Capacities, Potential Warehouse Locations, Service Level Requirements, Future Demand, Model and Data Validation, Solution Techniques, Key Features of a Network Configuration Supply Chain Planning; Inventory Positioning and Logistics Coordination -Strategic Safety Stock.	06
3	**THE VALUE OF INFORMATION** Introduction, The Bullwhip Effect-Quantifying the Bullwhip Effect, The Impact of Centralized Information on the Bullwhip Effect, Methods for	08

	Coping with the Bullwhip Effect, Information Sharing and Incentives, Effective Forecasts, Information for the Coordination of Systems, Locating Desired Products, Lead-Time Reduction, Information and Supply Chain Trade-offs-Conflicting Objectives in the Supply Chain, Designing the Supply Chain for Conflicting Goals ,Decreasing Marginal Value of Information.	
4	**Supply chain integration** Introduction, Push, Pull, and Push-Pull Systems-Push-Based Supply Chain, Pull-Based Supply Chain, Push-Pull Supply Chain ,Identifying the Appropriate Supply Chain Strategy, Implementing a Push-Pull Strategy The Impact of Lead Time Demand-Driven Strategies The Impact of the Internet on Supply Chain Strategies-what is E-Business, the Grocery Industry , the Book Industry , the Retail Industry and Impact on Transportation and Fulfillment.	08
5	**Information Technology and Business Process** Introduction, The Importance of Business Processes, Goals of Supply Chain IT Supply Chain Management System Components, Decision-Support Systems IT for Supply Chain Excellence, Sales and Operations Planning Integrating Supply Chain Information Technology. Implementation of ERP and Decision Support System.	06
6	**Technology standards** Introduction, IT Standards, Information Technology Infrastructure-Interface Devices, System Architecture and Electronic Commerce. Service-Oriented Architecture (SOA)-Technology Base: IBM and Microsoft and ERP Vendor Platform: SAP and Oracle. Radio Frequency Identification (RFID)- applications, point of sale data , business benefits and supply chain efficiency.	06
	Total	**39**

Books Recommended:

Text Books:

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

Reference Books:

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

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Program: Artificial Intelligence & Machine Learning	S.Y. B.Tech.	Semester: IV
Course: Innovative Product Development IV(DJS23IPSCX02)		

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.
- 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

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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.

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Program: Common to all Programs.	S.Y B. Tech.	Semester: IV
Course: Design Thinking Laboratory (DJS23ITHSX05)		

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 types of problems using design thinking methods and tools, and its application.
2. To equip students with techniques to empathize with users, and ideate innovative and sustainable solutions for real-world problems through an iterative approach to design.

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

1. Understand the importance of a 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 real-world problems

Design Thinking Laboratory (DJS23ITHSX05)		
Unit	**Description**	**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 contextualizingvarious macro & micro trends. • Case Study - conduct their research on how Design Thinking helpedsolve some of the biggest and most 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 to the problem statement selected. • Use walk-a-mile immersion and heuristic reviews to first empathize withend users and then to build an 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 the 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 thatcould 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 andeasily 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
	Total	26

Books Recommended:

Text books:

1. I. Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Businessor 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 BrandValue", Allworth Press, 2010.

4. K. T. Ulrich and S. D. Eppinger, "Product Design and Development", McGraw-Hill HillEducation, 6th Edition, 2016.
5. C. J. Meadows and C. Parikh, "The Design Thinking Workbook: Essential Skills for Creativityand 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 inJust 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_Develop ment
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 CentredDesign (https://nptel.ac.in/courses/109104109)
4. Design Thinking - A Primer (https://nptel.ac.in/courses/110106124)
5. Product Engineering and Design Thinking (https://nptel.ac.in/courses/112105316)

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Suggested List of Experiments:

Design Thinking Laboratory (DJS23ITHSX05)	
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 criticalproblems in various contexts.)
2	To exercise empathizing techniques to understand the needs and pain points of a target audience.
3	Developing empathy maps and customer journey maps based on collected insights.
4	To exercise different tools and techniques (such as affinity diagrams, journey mapping, and user story mapping) for synthesizing research findings.
5	Develop user personas to represent different user archetypes and their needs concerning the problem at hand.
6	To practice the SCAMPER technique, Brainstorming, and brain-writing as a collaborative ideation technique to create multiple creative ideas/ solutions for the problem at hand.
7	Create a mind map to generate a wide range of solutions to a problem at hand.
8	To explore different prototyping tools and platforms, such as Adobe XD, Figma, Sketch, and InVision.
9	To Conduct rapid prototyping sessions to build low-fidelity / High fidelity prototypes based on the ideas generated in the Ideation phase and iterate based on feedback received.
10	Develop a plan for implementing the final solution, considering factors like scalability and feasibility.
11	• Conduct usability testing to gather feedback on prototypes. • Use A/B testing to compare different versions of a solution and determine which performs better.

Mini Project (individual or in a group of 3-4 students): 10 marks

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

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Program: Common to all Programs.	S.Y B. Tech.	Semester: IV
Course: Universal Human Values (DJS23ICHSX08)		
Course: Universal Human Values Tutorial (DJS23ITHSX08)		

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

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 (DJS23ICHSX08)		
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,	4

	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	
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, seerand enjoyer), Understanding the characteristics and activities of 'I' andharmony in 'I', Understanding the harmony of I with the Body; correctappraisal of Physical needs, meaning of Prosperity in detail, Programsto ensure Self-regulation and health.	5
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, Understanding the meaningof Trust; Difference between intention and competence, Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family). Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family!	9
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.	4
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	4

	and ecologically responsible engineers, technologists and managers, b) At the level of society: as mutually enriching institutions and organizations.	
	Total	**26**

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: -

Universal Human Values Tutorial (DJS23ITHSX08)	
Sr No	Title of Tutorial
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 onliking-disliking.
2	Practice sessions to discuss the role others have played in making materialgoods available to me. Identifying from one's own life. Differentiatebetween prosperity and accumulation. Discuss program for ensuring healthvs dealing with disease.
3	Practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goalof education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.
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.
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.
6. Small is Beautiful - E. F Schumacher. 6. Slow is Beautiful - Cecile Andrews.
7. Economy of Permanence - J C Kumarappa.
8. Bharat Mein Angreji Raj – PanditSunderlal.
9. Rediscovering India - by Dharampal.

10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi.
11. India Wins Freedom - Maulana Abdul Kalam Azad.
12. Vivekananda - Romain Rolland. (English)
13. Gandhi - Romain Rolland. (English)

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