BONAM VENKATA CHALAMAYYA ENGINERING COLLEGE
ODALAREVU – 533 210, Andhra Pradesh, India
Autonomous

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
Course Structure – BR23 Regulations
For UG - B.Tech: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
II Year Course Structure

Semester–II							
S.No.	**Course Category**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	HSMC	23HM4T05	Optimization Techniques	2	0	0	2
2.	BSC	23BS4T11	Probability & Statistics	3	0	0	3
3.	PCC	23AM4T01	Machine Learning	3	0	0	3
4.	PCC	23CS4T05	Database Management Systems	3	0	0	3
5.	PCC	23AM4T02	Digital Logic & Computer Organization	3	0	0	3
6.	PCC	23ML4L01	AI & ML Lab	0	0	3	1.5
7.	PCC	23CS4L05	Database Management Systems Lab	0	0	3	1.5
8.	PCC	23CS4S05	Full Stack Development -I	0	1	2	2
9.	BSC	23ES4L06	Design Thinking & Innovation	1	0	2	2
Total				**15**	**1**	**10**	**21**
Mandatory Community Service Project Internship of 08 weeks duration during summer vacation							

Dr. N Ramakrishnaiah, Professor of CSE. UCEK, JNTUK Kakinada.	Dr. Jimson Mathew, Professor of CSE. IIT Patna	Dr. B D Sahoo, Professor of CSE, NIT Rourkela.	Narayana Rao Routhu, Technology Manager, Hidden Brains, Ahmadabad.	Dr. S Rao Chintalapudi, Professor and HoD, CSE(AIML) CMR Technical Campus, Hyderabad.	Dr. B S N Murthy Professor of CSE, BVCEC.

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II Year - II Semester	Subject Code: 23HM4T05	L	T	P	C
		3	0	0	3

OPTIMIZATION TECHNIQUES

(CSE-AIDS,AIML,CSE-AIML,IT)

Course Objectives:

- To define an objective function and constraint function in terms of design variables,
- And then state the optimization Problem.
- To state single variable and multi variable optimization problem, without and with constraints.
- To explain linear programming technique to an optimization problem, define slack and surplus variables by using Simplex method.
- To state transportation problem and assignment problem as a linear programming problem to determine Simplex method.

To study and explain nonlinear programming techniques, unconstrained or constrained and define exterior and interior penalty functions for optimization problems.

Course Outcomes: Students are able to

CO Number	Course Outcome	Blooms Level
CO1	State and formulate the optimization problem, without and with constraints by using design variables from an engineering design problem	BL1
CO2	Apply classical optimization techniques to minimize or maximize a multi-variable objective function without or with constraints and arrive at an optimal solution	BL3
CO3	Apply and solve transportation and assignment problem by using Linear programming simplex method	BL3
CO4	Apply Gradient and Non Gradient Methods to Non Linear Optimization problems and use interior or exterior penality functions for the constraints to derive the optimal solution.	BL3
CO5	Formulate and Apply Dyanamic programming technique to inventory control production planning,engineering design problems etc to reach a final optimal solution from the current optimal solution.	BL2

UNIT-1 : Introduction and Classical Optimization Techniques

Statement of an Optimization problem, design vector, design constraints, constraint surface, objective function , objective function surfaces, classification if optimization problems.

Classical optimization techniques: Single variable optimization, multi variable optimization without constraints, necessary and sufficient conditions for minimum/maximum multi variable optimization with equality constraints. Solution by method Lagrange's multipliers, multi variable optimization with inequality constraints, Kuhn-Tucker conditions.

UNIT II: Linear Programming

Standard form of a linear programming problem, geometry of linear programming problems, definitions and theorems, solution of a system of linear simultaneous equations, pivotal reduction of a general system of equations, motivation to the simplex method, simplex algorithm.

UNIT III: Transportation Problem

Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method, testing for optimality of balanced transportation problems, Special cases in transportation problem

UNIT IV: Nonlinear Programming

Unconstrained cases, One – dimensional minimization methods: Classification, Fibonacci method, Univariate method, steepest descent method. Constrained cases– Characteristics of a constrained problem, Classification, Basic approach of Penalty Function method, Basic approaches of Interior and Exterior penalty function methods,

A.D. Madhuri
(Chairman-BOS)

Dr. N.Uday Bhaskar
(University Nominee)

Dr. M.Sree Raju)
(Subject Expert)

Dr.B Charwak
(Subject Expert)

P V Sandhya
(Member, BOS)

UNIT V: Dynamic Programming

Dynamic programming multistage decision processes, types, concept of sub optimization and the principle of optimality, computational procedure in dynamic programming, examples illustrating the calculus method of solution, examples illustrating the tabular method of solution.

Textbooks:

1. "Engineering optimization: Theory and practice", S. S.Rao, New Age International (P) Limited, 3rd edition, 1998. 2. "Introductory Operations Research", H.S. Kasene& K.D. Kumar, Springer (India), Pvt.LTd.

Reference Books:

1. "Optimization Methods in Operations Research and systems Analysis", by K.V. Mital and C. Mohan, New Age International (P) Limited, Publishers, 3rd edition, 1996.
2. Operations Research, Dr.S.D.Sharma, Kedarnath, Ramnath& Co.

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Dr.B Charwak
(Subject Expert)

P V Sandhya
(Member, BOS)

II Year - II Semester	Code: 23BS4T11	L	T	P	C
		3	0	0	3

PROBABILITY AND STATISTICS

(CSE, AIML, CSE-AIML, IT)

Course Objectives:

The learning objectives of this course are to:

- To familiarize the students with the foundations of probability and statistical methods.
- To impart probability concepts and statistical methods in various applications Engineering.

Course Outcomes:

Students are able to

CO Number	Course Outcome	Blooms Level
CO1	Classify the concepts of data science and its importance.	BL2
CO2	Interpret the association of characteristics and through correlation and regression tools.	BL4
CO3	Apply discrete and continuous probability distributions.	BL3
CO4	Design the components of a classical hypothesis test.	BL6
CO5	Infer the statistical inferential methods based on small and large sampling tests.	BL4

Unit – I:

Descriptive statistics and methods for data science:

Data science – Statistics Introduction – Population vs Sample –Collection of data – primary andsecondary data – Type of variable: dependent and independent Categorical and Continuous variables– Data visualization – Measures of Central tendency – Measures of Variability – Skewness – Kurtosis

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(University Nominee)

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(Subject Expert)

Dr.U. Venu Gopalam
(Subject Expert)

Mr. P. Ganga Raju
(Member, BOS)

UNIT – II:
Probability and Distributions:

Conditional probability and Baye's theorem – Random variables – Discrete and Continuous random variables – Distribution functions – Probability mass function, Probability density function and Cumulative distribution functions – Mathematical Expectation and Variance – Binomial, Poisson, Uniform and Gaussian distributions

UNIT – III:
Small and Large samples:

Introduction – Population and Samples – Sampling distribution of Means and Variance (definition only) – Point and Interval estimations – Maximum error of estimate – Central limit theorem (without proof) .

UNIT – IV:
Tests of Hypothesis:

Introduction – Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors – Level of significance – One tail and two-tail tests – Test of significance for large samples and Small Samples: Single and difference means – Single and two proportions – Student's t- test, F-test, χ^2-test

UNIT – V:
Correlation and Regression:

Correlation – Correlation coefficient – Rank correlation. Linear Regression: Straight line – Multiple Linear Regression - Regression coefficients and properties – Curvilinear Regression: Parabola – Exponential – Power curves.

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U. Venugopalam

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Text Books:

1. **Miller and Freund's**, Probability and Statistics for Engineers,7/e, Pearson, 2008.
2. **S. C. Gupta and V.K. Kapoor**, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012. Reference

Reference Books:

1. **Shron L. Myers, Keying Ye, Ronald E Walpole**, Probability and Statistics Engineers and the Scientists,8th Edition, Pearson 2007.
2. **Jay l. Devore**, Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage.
3. **Sheldon M. Ross**, Introduction to probability and statistics Engineers and the Scientists, 4th Edition, Academic Foundation, 2011.
4. **Johannes Ledolter and Robert V. Hogg**, Applied statistics for Engineers and Physical Scientists, 3rd Edition, Pearson, 2010.

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II Year – II Semester	Code: 23AM4T01	L	T	P	C
		3	0	0	3

MACHINE LEARNING

Course Objectives: The objectives of the course is to

- Define machine learning and its different types (supervised and unsupervised) andunderstand their applications.
- Apply supervised learning algorithms including decision trees and k-nearestneighbours (k-NN).
- Implement unsupervised learning techniques, such as K-means clustering.

Course Outcomes:

CO Number	Course Outcome	Blooms Level
CO1	Students will be able to learn about computing central tendency measures and Data preprocessing techniques	BL1
CO2	Students will be able to learn about classification and regression algorithms	BL1
CO3	Students will be able to apply different clustering algorithms for a problem.	BL3
CO4	Students will be able to Adjust and refine the parameters of the K-means algorithm to optimize clustering results.	BL4
CO5	Students will be able to Modify the EM algorithm parameters to optimize clustering performance for specific datasets.	BL5

UNIT-I:

Introduction to Machine Learning: Evolution of Machine Learning, Paradigms for ML, Learning by Rote, Learning by Induction, Reinforcement Learning, Types of Data, Matching, Stages in Machine Learning, Data Acquisition, Feature Engineering, Data Representation, Model Selection, Model Learning, Model Evaluation, Model Prediction, Search and Learning, Data Sets.

UNIT-II:

Nearest Neighbor-Based Models: Introduction to Proximity Measures, Distance Measures, Non-Metric Similarity Functions, Proximity Between Binary Patterns, Different Classification Algorithms Based on the Distance Measures ,K-Nearest Neighbor Classifier, Radius Distance Nearest Neighbor Algorithm, KNN Regression, Performance of Classifiers, Performance of Regression Algorithms.

UNIT-III:

Models Based on Decision Trees: Decision Trees for Classification, Impurity Measures, Properties, Regression Based on Decision Trees, Bias–Variance Trade-off, Random Forests for Classification and Regression.

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UNIT-IV:

Linear Discriminants for Machine Learning: Introduction to Linear Discriminants, Linear Discriminants for Classification, Perceptron Classifier, Perceptron Learning Algorithm, Support Vector Machines, Linearly Non-Separable Case, Non-linear SVM, Kernel Trick, Logistic Regression, Linear Regression, Multi-Layer Perceptrons(MLPs), Backpropagation for Training an MLP.

UNIT-V:

Clustering : Introduction to Clustering, Partitioning of Data, Matrix Factorization | Clustering of Patterns, Divisive Clustering, Agglomerative Clustering, Partitional Clustering, K-Means Clustering, Soft Partitioning, Soft Clustering, Fuzzy C-Means Clustering, Rough Clustering, Rough K-Means Clustering Algorithm, Expectation Maximization-BasedClustering, Spectral Clustering.

Text Books:

1. "Machine Learning Theory and Practice", M N Murthy, V S Ananthanarayana,Universities Press (India), 2024

Reference Books:

1."Machine Learning", Tom M. Mitchell, McGraw-Hill Publication, 2017

2."Machine Learning in Action",Peter Harrington, DreamTech

3."Introduction to Data Mining", Pang-Ning Tan, Michel Stenbach, Vipin Kumar, 7thEdition,2019.

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II Year - II Semester	Code: 23CS4T05	L	T	P	C
		3	0	0	3

DATABASE MANAGEMENT SYSTEMS
(Common to CSE/IT/CSE(AI&ML)/AIML)

Course Objectives:

The main objectives of the course is to

- Introduce database management systems and to give a good formal foundation on the relational model of data and usage of Relational Algebra
- Introduce the concepts of basic SQL as a universal Database language
- Demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization
- Provide an overview of physical design of a database system, by discussing Database indexing techniques and storage techniques

Course Outcomes: Students are able to

CO Number	Course Outcome	Blooms Level
CO1	Explain the fundamental concepts of database systems and their characteristics, distinguishing them from file systems.	BL 1
CO2	Apply basic DML operations such as insert, delete, and update on tables in SQL.	BL 3
CO3	Create tables with relationships and implement primary key, foreign key, and integrity constraints.	BL 3
CO4	Analyze and apply the concepts of lossless join and dependency preserving decomposition during normalization.	BL 4
CO5	Implement operations on B+ Trees, including insertion, deletion, and search.	BL 3

UNIT I **10Hrs**

Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database. Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

UNIT II **8Hrs**

Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Relational Algebra, Relational Calculus. BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).

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UNIT III **8Hrs** SQL:Basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions(Date and Time, Numeric, String conversion).Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable and non-updatable), relational set operations.
UNITIV **10Hrs** Schema Refinement (Normalization):Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form(BCNF), MVD, Fourth normal form(4NF), Fifth Normal Form (5NF).
UNIT V **10Hrs** Transaction Concept: Transaction State, ACID properties, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, lock based, time stamp based, optimistic, concurrency protocols, Deadlocks, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm. Introduction to Indexing Techniques: B+ Trees, operations on B+ Trees, Hash Based Indexing/
Text Books: 1) Database Management Systems, 3rd edition, Raghurama Krishnan, Johannes Gehrke, TMH (For Chapters 2, 3, 4) 2) Database System Concepts,5th edition, Silberschatz, Korth, Sudarsan, TMH (For Chapter 1 and Chapter 3) Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning. 4) Database Management Systems,Battacharya,Pritimoy 5) Database Management Systems,POST,Gerald V 6) Database Management System,Pujari,Arun k.
Reference Books: 1) Introduction to Database Systems, 8thedition, C J Date, Pearson. 2) Database Management System, 6th edition, Ramez Elmasri, Shamkant B. Navathe, Pearson 3) Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.
Online Learning Resources: 1) https://nptel.ac.in/courses/106/105/106105175/ 2) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012758066672820 22456_shared/overview

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II Year – II Semester	Code: 23AM4T02	L	T	P	C
		3	0	0	3

DIGITAL LOGIC & COMPUTER ORGANIZATION

Course Objectives:

The main objectives of the course is to

- provide students with a comprehensive understanding of digital logic design principles and computer organization fundamentals
- Describe memory hierarchy concepts
- Explain input/output (I/O) systems and their interaction with the CPU, memory, and peripheral devices

Course Outcomes:

CO Number	Course Outcome	Blooms Level
CO1	Students should be able to design, implement, and troubleshoot digital systems and the use of decoders and multiplexers.	BL3
CO2	Students should be able to design,implement and analyze various sequential circuits, including binary counters, registers, and shift registers,	BL4
CO3	Students should be able to Understand, and apply arithmetic circuits and algorithms, understanding processor organization	BL3
CO4	Students will be able to understand and apply efficient memory systems and memory organization techniques	BL3
CO5	Design an efficient I/O system integrating DMA and various bus architectures to optimize system performance	BL6

UNIT I

Data Representation: Binary Numbers, Fixed Point Representation. Floating Point Representation. Number base conversions, Octal and Hexadecimal Numbers, components, Signed binary numbers, Binary codes Digital Logic Circuits-I: Basic Logic Functions, Logic gates, universal logic gates, Minimization of Logic expressions. K-Map Simplification, Combinational Circuits, Decoders, Multiplexers

UNIT II

Digital Logic Circuits-II: Sequential Circuits, Flip-Flops, Binary counters, Registers, Shift Registers, Ripple Counters Basic Structure of Computers: Computer Types, Functional units, Basic operational concepts, Bus structures, Software, Performance, multiprocessors and multi computers, Computer Generations, Von- Neumann Architecture

UNIT III

Computer Arithmetic : Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed-operand Multiplication, Fast Multiplication, Integer Division, Floating-Point Numbers and Operations Processor Organization: Fundamental Concepts, Execution of a Complete Instruction, Multiple-Bus Organization, Hardwired Control and Multi programmed Control

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UNIT IV The Memory Organization: Basic Concepts, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memories, Performance Considerations, Virtual Memories, Memory Management Requirements, Secondary Storage
UNIT V Input/Output Organization: Accessing I/O Devices, Interrupts, Processor Examples, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces
Text Books: 1. Computer Organization, Carl Hamacher, Zvonko Vranesic, Safwat Zaky, 6th edition, McGraw Hill 2. Digital Design, 6th Edition, M. Morris Mano, Pearson Education. 3. Computer Organization and Architecture, William Stallings, 11thEdition, Pearson.
Reference Books: 1. Computer Systems Architecture, M.Moris Mano, 3rdEdition, Pearson 2. Computer Organization and Design, David A. Paterson, John L.Hennessy, Elsevier 3. Fundamentals of Logic Design, Roth, 5thEdition, Thomson
Online Learning Resources: 1. https://nptel.ac.in/courses/106/103/106103068/

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II Year – II Semester	Code: 23ML4L01	L	T	P	C
		0	0	3	1.5

AI & ML LAB

Course Objectives:

1.The student should be made to learn the methods of solving problems using ArtificialIntelligence.

2.The student should be made to introduce the concepts of Expert Systems and machinelearning.

3.To learn about computing central tendency measures and Data preprocessingtechniques.

4.To learn about classification and regression algorithms.

5.To apply different clustering algorithms for a problem.

Software Required for ML: Python/R/Weka List of Experiments

1.**Pandas Library**

a) Write a python program to implement Pandas Series with labels.
b) Create a Pandas Series from a dictionary.
c) Creating a Pandas Data Frame.
d) Write a program which makes use of the following Pandas methods
i) describe () ii) head () iii) tail () iv) info ()

2.Pandas Library: Visualization

a) Write a program which use pandas inbuilt visualization to plot following graphs:
i. Bar plots ii. Histograms iii. Line plots iv. Scatter plot

3.Write a Program to Implement Breadth First Search using Python.
4.Write a program to implement Best First Searching Algorithm
5.Write a Program to Implement Depth First Search using Python.
6.Write a program to implement the Heuristic Search
7. Write a python program to implement A* and AO* algorithm. (Ex: find the shortestpath)

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8. Apply the following Pre-processing techniques for a given dataset. a) Attribute selection b) Handling Missing Values c) Discretization d) Elimination of Outliers
9.Apply KNN algorithm for classification and regression. 10.Demonstrate decision tree algorithm for a classification problem and performparameter tuning for better results. 11. Apply Random Forest algorithm for classification and regression. 12. Demonstrate Naïve Bayes Classification algorithm. 13. Apply Support Vector algorithm for classification 14. Implement the K-means algorithm and apply it to the data you selected. Evaluate performance by measuring the sum of the Euclidean distance of each example from its class center. Test the performance of the algorithm as a function of the parameters K.

Note: At the end of Lab course students have to complete a Mini Project/Case Study for evaluation of Internal Marks.

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II Year - II Semester	Code: 23CS4L05	L	T	P	C
		0	0	3	1.5

DATABASE MANAGEMENT SYSTEMS LAB
(Common to CSE/IT/CSE(AI&ML)/AIML)

Course Objectives:

This Course will enable students to

- Populate and query a database using SQL DDL/DML Commands
- Declare and enforce integrity constraints on a database
- Writing Queries using advanced concepts of SQL
- Programming PL/SQL including procedures, functions, cursors and triggers

Course Outcomes: Students are able to

CO Number	Course Outcome	Blooms Level
CO1	Populate and query a database using SQL DDL/DML Commands	BL 3
CO2	Declare and enforce integrity constraints on a database	BL 3
CO3	Writing Queries using advanced concepts of SQL	BL 4
CO4	Programming PL/SQL including procedures, functions, cursors and triggers	BL 3

Experiments covering the topics:

- DDL, DML, DCL commands
- Queries, nested queries, built-in functions,
- PL/SQL programming- control structures
- Procedures, Functions, Cursors, Triggers,
- Database connectivity- ODBC/JDBC

Sample Experiments:

1. Creation, altering and droping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.
2. Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET, Constraints. Example:- Select the roll number and name of the student who secured fourth rank in the class.
3. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.
4. Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date)

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5. i. Create a simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found) ii. Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block. 6. Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions. 7. Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISEAPPLICATION ERROR. 8. Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES. 9. Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions. 10. Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables. 11. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers 12. Create a table and perform the search operation on table using indexing and non indexing techniques.
Text Books: 1. Oracle: The Complete Reference by Oracle Press 2. Nilesh Shah, "Database Systems Using Oracle", PHI, 2007 3. Rick F Vander Lans, "Introduction to SQL", Fourth Edition, Pearson Education, 2007
Online Learning Resources: 1.https://gradwise.in/ 2.https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01384167253376204874 8_shared/overview 3. https://myacademy.oracle.com/

Note: At the end of Lab course students have to complete a Mini Project/Case Study for evaluation on Internal Marks.

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II Year - II Semester	Code: 23CS4S05	L	T	P	C
		0	1	2	2

FULL STACK DEVELOPMENT – I
(Common to CSE/CSE(AI&DS)/CSE(AI&ML)/AIML)

Course Objectives:
The main objectives of the course are to
- Make use of HTML elements and their attributes for designing static web pages
- Build a web page by applying appropriate CSS styles to HTML elements
- Experiment with JavaScript to develop dynamic web pages and validate forms

Course Outcomes: Students are able to

CO Number	Course Outcome	Blooms Level
CO1	Apply HTML5 and CSS, differentiate types of CSS, with a focus on modern web design principles.	BL3
CO2	Apply understanding of HTML for developing basic web pages incorporating lists, links, images, tables, forms and frames	BL3
CO3	Creating and manipulating HTML tables, forms and frames	BL3
CO4	Effectively applying JavaScript with a focus on I/O, type conversion, and handling of both internal and external scripts	BL3
CO5	Developing proficiency in the use of JavaScript Functions, Events, and application of Node.js	BL3

Experiments covering the Topics:
- Lists, Links and Images
- HTML Tables, Forms and Frames
- HTML 5 and Cascading Style Sheets, Types of CSS
- Selector forms
- CSS with Color, Background, Font, Text and CSS Box Model
- Applying JavaScript - internal and external, I/O, Type Conversion
- JavaScript Conditional Statements and Loops, Pre-defined and User-defined Objects
- JavaScript Functions and Events
- Node.js

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Sample Experiments:

1. Lists, Links and Images

a. Write a HTML program, to explain the working of lists.

Note: It should have an ordered list, unordered list, nested lists and ordered list in an unordered list and definition lists.

b. Write a HTML program, to explain the working of hyperlinks using <a> tag and href, target Attributes.

c. Create a HTML document that has your image and your friend's image with a specific height and width. Also when clicked on the images it should navigate to their respective profiles.

d. Write a HTML program, in such a way that, rather than placing large images on a page, the preferred technique is to use thumbnails by setting the height and width parameters to something like to 100*100 pixels. Each thumbnail image is also a link to a full sized version of the image. Create an image gallery using this technique

2. HTML Tables, Forms and Frames

a. Write a HTML program, to explain the working of tables. (use tags: <table>, <tr>, <th>, <td> and attributes: border, rowspan, colspan)

b. Write a HTML program, to explain the working of tables by preparing a timetable. (Note: Use <caption> tag to set the caption to the table & also use cell spacing, cell padding, border, rowspan, colspan etc.).

c. Write a HTML program, to explain the working of forms by designing Registration form. (Note: Include text field, password field, number field, date of birth field, checkboxes, radio buttons, list boxes using <select>&<option> tags, <text area> and two buttons ie: submit and reset. Use tables to provide a better view).

d. Write a HTML program, to explain the working of frames, such that page is to be divided into 3 parts on either direction. (Note: first frame □ image, second frame □ paragraph, third frame □ hyperlink. And also make sure of using "no frame" attribute such that frames to be fixed).

3. HTML 5 and Cascading Style Sheets, Types of CSS

a. Write a HTML program, that makes use of <article>, <aside>, <figure>, <figcaption>, <footer>, <header>, <main>, <nav>, <section>, , tags.

b. Write a HTML program, to embed audio and video into HTML web page.

c. Write a program to apply different types (or levels of styles or style specification formats) - inline, internal, external styles to HTML elements. (identify selector, property and value).

4. Selector forms

a. Write a program to apply different types of selector forms

i. Simple selector (element, id, class, group, universal)

ii. Combinator selector (descendant, child, adjacent sibling, general sibling)

iii. Pseudo-class selector

iv. Pseudo-element selector

v. Attribute selector

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5. CSS with Color, Background, Font, Text and CSS Box Model a. Write a program to demonstrate the various ways you can reference a color in CSS. b. Write a CSS rule that places a background image halfway down the page, tilting it horizontally. The image should remain in place when the user scrolls up or down. c. Writc a program using the following terms related to CSS font and text: i. font-size ii. font-weight iii. font-style iv. text-decoration v. text-transformation vi. text-alignment d. Write a program, to explain the importance of CSS Box model using i. Content ii. Border iii. Margin iv. padding
6. Applying JavaScript - internal and external, I/O, Type Conversion a. Write a program to embed internal and external JavaScript in a web page. b. Write a program to explain the different ways for displaying output. c. Write a program to explain the different ways for taking input. d. Create a webpage which uses prompt dialogue box to ask a voter for his name and age. Display the information in table format along with either the voter can vote or not

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7. Java Script Pre-defined and User-defined Objects a. Write a program using document object properties and methods. b. Write a program using window object properties and methods. c. Write a program using array object properties and methods. d. Write a program using math object properties and methods. e. Write a program using string object properties and methods. f. Write a program using regex object properties and methods. g. Write a program using date object properties and methods. h. Write a program to explain user-defined object by using properties, methods, accessors, constructors and display.
8. Java Script Conditional Statements and Loops a. Write a program which asks the user to enter three integers, obtains the numbers from the user and outputs HTML text that displays the larger number followed by the words "LARGER NUMBER" in an information message dialog. If the numbers are equal, output HTML text as "EQUAL NUMBERS". b. Write a program to display week days using switch case. c. Write a program to print 1 to 10 numbers using for, while and do-while loops. d. Write aprogram to print data in object using for-in, for-each and for-of loops e. Develop a program to determine whether a given number is an 'ARMSTRONG NUMBER' or not. [Eg: 153 is an Armstrong number, since sum of the cube of the digits is equal to the number i.e.,13 + 53+ 33 = 153] f. Write a program to display the denomination of the amount deposited in the bank in terms of 100's, 50's, 20's, 10's, 5's, 2's & 1's. (Eg: If deposited amount is Rs.163, the output should be 1-100's, 1-50's, 1- 10's, 1-2's & 1-1's)

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9. Java Script Functions and Events a. Design a appropriate function should be called to display i. Factorial of that number ii. Fibonacci series up to that number iii. Prime numbers up to that number iv. Is it palindrome or not b. Design a HTML having a text box and four buttons named Factorial, Fibonacci, Prime, and Palindrome. When a button is pressed an appropriate function should be called to display i. Factorial of that number ii. Fibonacci series up to that number iii. Prime numbers up to that number iv. Is it palindrome or not c. Write a program to validate the following fields in a registration page i. Name (start with alphabet and followed by alphanumeric and the length should not be less than 6 characters) ii. Mobile (only numbers and length 10 digits) iii. E-mail (should contain format like xxxxxxx@xxxxxx.xxx)
Text Books: 1. Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson, 2013. 2. Web Programming with HTML5, CSS and JavaScript, John Dean, Jones & Bartlett Learning, 2019 (Chapters 1-11). 3. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2nd edition, APress, O'Reilly.
Online Learning Resources: 1. https://www.w3schools.com/html 2. https://www.w3schools.com/css 3. https://www.w3schools.com/js/ 4. https://www.w3schools.com/nodejs 5. https://gradwise.in/

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II Year - II Semester	CODE: **23ES4L06**	L	T	P	C
		1	0	2	2

DESIGN THINKING & INNOVATION

Course Objectives:

This Course will enable students to

- Bring awareness on innovative design and new product development.
- Explain the basics of design thinking.
- Familiarize the role of reverse engineering in product development.
- Train how to identify the needs of society and convert into demand.
- Introduce product planning and product development process.

Course Outcomes: Students are able to

COs	Statement	Blooms Level
CO1	Define the concepts related to design thinking.	L1
CO2	Explain the fundamentals of Design Thinking and innovation.	L2
CO3	Apply the design thinking techniques for solving problems in various sectors.	L3
CO4	Analyse to work in a multidisciplinary environment.	L4
CO5	Evaluate the value of creativity.	L5

UNIT – I **Introduction to Design Thinking**

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT - II **Design Thinking Process**

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT - III **Innovation**

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

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UNIT - IV Product Design Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies. Activity: Importance of modeling, how to set specifications, Explaining their own product design.
UNIT – V Design Thinking in Business Processes Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes. Activity: How to market our own product, about maintenance, Reliability and plan for startup.
Textbooks: 1. Tim Brown, Change by design, 1/e, Harper Bollins, 2009. 2. Idris Mootee, Design Thinking for Strategic Innovation, 1/e, Adams Media, 2014.
Reference Books: 1. David Lee, Design Thinking in the Classroom, Ulysses press, 2018. 2. Shrrutin N Shetty, Design the Future, 1/e, Norton Press, 2018. 3. William lidwell, Kritinaholden, &Jill butter, Universal principles of design, 2/e, Rockport Publishers, 2010. 4. Chesbrough.H, The era of open innovation, 2003.
Online Learning Resources: 1. https://nptel.ac.in/courses/110/106/110106124/ 2. https://nptel.ac.in/courses/109/104/109104109/ 3. https://swayam.gov.in/nd1_noc19_mg60/preview 4. https://onlinecourses.nptel.ac.in/noc22_de16/preview

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