GEETHANJALI INSTITUTE OF SCIENCE AND TECHNOLOGY

NELLORE

DEPARTMENT OF CSE(AI&ML)

REGULATION: RG23

II – YEAR

COURSE STRUCTURE AND SYLLABUS

GEETHANJALI INSTITUTE OF SCIENCE & TECHNOLOGY
Unit of USHODAYA EDUCATIONAL SOCIETY
An ISO 9001:2015 certified Institution: Recognized under Sec. 2(f)& 12(B) of UGC Act, 1956
3rd Mile, Bombay Highway, Gangavaram (V), Kovur(M), SPSR Nellore (Dt), Andhra Pradesh, India- 524137
Ph. No. 08622-212769, E-Mail: geethanjali@gist.edu.in, Website: www.gist.edu.in

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	**T**	**P**	**C**
1	BSC	23A0015T	Discrete Mathematics & Graph Theory	3	0	0	3
2	HSC	23A0021T	Universal Human Values 2 Understanding Harmony and Ethical human conduct	2	1	0	3
3	ESC	23A3301T	Artificial Intelligence	3	0	0	3
4	PCC	23A0506T	Advanced Data Structures & Algorithm Analysis	3	0	0	3
5	PCC	23A0507T	Object-Oriented Programming Through JAVA	3	0	0	3
6	PCC(Lab)	23A0508P	Advanced Data structures and Algorithms Analysis Lab	0	0	3	1.5
7	PCC(Lab)	23A0509P	Object-Oriented Programming Through JAVA Lab	0	0	3	1.5
8	SEC	23A0510P	Python programming	0	1	2	2
9	AC	23A0109T	Environmental Science	2	0	0	-
			Total	**16**	**2**	**8**	**20**

Table title: **Semester-3 (Theory-5, Lab-2, SEC-1, MC-1)**

Category	Credits
Basic Science Course (BSC)	3
Professional Core Courses (PCC)	9
Engineering Science Courses (ESC)	3
Humanities and Social Science Course (HSC)	3
Skill Enhancement Course (SEC)	2
Total	**20**

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Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1	MEC	23A0020T	Optimization Techniques	2	0	0	2
2	BSC	23A0017T	Probability & Statistics	3	0	0	3
3	PCC	23A3302T	Machine Learning	3	0	0	3
4	PCC	23A0512T	Database Management Systems	3	0	0	3
5	PCC	23A0406T	Digital Logic and Computer Organization	3	0	0	3
6	PCC(Lab)	23A3303P	Machine Learning Lab	0	0	3	1.5
7	PCC(Lab)	23A0515P	Database Management Systems Lab	0	0	3	1.5
8	SEC	23A0516P	Full Stack Development-1	0	1	2	2
9	ESC	23A0413T	Design Thinking & Innovation	1	0	2	2
			Total	**15**	**1**	**10**	**21**

Semester-4 (Theory-5, Lab-2, SEC-1, MC-1)

Mandatory Community Service Project Internship of 08 weeks duration during summer vacation

Category	Credits
Basic Science Course (BSC)	3
Professional Core Courses (PCC)	12
Engineering Science Courses (ESC)	2
Skill Enhancement Course (SEC)	2
Management Elective Course (MEC)	2
Total	21

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DISCRETE MATHEMATICS & GRAPH THEORY					
(Common to CSE and CSE allied branches)					
Course Code	**L:T:P:C**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0015T	**3:0:0:3**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**BSC**

Course Outcomes (CO):

On completion of this course, student will be able to

- Apply mathematical logic to solve problems.
- Understand the concepts and perform the operations related to sets, relations and functions.
- Gain the conceptual background needed and identify structures of algebraic nature.
- Apply basic counting techniques to solve combinatorial problems.
- Formulate problems and solve recurrence relations.
- Apply Graph Theory in solving computer science problems

Syllabus		Total Hours:48
Module-I	**Mathematical Logic**	**9Hrs**

Mathematical Logic: Introduction, Statements and Notation, Connectives, Well-formed formulas, Tautology, Duality law, Equivalence, Implication, Normal Forms, functionally complete set of connectives, Inference Theory of Statement Calculus, Predicate Calculus, Inference theory of Predicate Calculus

Module-II	**Set theory and algebraic structures**	**10Hrs**

Set theory: Sets and its operations, The Principle of Inclusion- Exclusion, Pigeon hole principle and its application, Functions composition of functions, Inverse Functions, Recursive Functions, Lattices and its properties. **Algebraic structures**: Algebraic Systems-Examples and General Properties, Semi groups and Monoids, groups, sub groups, homomorphism, Isomorphism**...**

Module-III	**Elementary Combinatorics**	**10Hrs**

Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutations with Constrained Repetitions, Binomial Coefficients, The Binomial and Multinomial Theorems.

Module-IV	**Recurrence Relations**	**10Hrs**

Generating Functions of Sequences, Calculating Coefficients of Generating Functions, Recurrence relations, Solving Recurrence Relations by Substitution and Generating functions, The Method of Characteristic roots, Solutions of Inhomogeneous, Recurrence Relations.

Module-V	**Graphs**	**9Hrs**

Basic Concepts, Isomorphism and Subgraphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multigraphs and Euler Circuits, Hamiltonian Graphs

Text Books:
1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 2002.
2. Kenneth H. Rosen, Discrete Mathematics and its Applications with Combinatoricsand Graph Theory, 7th Edition, McGraw Hill Education (India) Private Limited.

Reference Books:
1. Joe L. Mott, Abraham Kandel and Theodore P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians, 2nd Edition, Pearson Education.
2. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science.

Web References:
1. http://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf

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UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY ANDETHICAL HUMAN CONDUCT
(Common to all branches of Engineering)

Course Code	L:T:P:C	Credits	Exam Marks	Exam Duration	Course Type
23A0021T	2:1:0:3	3	CIE: 30 SEE:70	3 Hours	HSC

Course Objectives:

This course will enable students to:
- To help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutuallyenriching interaction with Nature.

Course Outcomes (CO):

On completion of this course, student will be able to
- Define the terms like Natural Acceptance, Happiness and Prosperity.
- Identify one's self, and one's surroundings (family, society nature)
- Apply what they have learnt to their own self in different day-to-day settings in real life.
- Relate human values with human relationship and human society.
- Justify the need for universal human values and harmonious existence
- Develop as socially and ecologically responsible engineers

Course Topics

Course Topics

The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1- hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions.
The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue

Syllabus	Total Hours:48
Module-I **Introduction to Value Education (6 lectures and 3 tutorials for practice session)**	**9Hrs**

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)
Lecture 2: Understanding Value Education

Tutorial 1: Practice Session PS1 Sharing about Oneself Lecture 3: self-exploration as the Process for Value Education

Lecture4: Continuous Happiness and Prosperity – the Basic Human Aspirations

Tutorial 2: Practice Session PS2 Exploring Human Consciousness Lecture 5: Happiness and Prosperity – Current Scenario

Lecture 6: Method to Fulfill the Basic Human Aspirations Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

Module-II	**Harmony in the Human Being (6 lectures and 3 tutorials for practice session)**	**10Hrs**

Lecture 7: Understanding Human being as the Co-existence of the self and the body.

Lecture 8: Distinguishing between the Needs of the self and the body

Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.

Lecture 9: The body as an Instrument of the self-Lecture 10: Understanding Harmony in the self

Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self Lecture 11: Harmony of the self with the body

Lecture 12: Programme to ensure self-regulation and Health

Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

Module-III	**Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)**	**10Hrs**

Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction Lecture 14: 'Trust' – the Foundational Value in Relationship

Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust Lecture 15: 'Respect' – as the Right Evaluation

Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect Lecture 16: Other Feelings, Justice in Human-to-Human Relationship Lecture 17: Understanding Harmony in the Society

Lecture 18: Vision for the Universal Human Order

Tutorial 9: Practice Session PS9 Exploring Systems to fulfill Human Goal.

Module-IV	**Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)**	**10Hrs**

Lecture 19: Understanding Harmony in the Nature

Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature

Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature Lecture 21: Realizing Existence as Co-existence at All Levels

Lecture 22: The Holistic Perception of Harmony in Existence

Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence.

Module-V	**Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)**	**9Hrs**

Lecture 23: Natural Acceptance of Human Values Lecture 24: Definitiveness of (Ethical) Human Conduct

Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct

Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order

Lecture 26: Competence in Professional Ethics

Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies

Lecture 28: Strategies for Transition towards Value-based Life and Profession
Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

Practice Sessions for UNIT I – Introduction to Value Education PS1 Sharing about Oneself
PS2 Exploring Human Consciousness PS3 Exploring Natural Acceptance

Practice Sessions for UNIT II – Harmony in the Human Being PS4 Exploring the difference of Needs of self and body
PS5 Exploring Sources of Imagination in the self PS6 Exploring Harmony of self with the body

Practice Sessions for UNIT III – Harmony in the Family and Society PS7 Exploring the Feeling of Trust
PS8 Exploring the Feeling of Respect
PS9 Exploring Systems to fulfil Human Goal

Practice Sessions for UNIT IV – Harmony in the Nature (Existence) PS10 Exploring the Four Orders of Nature
PS11 Exploring Co-existence in Existence

Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics
PS12 Exploring Ethical Human Conduct
PS13 Exploring Humanistic Models in Education
PS14 Exploring Steps of Transition towards Universal Human Order

Mode of Conduct:
Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.
Tutorial hours are to be used for practice sessions.
While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.
In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self- exploration.
Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.
It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may

be offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by any one department.

Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program on Universal Human Values is deemed essential.

Text Books:

a. The Textbook

R R Gaur, R Asthana, G P Bagaria, *A Foundation Course in Human Values and ProfessionalEthics*, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

b. The Teacher's Manual

R R Gaur, R Asthana, G P Bagaria,*Teachers' Manual for A Foundation Course in Human Values and Professional Ethics,* 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books:

1. *JeevanVidya: EkParichaya,* A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. *Human Values*, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. *The Story of Stuff* (Book).
4. *The Story of My Experiments with Truth* - by Mohandas Karamchand Gandhi
5. *Small is Beautiful* - E. F Schumacher.
6. *Slow is Beautiful* - Cecile Andrews
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).

Web References:

1. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf

2. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf

3. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf

4. https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%202023.pdf

5. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf

6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf

7. https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf

8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385

https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

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ARTIFICIAL INTELLIGENCE

Course Code	L:T:P:C	Credits	Exam Marks	Exam Duration	Course Type
23A3301T	3:0:0:3	3	CIE: 30 SEE:70	3 Hours	ESC

Course Objectives:

The student should be made to study the concepts of Artificial Intelligence.

• The student should be made to learn the methods of solving problems using Artificial Intelligence.

• The student should be made to introduce the concepts of Expert Systems.

• To understand the applications of AI, namely game playing, theorem proving, and machine learning.

• To learn different knowledge representation techniques

Syllabus		Total Hours:48
Module-I	**INTRODUCTION**	**9Hrs**

Introduction: AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.

Module-II	**SEARCHING**	**10Hrs**

Searching- Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing, A*, AO* Algorithms, Problem reduction, Game Playing-Adversial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning, Evaluation functions.

Module-III	**REPRESENTATION OF KNOWLEDGE**	**10Hrs**

Representation of Knowledge: Knowledge representation issues, predicate logic- logic programming, semantic nets- frames and inheritance, constraint propagation, representing knowledge using rules, Rules based deduction systems. Reasoning under uncertainty, review of probability, Bayes' probabilistic interferences and dempster Shafer theory.

Module-IV	**LOGIC CONCEPTS**	**10Hrs**

Logic concepts: First order logic. Inference in first order logic, propositional vs. first order inference, unification & lifts forward chaining, Backward chaining, Resolution, Learning from observation Inductive learning, Decision trees, Explanation based learning, Statistical Learning methods, Reinforcement Learning.

Module-V	**EXPERT SYSTEMS**	**9Hrs**

Expert Systems: Architecture of expert systems, Roles of expert systems – Knowledge Acquisition Meta knowledge Heuristics. Typical expert systems – MYCIN, DART, XCON:

Expert systems shells.

Text Books:

1.S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach",SecondEdition, Pearson Education.
2. Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", Mc Graw Hill

Reference Books:

1.David Poole, Alan Mackworth, Randy Goebel,"Computational Intelligence: a logical approach", Oxford University Press.
2. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problemsolving", Fourth Edition, Pearson Education.
3. J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers.
4. Artificial Intelligence, SarojKaushik, CENGAGE Learning.

Web References:

1. https://ai.google/

2. https://swayam.gov.in/nd1_noc19_me71/preview

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ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS

Course Code	L:T:P:C	Credits	Exam Marks	Exam Duration	Course Type
23A0506T	3:0:0:3	3	CIE: 30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:
- Provide knowledge on advance data structures frequently used in Computer Sciencedomain
- Develop skills in algorithm design techniques
- Understand the use of various data structures in the algorithm design

Course Outcomes (CO):

On completion of this course, student will be able to
- Illustrate the working of the advanced tree data structures and their applications.
- Understand the Graph data structure, traversals and apply them in various contexts.
- Apply different algorithmic techniques for solving real world problems
- Recommend appropriate data structures based on the problem being solved.
- Analyze algorithms with respect to space and time complexities.
- Design new algorithms

Syllabus		Total Hours:48
Module-I	**Introduction**	**9Hrs**
Introduction to Algorithm Analysis, Space and Time Complexity analysis, Asymptotic Notations. AVL Trees – Creation, Insertion, Deletion operations and Applications B-Trees – Creation, Insertion, Deletion operations and Applications		
Module-II	**Heap Trees (Priority Queues)**	**10Hrs**
Heap Trees (Priority Queues) – Min and Max Heaps, Operations and Applications Graphs – Terminology, Representations, Basic Search and Traversals, Connected Components and Bi connected Components, applications Divide and Conquer: The General Method, Quick Sort, Merge Sort, Strassen's matrix multiplication, Convex Hull		
Module-III	**Greedy Method**	**10Hrs**
Greedy Method: General Method, Job Sequencing with deadlines, Knapsack Problem, Minimum cost spanning trees, Single Source Shortest Paths **Dynamic Programming**: General Method, All pairs shortest paths, Single Source Shortest Paths – General Weights (Bellman Ford Algorithm), Optimal Binary Search Trees, 0/1 Knapsack, String Editing, Travelling Salesperson problem		
Module-IV	**Backtracking & Branch and Bound**	**10Hrs**

Backtracking: General Method, 8-Queens Problem, Sum of Subsets problem, Graph Coloring, 0/1 Knapsack Problem (Hamiltonian Cycle)

Branch and Bound: The General Method, 0/1 Knapsack Problem, Travelling Salesperson problem

Module-V	P and NP Problems	9Hrs

NP Hard and NP Complete Problems: Basic Concepts, Satisfiability Problem, Cook's theorem

NP Hard Graph Problems: Clique Decision Problem (CDP), Chromatic Number Decision Problem (CNDP), Traveling Salesperson Decision Problem (TSP)

NP Hard Scheduling Problems: Scheduling Identical Processors, Job Shop Scheduling

Text Books:

1. Fundamentals of Data Structures in C++, Horowitz, Ellis; Sahni, Sartaj; Mehta,Dinesh
2nd Edition Universities Press

Reference Books:

1. Computer Algorithms/C++ Ellis Horowitz, SartajSahni, SanguthevarRajasekaran2ndEdition University Press.(added to reference).
2. Data Structures and program design in C, Robert Kruse, Pearson Education Asia.
3. An introduction to Data Structures with applications, Trembley & Sorenson, McGrawHill.
4. The Art of Computer Programming, Vol.1: Fundamental Algorithms, Donald E Knuth, Addison-Wesley, 1997.
5. Data Structures using C & C++: Langsam, Augenstein &Tanenbaum, Pearson, 1995.
6. Algorithms + Data Structures &Programs: N.Wirth, PHI.
7. Fundamentals of Data Structures in C++: Horowitz Sahni & Mehta, Galgottia Pub.
8. Data structures in Java: Thomas Standish, Pearson Education Asia.

Web References:

1. https://onlinecourses.swayam2.ac.in/cec20_cs03/preview
2. https://www.tutorialspoint.com/advanced_data_structures/index.asp
3. http://peterindia.net/Algorithms.html
4. Abdul Bari,1. Introduction to Algorithms (youtube.com)

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OBJECT-ORIENTED PROGRAMMING THROUGH JAVA

Course Code	L: T:P:C	Credits	Exam Marks	Exam Duration	Course Type
23A0507T	3:0:0:3	3	CIE: 30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:
- Identify Java language components and how they work together in applications
- Learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
- Learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications
- Understand how to design applications with threads in Java
- Understand how to use Java apis for program development

Course Outcomes (CO):

On completion of this course, student will be able to
- Analyze problems, design solutions using OOP principles, and implement them efficiently in Java
- Design and implement classes to model real-world entities, with a focus on attributes, behaviors, and relationships between objects
- Demonstrate an understanding of inheritance hierarchies and polymorphic behaviour, including method overriding and dynamic method dispatch.
- Apply Competence in handling exceptions and errors to write robust and fault-tolerant code
- Perform file input/output operations, including reading from and writing to files using Java I/O classes, graphical user interface (GUI) programming using JavaFX.
- Choose appropriate data structure of Java to solve a problem

Syllabus		Total Hours:48
Module-I	**Object Oriented Programming**	**9Hrs**

Object Oriented Programming: Basic concepts, Principles, Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style.

Data Types, Variables, and Operators :Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, **Introduction to Operators**, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

Control Statements: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator?:, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop,

Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.

Module-II	Classes and Objects & Methods	10Hrs

Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this.
Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

Module-III	Arrays	10Hrs

Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors.

Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class- Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.

Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

Module-IV	Packages and Java Library	10Hrs

Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto- unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.
Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions.
Java I/O and File: Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java, Serialization and Deserialization (Text Book 2)

Module-V	String Handling in Java	9Hrs

Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer.
Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread-Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads.

Java Database Connectivity: Introduction, JDBC Architecture, Installing MySQL and MySQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, ResultSet Interface
Java FX GUI: Java FX Scene Builder, Java FX App Window Structure, displaying text and image, event handling, laying out nodes in scene graph, mouse events (Text Book 3)

Text Books:
1. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2. Joy with JAVA, Fundamentals of Object Oriented Programming, DebasisSamanta, MonalisaSarma, Cambridge, 2023.
3. JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.

Reference Books:
1. The complete Reference Java, 11th edition, Herbert Schildt,TMH
2. Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson

Web References:
1.https://nptel.ac.in/courses/106/105/106105191/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347
_shared/overview

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ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS LAB
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:C	Credits	Exam Marks	Exam Duration	Course Type
23A0508P	0:0:3:1.5	1.5	CIE: 30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:
- Acquire practical skills in constructing and managing Data structures
- Apply the popular algorithm design methods in problem-solving scenarios

Course Outcomes (CO):

On completion of this course, student will be able to
- Design and develop programs to solve real world problems with the popular algorithmdesign methods
- Demonstrate an understanding of Non-Linear data structures by developing implementing the operations on AVL Trees, B-Trees, Heaps and Graphs
- Critically assess the design choices and implementation strategies of algorithms and data structures in complex applications.
- Utilize appropriate data structures and algorithms to optimize solutions for specific computational problems
- Compare the performance of different of algorithm design strategies
- Design algorithms to new real-world problems

Experiments covering the Topics:
- Operations on AVL trees, B-Trees, Heap Trees
- Graph Traversals
- Sorting techniques
- Minimum cost spanning trees
- Shortest path algorithms
- 0/1 Knapsack Problem
- Travelling Salesperson problem
- Optimal Binary Search Trees
- N-Queens Problem
- Job Sequencing

Sample Programs:

Week-1:
1. Construct an AVL tree for a given set of elements which are stored in a file. And implement insert and delete operation on the constructed tree. Write contents of tree into a new file using in-order.

Week-2:
2. Construct B-Tree an order of 5 with a set of 100 random elements stored in array. Implement searching, insertion and deletion operations.

Week-3:
3. Construct Min and Max Heap using arrays, delete any element and display the content of the Heap.

Week-4:
4. Implement BFT and DFT for given graph, when graph is represented by
   a) Adjacency Matrix   b) Adjacency Lists

Week-5:
5. Write a program for finding the bi-connected components in a given graph.

Week-6:
6. Implement Quick sort and Merge sort and observe the execution time for various input sizes (Average, Worst and Best cases).

Week-7:
7. Compare the performance of Single Source Shortest Paths using Greedy method when the graph is represented by adjacency matrix and adjacency lists

Week-8:
8. Implement Job sequencing with deadlines using Greedy strategy.

Week-9:
9. Write a program to solve 0/1 Knapsack problem Using Dynamic Programming.

Week-10:
10. Implement N-Queens Problem Using Backtracking.

Week-11:
11. Use Backtracking strategy to solve 0/1 Knapsack problem.

Week-12:
12. Implement Travelling Sales Person problem using Branch and Bound approach

Reference Books:
1. Fundamentals of Data Structures in C++, Horowitz Ellis, SahniSartaj, Mehta, Dinesh, 2nd Edition, Universities Press
2. Computer Algorithms/C++ Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, 2nd Edition, University Press
3. Data Structures and program design in C, Robert Kruse, Pearson Education Asia
4. An introduction to Data Structures with applications, Trembley& Sorenson, McGraw Hill

Web References:
1. http://cse01-iiith.vlabs.ac.in/
2. http://peterindia.net/Algorithms.html
3. https://onlinecourses.swayam2.ac.in/cec20_cs03/preview

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OBJECT-ORIENTED PROGRAMMING THROUGH JAVA LAB
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:C	Credits	Exam Marks	Exam Duration	Course Type
23A0509P	0:0:3:1.5	1.5	CIE: 30 SEE:70	3 Hours	PCC

Course Objectives:

The aim of this course is to:
- Practice object-oriented programming in the Java programming language
- Implement Classes, Objects, Methods, Inheritance, Exception, Runtime Polymorphism, User defined Exception handling mechanism
- Illustrate inheritance, Exception handling mechanism, JDBC connectivity
- Construct Threads, Event Handling, implement packages, Java FX GUI

Course Outcomes (CO):

On completion of this course, student will be able to
- Demonstrate a solid understanding of Java syntax, including data types, controlstructures, methods, classes, objects, inheritance, polymorphism, and exceptionhandling.
- Apply fundamental OOP principles such as encapsulation, inheritance, polymorphism, and abstraction to solve programming problems effectively.
- Familiar with commonly used Java libraries and APIs, including the CollectionsFramework, Java I/O, JDBC, and other utility classes.
- Develop problem-solving skills and algorithmic thinking, applying OOP concepts to design efficient solutions to various programming challenges.
- Proficiently construct graphical user interface (GUI) applications using JavaFX.
- Develop new programs for solving typical computer science problems.

Experiments covering the Topics:
- Object Oriented Programming fundamentals- data types, control structures
- Classes, methods, objects, Inheritance, polymorphism,
- Exception handling, Threads, Packages, Interfaces
- Files, I/O streams, JavaFX GUI

Sample Programs:
Week-1:
1. Develop a java program to display default value of all primitive data type of JAVA
2. Develop a java program that display the roots of a quadratic equation $ax^2+bx=0$. Calculate the discriminate D and basing on value of D, describe the nature of root.

Week-2:
3. Develop a JAVA program to search for an element in a given list of elements using binary search mechanism.
4. Develop a JAVA program to sort for an element in a given list of elements using bubble sort

Week-3:
5. Develop a JAVA program using StringBuffer to delete, remove character.
Week-4:
6. Develop a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method.
7. Develop a JAVA program implement method overloading.
Week-5:
8. Develop a JAVA program to implement constructor.

9. Develop a JAVA program to implement constructor overloading.

Week-6:
10. Develop a JAVA program to implement Single Inheritance
11. Develop a JAVA program to implement multi level Inheritance
Week-7:
12. Develop a JAVA program for abstract class to find areas of different shapes
13. Develop a JAVA program give example for "super" keyword.
Week-8:
14. Develop a JAVA program to implement Interface. What kind of Inheritance can be achieved?
15. Develop a JAVA program that implements Runtime polymorphism
Week-9:
16. Develop a JAVA program that describes exception handling mechanism
17. Develop a JAVA program Illustrating Multiple catch clauses
Week-10:
18. Develop a JAVA program for creation of Java Built-in Exceptions
19. Develop a JAVA program for creation of User Defined Exception
Week-11:
20. Develop a JAVA program that creates threads by extending Thread class. First thread display "Good Morning "every 1 sec, the second thread displays "Hello "every 2 seconds and the third display "Welcome" every 3 seconds, (Repeat the same by implementing Runnable)
21. Develop a program illustrating is Alive( ) and join ()
Week-12:
22. Develop a Program illustrating Daemon Threads.
23. Develop a JAVA program Producer Consumer Problem
Week-13:
24. Develop a JAVA program that import and use the user defined packages
25. Without writing any code, build a GUI that display text in label and image in anImageView (use JavaFX)
Week-14:
26. Build a Tip Calculator app using several JavaFX components and learn how torespond to user interactions with the GUI
27. Develop a java program that connects to a database using JDBC
Week-15:
28. Develop a java program to connect to a database using JDBC and insert values into it.
29. Develop a java program to connect to a database using JDBC and delete values from it

Text Books:
1. Fundamentals of Data Structures in C++, Horowitz Ellis, SahniSartaj, Mehta, Dinesh, 2ndEdition, Universities Press
2. Computer Algorithms/C++ Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, 2ndEdition, University Press
3. Data Structures and program design in C, Robert Kruse, Pearson Education Asia
4. An introduction to Data Structures with applications, Trembley& Sorenson, McGraw Hill

Reference Books:
1. The complete Reference Java, 11th edition, Herbert Schildt,TMH
2. Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson

Web References:

1. https://nptel.ac.in/courses/106/105/106105191/

2.https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547 618816347_shared/overview

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PYTHON PROGRAMMING
(SKILL ENHANCEMENT COURSE)
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:C	Credits	Exam Marks	Exam Duration	Course Type
23A0510P	0:1:2:2	2	CIE: 30 SEE:70	3 Hours	SEC

Course Objectives:

This course will enable students to:
- Introduce core programming concepts of Python programming language.
- Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
- Implement Functions, Modules and Regular Expressions in Python Programmingand to create practical and contemporary applications using these

Course Outcomes (CO):

On completion of this course, student will be able to
- Classify data structures of Python
- Apply Python programming concepts to solve a variety of computational problems
- Understand the principles of object-oriented programming (OOP) in Python, including classes, objects, inheritance, polymorphism, and encapsulation, and apply them to design and implement Python programs
- Become proficient in using commonly used Python libraries and frameworks such as JSON, XML, NumPy, pandas
- Exhibit competence in implementing and manipulating fundamental data structuressuch as lists, tuples, sets, dictionaries
- Propose new solutions to computational problems

Syllabus	Total Hours:48

Module-I	History of Python Programming Language	9Hrs

History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.
Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type ( ) Function and Is Operator, Dynamic and Strongly Typed Language.
Control Flow Statements: if statement, if-else statement, if...elif…else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement.
Sample Experiments:
Week-1:
1. Develop a Python Program to find the largest element among three Numbers.
2. Develop a Python Program to display all prime numbers within an interval

Week-2:

3. Develop a Python Program to swap two numbers without using a temporary variable.
4. Demonstrate the following Operators in Python with suitable examples.
    i)Arithmetic Operators ii) Relational Operators iii) Assignment Operators iv) Logical
    Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operators
    viii) Identity Operators

Week-3:

5. Develop a Python Program to add and multiply complex numbers
6. Develop a Python Program to print multiplication table of a given number.

Module-II	Functions, Strings, Lists	10Hrs

Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.

Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.

Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

Sample Experiments:

Week-4:

7.Develop a Python Program to define a function with multiple return values.

8.Develop a Python Program to define a function using default arguments.

Week-5:

9. Develop a Python Program to find the length of the string without using any library functions.

10. Develop a Python Program to check if the substring is present in a given string or not.

Week-6:

11.Develop a Python Program to perform the given operations on a list:
    i. Addition   ii. Insertion   iii. Slicing

12.Develop a Python Program to perform any 5 built-in functions by taking any list.

Module-III	Dictionaries	10Hrs

Dictionaries: Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.

Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozenset.

Sample Experiments:

Week-7:

13. Develop a Python Program to create tuples (name, age, address, college) for at least two membersand concatenate the tuples and print the concatenated tuples.

14. Develop a Python Program to count the number of vowels in a string (No control flow allowed).

Week-8:

15. Develop a Python Program to check if a given key exists in a dictionary or not.

16. Develop a Python Program to add a new key-value pair to an existing dictionary.
17. Develop a Python Program to sum all the items in a given dictionary.

Module-IV	Files	10Hrs

Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.
Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism**.**

Sample Experiments:
Week-9:
18. Develop a Python Program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.
19. Develop a Python Program to print each line of a file in reverse order.

Week-10:
20. Develop a Python Program to compute the number of characters, words and lines in a file.
21. Develop a Python Program to create, display, append, insert and reverse the order of the items in the array.

Week-11:
22. Develop a Python Program to add, transpose and multiply two matrices.
23. Develop a Python Program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle,triangle, and square.

Module-V	Introduction to Data Science	9Hrs

Introduction to Data Science: Functional Programming, JSON and XML inPython, NumPy with Python, Pandas

Sample Experiments:
Week-12:
24. Develop a Python Program to check whether a JSON string contains complex object or not.
25. Develop a Python Program to demonstrate NumPy arrays creation using array ( ) function.

Week-13:
26. Develop a Python Program to demonstrate use of ndim, shape, size, dtype.
27. Develop a Python Program to demonstrate basic slicing, integer and Boolean indexing.

Week-14:
28. Develop a Python program to find min, max, sum, cumulative sum of array
29. Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
    a)   Apply head ( ) function to the pandas data frame
    b)   Perform various data selection operations on Data Frame

Week-15:
30. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib

Text Books:
1. Gowrishankar S, Veena A., Introduction to Python Programming, CRC Press

Reference Books:
1. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2ndEdition, Pearson,2024
2. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

Web References:
1. https://www.coursera.org/learn/python-for-applied-data-science-ai
2. https://www.coursera.org/learn/python?specialization=python#syllabus

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ENVIRONMENTAL SCIENCE					
(Common to CSE, AI&ML, DS, CS)					
Course Code	**L:T:P:C**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0109T	**2:0:0:0**	**0**	**CIE: 30**	**1.5 hrs**	**AC**

Course Objectives:

This course will enable students to:

- To make the students to get awareness on environment.
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life
- To save earth from the inventions by the engineers

Syllabus	Total Hours:48

Module-I	**Multidisciplinary Nature of Environmental Studies**	**9Hrs**

Multidisciplinary Nature of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness.

Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

Module-II	**Ecosystems**	**10Hrs**

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem.
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and its Conservation : Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of

biodiversity: In-situ and Ex-situ conservation of biodiversity.

Module-III	Environmental Pollution	10Hrs

Environmental Pollution: Definition, Cause, effects and control measures of :
   a.   Air Pollution.
   b.   Water pollution
   c.   Soil pollution
   d.   Marine pollution
   e.   Noise pollution
   f.   Thermal pollution
   g.   Nuclear hazards

Solid Waste Management: Causes**,** effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

Module-IV	Social Issues and the Environment	10Hrs

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness**.**

Module-V	Human Population and the Environment	9Hrs

Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

Text Books:
1. Textbook of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press.
2. Palaniswamy, "Environmental Studies", Pearson education
3. S.Azeem Unnisa, "Environmental Studies" Academic Publishing Company
4. K.Raghavan Nambiar, "Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", Scitech Publications (India), Pvt. Ltd.

Reference Books:
1. Deeksha Dave and E.Sai Baba Reddy, "Textbook of Environmental Science",Cengage Publications.
2. M.Anji Reddy, "Text book of Environmental Sciences and Technology", BSPublication.
3. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications.
4. J. Glynn Henry and Gary W. Heinke, "Environmental Sciences and Engineering", Prentice hall of India Private limited
5. G.R.Chatwal, "A Text Book of Environmental Studies" Himalaya Publishing House
6. Gilbert M. Masters and Wendell P. Ela, "Introduction to Environmental Engineeringand Science, Prentice hall of India Private limited.

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Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	**T**	**P**	**C**
1	MEC	23A0020T	Optimization Techniques	2	0	0	2
2	BSC	23A0017T	Probability & Statistics	3	0	0	3
3	PCC	23A3302T	Machine Learning	3	0	0	3
4	PCC	23A0512T	Database Management Systems	3	0	0	3
5	PCC	23A0406T	Digital Logic and Computer Organization	3	0	0	3
6	PCC(Lab)	23A3303P	Machine Learning Lab	0	0	3	1.5
7	PCC(Lab)	23A0515P	Database Management Systems Lab	0	0	3	1.5
8	SEC	23A0516P	Full Stack Development-1	0	1	2	2
9	ESC	23A0413T	Design Thinking & Innovation	0	1	2	2
			Total credits				**21**

Semester-4 (Theory-6, Lab-3, SC-1, MC-1)

Mandatory Community Service Project Internship of 08 weeks duration during summer vacation

Category	Credits
Basic Science Course (BSC)	3
Professional Core Courses (PCC)	12
Engineering Science Courses (ESC)	2
Skill Oriented Course (SEC)	2
Management Elective Course (MEC)	2
Total	**21**

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OPTIMIZATION TECHNIQUES					
Course Code	**L:T:P:C**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0020T	**2:0:0:2**	**2**	**CIE: 30 SEE:70**	**3 Hours**	**MEC**

Course Objectives:

The objectives of the course are
- To provide the basic knowledge about Optimization, importance, application areas ofin theindustry, Linear Programming.
- To impart different optimization models under typical situations in the business organization like transportation, assignment.
- To understand the process of sequencing in a typical industry.
- To describe different game strategies under cut-throat competitive business environment
- To develop networks of activities of projects and to find out optimal modes of completing projects using network modelling evaluation techniques

Course Outcomes(CO):
- Understanding Optimization and Formulation of Linear Programing Models
- Formulate and Solve Transportation & Assignment Models
- Sequencing of operations and optimizing
- Discuss the game theory and strategies
- Developing networks of activities and finding optimal mode of projects evaluation

Syllabus		Total Hours:48
Module-I	**Introduction**	**9Hrs**

Meaning, Nature, Scope & Significance of Optimization - Typical applications.The Linear Programming Problem – Introduction, Formulation of Linear Programming problem, Limitations of L.P.P, Graphical method, Simplex method: Maximization and Minimization model(exclude Duality problems), Big-M method and Two Phase method.

Module-II	**Transportation Problem**	**10Hrs**

Introduction, Transportation Model, Finding initial basic feasible solutions, Moving towards optimality, Unbalanced Transportation problems, Transportation problems with maximization, Degeneracy.
Assignment Problem – Introduction, Mathematical formulation of the problem, Solution of an Assignment problem, Hungarian Algorithm, Multiple Solution, Unbalanced Assignment problems, Maximization in Assignment Model.

Module-III	Sequencing	10Hrs

Job sequencing, Johnsons Algorithm for n Jobs and Two machines, n Jobs and Three Machines, n jobs through m machines, Two jobs and m Machines Problems

Module-IV	Game Theory	10Hrs

Concepts, Definitions and Terminology, Two Person Zero Sum Games, Pure Strategy Games (with Saddle Point), Principal of Dominance, Mixed Strategy Games (Game without Saddle Point), Significance of Game Theory in Managerial Application.

Module-V	Project Management	9Hrs

Network Analysis – Definition –objectives -Rules for constructing network diagram- Determining Critical Path – Earliest & Latest Times – Floats - Applicationof CPM and PERT techniques in Project Planning and Control – PERT Vs CPM. (exclude Project Crashing).

Text Books:
1. Operations Research / R.Pannerselvam, PHI Publications.
2. Operations Research / S.D.Sharma-Kedarnath
3. Operations Research /A.M.Natarajan,P.Balasubramani,A. Tamilarasi/Pearson Education.
4. Engineering Optimization: Theory and practice / S.S.Rao, New Age International (P) Limited.

Reference Books:
1. Quantitative Techniques in Management / ND Vohra, Tata McGraw Hill, 4th Edition, 2011.
2. ntroduction to O.R/Hiller &Libermann (TMH).
3. Operations Research: Methods & Problems / Maurice Saseini, ArhurYaspan&Lawrence Friedman. Pearson
4. Quantitative Analysis For Management/ Barry Render, Ralph M. Stair, Jr and Michael E.Hanna/
5. Operations Research / Wagner/ PHI Publications.

Online Learning Sources:
https://onlinecourses.swayam2.ac.in/cec20_ma10/preview
https://onlinecourses.nptel.ac.in/noc20_ma23/preview
https://onlinecourses.nptel.ac.in/noc19_ma29/preview

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PROBABILITY & STATISTICS
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:C	Credits	Exam Marks	Exam Duration	Course Type
23A0017T	3:0:0:3	3	CIE: 30 SEE:70	3 Hours	BSC

Course Objectives:

This course will enable students to:

-

Course Outcomes(CO):

On completion of this course, student will be able to

- Acquire knowledge in finding the analysis of the data quantitatively or categorically and various statistical elementary tools.
- Develop skills in designing mathematical models involving probability, random variables and the critical thinking in the theory of probability and its applications in real life problems.
- Apply the theoretical probability distributions like binomial, Poisson, and Normalin the relevant application areas.
- Analyze to test various hypotheses included in theory and types of errors for large samples.
- Apply the different testing tools like t-test, F-test, chi-square test to analyze the relevant real life problems.

Syllabus		Total Hours:48
Module-I	**Descriptive statistics**	**9Hrs**

Statistics Introduction, Population vs Sample, Collection of data, primary and secondary data, Measures of Central tendency, Measures of Variability (spread or variance) Skewness, Kurtosis, correlation, correlation coefficient, rank correlation, regression coefficients, methodof least squares, regression lines.

Module-II	**Probability**	**10Hrs**

Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous), probability density functions, properties, mathematical expectation.

Module-III	**Probability distributions**	**10Hrs**

Probability distributions: Binomial, Poisson and Normal-their properties (Chebyshevs inequality). Approximation of the binomial distribution to normal distribution.

Module-IV	Estimation and Testing of hypothesis, large sample tests	10Hrs

Estimation-parameters, statistics, sampling distribution, point estimation, Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors and power of the test. Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems

Module-V	Small sample tests	9Hrs

Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test), χ^2 - test for goodness of fit, χ^2 - test for independence of attributes.

Text Books:
1. Miller and Freunds, Probability and Statistics for Engineers,7/e, Pearson, 2008.
2. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, SultanChand & Sons Publications, 2012.

Reference Books:
1. S. Ross, a First Course in Probability, Pearson Education India, 2002.
2. W. Feller, an Introduction to Probability Theory and its Applications, 1/e, Wiley,1968.
3. B. V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education.

Web References:
1. https://onlinecourses.nptel.ac.in/noc21_ma74/preview
2. https://onlinecourses.nptel.ac.in/noc22_mg31/preview

MACHINE LEARNING					
Course Code	**L:T:P:C**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A3302T	**3:0:0:3**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**PCC**

Course Objectives:

The objectives of the course are
- Define machine learning and its different types (supervised and unsupervised) and understand their applications.
- Apply supervised learning algorithms including decision trees and k-nearestneighbors (k-NN).
- Implement unsupervised learning techniques, such as K-means clustering.

Course Outcomes(CO):

- CO1: Identify machine learning techniques suitable for a given problem. (L3)
- CO2: Solve real-world problems using various machine learning techniques. (L3)
- CO3: Apply Dimensionality reduction techniques for data preprocessing. (L3)
- CO4: Explain what is learning and why it is essential in the design of intelligent machines. (L2)
- CO5: Evaluate Advanced learning models for language, vision, speech, decisionmaking etc. (L5)

Syllabus	**Total Hours:48**

Module-I	**Introduction to Machine Learning**	**9Hrs**

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.

Module-II	**Nearest Neighbor-Based Models**	**10Hrs**

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.

Module-III	**Models Based on Decision Trees**	**10Hrs**

Decision Trees for Classification, Impurity Measures, Properties, Regression Based on Decision Trees, Bias–Variance Trade-off, Random Forests for Classification and Regression.
The Bayes Classifier: Introduction to the Bayes Classifier, Bayes' Rule and Inference, The Bayes Classifier and its Optimality, Multi-Class Classification | Class Conditional Independence and Naive Bayes Classifier (NBC)

Module-IV	Linear Discriminants for Machine Learning	10Hrs

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.

Module-V	Clustering	9Hrs

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, UniversitiesPress (India), 2024

Reference Books:
1. Machine Learning", Tom M. Mitchell, McGraw-Hill Publication, 2017
   2."Machine Learning in Action",Peter Harrington, DreamTech
2. 3."Introduction to Data Mining", Pang-Ning Tan, Michel Stenbach, Vipin Kumar, 7th Edition, 2019.

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DATABASE MANAGEMENT SYSTEMS (Common to CSE, AI&ML, DS, CS)					
Course Code	**L:T:P:C**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0512T	**3:0:0:3**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**PCC**

Course Objectives:

This course will enable students 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(CO):

On completion of this course, student will be able to

- Understand the basic concepts of database management systems (L2)
- Analyze a given database application scenario to use ER model for conceptual designof the database (L4)
- Utilize SQL proficiently to address diverse query challenges (L3).
- Employ normalization methods to enhance database structure (L3)
- Assess and implement transaction processing, concurrency control and databaserecovery protocols in databases. (L4)

Syllabus		**Total Hours:48**
Module-I	**Introduction**	**9Hrs**

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.

Module-II	**Relational Model**	**10Hrs**

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).

Module-III	SQL	10Hrs

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**.**

Module-IV	Schema Refinement	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).DeNormalization

Module-V	Transaction Concept	9Hrs

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 (ForChapter 1 and Chapter 5)

Reference Books:
  1. Introduction to Database Systems, 8thedition, C J Date, Pearson.
  2. Database Management System, 6th edition, RamezElmasri, Shamkant B. Navathe, Pearson
  3. Database Principles Fundamentals of Design Implementation and Management,Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

Web References:
  1. https://nptel.ac.in/courses/106/105/106105175/
  2.https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0127580666728202
     2456_shared/overview

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DIGITAL LOGIC & COMPUTER ORGANIZATION
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:C	Credits	Exam Marks	Exam Duration	Course Type
23A0406T	3:0:0:3	3	CIE: 30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:
- provide students with a comprehensive understanding of digital logic designprinciples 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):

On completion of this course, student will be able to
- Differentiate between combinational and sequential circuits based on their characteristics and functionalities.
- Demonstrate an understanding of computer functional units.
- Analyze the design and operation of processors, including instruction execution, pipelining, and control unit mechanisms, to comprehend their role in computer systems.
- Describe memory hierarchy concepts, including cache memory, virtual memory, and secondary storage, and evaluate their impact on system performance and scalability.
- Explain input/output (I/O) systems and their interaction with the CPU, memory, and peripheral devices, including interrupts, DMA, and I/O mapping techniques.
- Design Sequential and Combinational Circuits

Syllabus	Total Hours:48

Module-I	Data Representation	9Hrs

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

Module-II	Digital Logic Circuits	10Hrs

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

Module-III	Computer Arithmetic	10Hrs

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

Module-IV	The Memory Organization	10Hrs

Basic Concepts, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memories, Performance Considerations, Virtual Memories, Memory Management Requirements, Secondary Storage

Module-V	Input /Output Organization	9Hrs

Accessing I/O Devices, Interrupts, Processor Examples, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces, Arbitration

Text Books:
1. Computer Organization, Carl Hamacher, ZvonkoVranesic, SafwatZaky, 6th edition, McGraw Hill, 2023.
2. Digital Design, 6th Edition, M. Morris Mano, Pearson Education, 2018.
3. Computer Organization and Architecture, William Stallings, 11thEdition, Pearson,2022.

Reference Books:
1. Computer Systems Architecture, M.Moris Mano, 3rdEdition, Pearson, 2017.
2. Computer Organization and Design, David A. Paterson, John L. Hennessy, Elsevier,2004.
3. Fundamentals of Logic Design, Roth, 5thEdition, Thomson, 2003.

Web References:
https://nptel.ac.in/courses/106/103/106103068/

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MACHINE LEARNING LAB					
Course Code	**L:T:P:C**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A3303P	**0:0:3:1.5**	**1.5**	**CIE: 30 SEE:70**	**3 Hours**	**PCC**

Course Objectives:

- To learn about computing central tendency measures and Data preprocessingtechniques
- To learn about classification and regression algorithms
- To apply different clustering algorithms for a problem.

Experiments:	Total Hours:48

WEEK-1

1. Compute Central Tendency Measures: Mean, Median, Mode Measure of Dispersion: Variance, Standard Deviation.

WEEK-2

2. Apply the following Pre-processing techniques for a given dataset.
- a.   Attribute selection
- b.   Handling Missing Values
- c.   Discretization
- d.   Elimination of Outliers.

WEEK-3

3. Apply KNN algorithm for classification and regression

WEEK-4

4. Demonstrate decision tree algorithm for a classification problem and performparameter tuning for better results.

WEEK-5

5. Demonstrate decision tree algorithm for a regression problem.

WEEK-6

6. Apply Random Forest algorithm for classification and regression.

WEEK-7

7. Demonstrate Naïve Bayes Classification algorithm.

WEEK-8

8. Apply Support Vector algorithm for classification.

WEEK-9

9. Demonstrate simple linear regression algorithm for a regression problem.

WEEK-10

10.   Apply Logistic regression algorithm for a classification problem.

WEEK-11

11.   Demonstrate Multi-layer Perceptron algorithm for a classification problem

WEEK-12

12.   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 fromits class center. Test the performance of the algorithm as a function of the parameters K.

WEEK-13
13. Demonstrate the use of Fuzzy C-Means Clustering
WEEK-14
14. Demonstrate the use of Expectation Maximization based clustering algorithm

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DATABASE MANAGEMENT SYSTEMS LAB
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:C	Credits	Exam Marks	Exam Duration	Course Type
23A0515P	0:0:3:1.5	1.5	CIE: 30 SEE:70	3 Hours	PCC

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(CO):

On completion of this course, student will be able to
- Utilizing Data Definition Language (DDL), Data Manipulation Language (DML), and Data Control Language (DCL) commands effectively within a database environment (L3)
- Constructing and execute queries to manipulate and retrieve data from databases. (L3)
- Develop application programs using PL/SQL. (L3)
- Analyze requirements and design custom Procedures, Functions, Cursors, and Triggers, leveraging their capabilities to automate tasks and optimize database functionality (L4)
- Establish database connectivity through JDBC (Java Database Connectivity) (L3)

Experiments:	Total Hours:48

Week-1:
1. Creation, altering and droping of tables and inserting rows into a table (use constraintswhile creating tables) examples using SELECT command.

Week-2:
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.

Week-3:
3. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.

Week-4:
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)

Week-5
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.

Week-6:

6. Develop a PL/SQL program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions.

Week-7:

7. Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE- APPLICATION ERROR.

Week-8:

8. Program development using creation of procedures, passing parameters IN and OUT of PROCEDURES.

Week-9:

9. Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.

Week-10:

10. Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables.

Week-11:

11. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers

Week-12:

12. Create a table and perform the search operation on table using indexing and non-indexing techniques.

Week-13:

13. Develop a Java program that connects to a database using JDBC

Week-14:

14. Develop a Java program to connect to a database using JDBC and insert values into it

Week-15:

15. Develop a Java program to connect to a database using JDBC and delete values from it

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

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

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FULL STACK DEVELOPMENT – 1 **(Skill Enhancement Course)** (Common to CSE, AI&ML, DS, CS)					
Course Code	**L:T:P:C**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0516P	**0:1:2:2**	**2**	**CIE: 30 SEE:70**	**3 Hours**	**SEC**

Course Objectives:

This course will enable students 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(CO):

On completion of this course, student will be able to
- CO1: Design Websites. (L6)
- CO2: Apply Styling to web pages. (L4)
- CO3: Make Web pages interactive. (L6)
- CO4: Design Forms for applications. (L6)
- CO5: Choose Control Structure based on the logic to be implemented. (L3)
- CO6: Understand HTML tags, Attributes and CSS properties (L2)

Experiments:	**Total Hours:48**

1. Lists, Links and Images
Week-1:

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

Week-2:

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. Develop 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
Week-3:

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

b. Develop 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.).

Week-4:

c.Develop 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.Develop 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 tobe fixed).

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

Week-5:

a. Develop a HTML program, that makes use of <article>, <aside>, <figure>, <figcaption>, **<footer>, <header>, <main>, <nav>, <section>, <div>, <span> tags.**
b. Develop a HTML program, to embed audio and video into HTML web page.
c. Develop 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

Week-6:

a. Develop a HTML program to apply different types of selector forms
   ● Simple selector (element, id, class, group, universal)
   ● Combinator selector (descendant, child, adjacent sibling, general sibling)
   ● Pseudo-class selector
   ● Pseudo-element selector
   ● Attribute selector

5. CSS with Color, Background, Font, Text and CSS Box Model
Week-7:

a. Develop a HTML 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.

Week-8:

c. Develop a HTML 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. Develop a HTML 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
Week-9:

a. Develop a program to embed internal and external JavaScript in a web page.

b. Develop a program to explain the different ways for displaying output using JavaScript.
c. Develop a program to explain the different ways for taking input using Java script.
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

7. JavaScript Pre-defined and User-defined Objects
Week-10:

a. Develop a program using document object properties and methods in Java script.
b. Develop a program using window object properties and methods in Java script.
Week-11:

c. Develop a program using array object properties and methods in JavaScript.
d. Develop a program using math object properties and methods in JavaScript.

e. Develop a program using string object properties and methods in JavaScript.
Week-12:

f. Develop a program using regex object properties and methods in JavaScript.
g. Develop a program using date object properties and methods in JavaScript.
h. Develop a program to explain user-defined object by using properties, methods, accessors, constructors and display in JavaScript.
8. JavaScript Conditional Statements and Loops
Week-13:

a. Develop 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, outputHTML text as "EQUAL NUMBERS".
b. Develop a program to display week days using switch case in JavaScript.
c. Develop a program to print 1 to 10 numbers using for, while and do-while loops in JavaScript.
Week-14:
d. Develop a program to print data in object using for-in, for-each and for-of loops in JavaScript
e. Develop a program to determine whether a given number is an 'ARMSTRONG NUMBER' or not in JavaScript. [Eg: 153 is an Armstrong number, since sum of the cube of the digits isequal to the number i.e.,13 + 53+ 33 = 153]
f. Develop 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)
9. Javascript Functions and Events
Week-15:
a. Design a appropriate function should be called to display
   ● Factorial of that number
   ● Fibonacci series up to that number
   ● Prime numbers up to that number
   ● Is it palindrome or not
b. Design a HTML page 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

    Factorial of that number

    Fibonacci series up to that number

    Prime numbers up to that number

    Is it palindrome or not

c. Develop 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)

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

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.

Reference Books:

Web References:
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://www.w3schools.com/typescript

GEETHANJALI INSTITUTE OF SCIENCE & TECHNOLOGY

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DESIGN THINKING FOR INNOVATION
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:C	Credits	Exam Marks	Exam Duration	Course Type
23A0413T	1:0:2:2	2	CIE: 30 SEE:70	3 Hours	ESC

Course Objectives:

This course will enable students to:

The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.

Course Outcomes (CO):

On completion of this course, student will be able to

- Define the concepts related to design thinking. (L1, L2)
- Explain the fundamentals of Design Thinking and innovation (L1, L2)
- Apply the design thinking techniques for solving problems in various sectors. (L3)
- Analyse to work in a multidisciplinary environment (L4)
- Evaluate the value of creativity (L5)
- Formulate specific problem statements of real time issues (L3, L6)

Syllabus		Total Hours:48
Module-I	**Introduction to Design Thinking**	**9Hrs**

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.

Module-II	**Design Thinking Process**	**10Hrs**

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.

Module-III	**Innovation**	**10Hrs**

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.

Module-IV	**Product Design**	**10Hrs**

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications- Innovation towards product design- Case studies

Activity: Importance of modelling, how to set specifications, Explaining their own product design.

Module-V	Design Thinking in Business Processes	9Hrs

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.

Text Books:
1. Tim Brown,Change by design, Harper Bollins (2009)
2. Idris Mootee, Design Thinking for Strategic Innovation, 2013, John Wiley & Sons.

Reference Books:
1. David Lee, Design Thinking in the Classroom, Ulysses press
2. Shrutin N Shetty, Design the Future, Norton Press
3. William Lidwell,Universal Principles of Design- Kritinaholden, Jill Butter.
4. Chesbrough.H, The Era of Open Innovation – 2013

Web References:
https://nptel.ac.in/courses/110/106/110106124/
https://nptel.ac.in/courses/109/104/109104109/
https://swayam.gov.in/nd1_noc19_mg60/preview

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COMMUNITY SERVICE PROJECT					
Experiential learning through community engagement					
(Common to CSE, AI&ML, DS, CS)					
Course Code	**L:T:P:C**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A3304P	**0:0:0:0**	**2**	**CIE: 30 SEE:70**	**3 Hours**	**PCC**

Introduction

- Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development.
- Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.
- Community Service Project is meant to link the community with the college for mutual benefit. The community will benefit with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and emerge as asocially responsible institution.

Objective

Community Service Project should be an integral part of the curriculum, as an alternative to the 2 months of Summer Internships / Apprenticeships / On the Job Training, whenever there is an exigency when students cannot pursue their summer internships. The specific objectives are;

- To sensitize the students to the living conditions of the people who are around them,
- To help students to realize the stark realities of society.
- To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
- To make students aware of their inner strength and help them to find new /out of box solutions to social problems.
- To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
- To help students to initiate developmental activities in the community in coordination with public and government authorities.
- To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

Implementation of Community Service Project

- Every student should put in 6 weeks for the Community Service Project during the summer vacation.
- Each class/section should be assigned with a mentor.

- Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, housewives, etc
- A logbook must be maintained by each of the students, where the activities undertaken/involved to be recorded.
- The logbook has to be countersigned by the concerned mentor/faculty in charge.
- An evaluation to be done based on the active participation of the student and gradecould be awarded by the mentor/faculty member.
- The final evaluation to be reflected in the grade memo of the student.
- The Community Service Project should be different from the regular programs of NSS/NCC/Green Corps/Red Ribbon Club, etc.
- Minor project reports should be submitted by each student. An internal Viva shall alsobe conducted by a committee constituted by the principal of the college.
- Award of marks shall be made as per the guidelines of Internship/apprentice/ on thejob training.

Procedure

- A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, to enable them to commute from their residence and return back by evening or so.
- The Community Service Project is a twofold one –
  - First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, it could be another primary source of data.
  - Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –
    - Agriculture
    - Health
    - Marketing and Cooperation
    - Animal Husbandry
    - Horticulture
    - Fisheries
    - Sericulture
    - Revenue and Survey
    - Natural Disaster Management
    - Irrigation
    - Law & Order
    - Excise and Prohibition
    - Mines and Geology
    - Energy
    - Internet
    - Free Electricity
    - Drinking Water

EXPECTED OUTCOMES
BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS

Learning Outcomes
- Positive impact on students' academic learning
- Improves students' ability to apply what they have learned in "the real world"
- Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development.
- Improved ability to understand complexity and ambiguity

Personal Outcomes
Greater sense of personal efficacy, personal identity, spiritual growth, and moral development
Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills.

Social Outcomes

- Reduced stereotypes and greater inter-cultural understanding
- Improved social responsibility and citizenship skills
- Greater involvement in community service after graduation

Career Development

- Connections with professionals and community members for learning and career opportunities
- Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity.

Relationship with the Institution

- Stronger relationships with faculty
- Greater satisfaction with college
- Improved graduation rates

BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS

- Satisfaction with the quality of student learning
- New avenues for research and publication via new relationships between faculty and community
- Providing networking opportunities with engaged faculty in other disciplines orinstitutions
- A stronger commitment to one's research.

BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES

- Improved institutional commitment.
- Improved student retention
- Enhanced community relations

BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY

- Satisfaction with student participation
- Valuable human resources needed to achieve community goals.
- New energy, enthusiasm and perspectives applied to community work.
- Enhanced community-university relations.

SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT

The following the recommended list of projects for Engineering students. The lists are not exhaustive and open for additions, deletions, and modifications. Colleges are expected to focus on specific local issues for this kind of project. The students are expected to carry out these projects with involvement, commitment, responsibility, and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of project. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting should beensured.

For Engineering Students

1. Water facilities and drinking water availability
2. Health and hygiene
3. Stress levels and coping mechanisms
4. Health intervention programmes
5. Horticulture
6. Herbal plants
7. Botanical survey
8. Zoological survey
9. Marine products
10. Aqua culture
11. Inland fisheries
12. Animals and species
13. Nutrition
14. Traditional health care methods
15. Food habits
16. Air pollution
17. Water pollution
18. Plantation
19. Soil protection
20. Renewable energy
21. Plant diseases
22. Yoga awareness and practice
23. Health care awareness programmes and their impact
24. Use of chemicals on fruits and vegetables
25. Organic farming
26. Crop rotation

27. Floury culture
28. Access to safe drinking water
29. Geographical survey
30. Geological survey
31. Sericulture
32. Study of species
33. Food adulteration
34. Incidence of Diabetes and other chronic diseases

35. Human genetics
36. Blood groups and blood levels
37. Internet Usage in Villages
38. Android Phone usage by different people
39. Utilisation of free electricity to farmers and related issues
40. Gender ration in schooling lvel- observation.

Complimenting the community service project the students may be involved to take up some awareness campaigns on social issues/special groups. The suggested list of programs

Programs for School Children

1. Reading Skill Program (Reading Competition)
2. Preparation of Study Materials for the next class.
3. Personality / Leadership Development
4. Career Guidance for X class students
5. Screening Documentary and other educational films
6. Awareness Program on Good Touch and Bad Touch (Sexual abuse)
7. Awareness Program on Socially relevant themes.

Programs for Women Empowerment

1. Government Guidelines and Policy Guidelines
2. Women's Rights
3. Domestic Violence
4. Prevention and Control of Cancer
5. Promotion of Social Entrepreneurship

General Camps

1. General Medical camps
2. Eye Camps
3. Dental Camps
4. Importance of protected drinking water
5. ODF awareness camp
6. Swatch Bharath
7. AIDS awareness camp
8. Anti Plastic Awareness
9. Programs on Environment
10. Health and Hygiene

11. Hand wash programmes
12. Commemoration and Celebration of important days

Programs for Youth Empowerment

1. Leadership
2. Anti-alcoholism and Drug addiction
3. Anti-tobacco
4. Awareness on Competitive Examinations
5. Personality Development

Common Programs

1. Awareness on RTI
2. Health intervention programmes

3. Yoga
4. Tree plantation
5. Programs in consonance with the Govt. Departments like –
   i. Agriculture
   ii. Health
   iii. Marketing and Cooperation
   iv. Animal Husbandry
   v. Horticulture
   vi. Fisheries
   vii. Sericulture
   viii. Revenue and Survey
   ix. Natural Disaster Management
   x. Irrigation
   xi. Law & Order
   xii. Excise and Prohibition
   xiii. Mines and Geology
   xiv. Energy

Role of Students:

- Students may not have the expertise to conduct all the programmes on their own. The students then can play a facilitator role.
- For conducting special camps like Health related, they will be coordinating with the Governmental agencies.
- As and when required the College faculty themselves act as Resource Persons.
- Students can work in close association with Non-Governmental Organizations like Lions Club, Rotary Club, etc or with any NGO actively working in that habitation.
- And also, with the Governmental Departments. If the program is rolled out, the District Administration could be roped in for the successful deployment of the program.
  An in-house training and induction program could be arranged for the faculty and participating students, to expose them to the methodology of Service Learning.

Timeline for the Community Service Project Activity	Duration: 8 weeks

1. **Preliminary Survey (One Week)**
   - A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.
   - A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.
   - The Governmental agencies, like revenue administration, corporation and municipal authorities and village secreteriats could be aligned for the survey.

2. **Community Awareness Campaigns (One Week)**

   - Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmesto be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.

3. **Community Immersion Programme (Three Weeks)**

Along with the Community Awareness Programmes, **the student batch can also work with any one of the below-listed governmental agencies and work in tandem with them. This community involvement programme will involve the students in exposing themselves to experiential learning about the community and its dynamics. Programs could be in consonance with the Govt. Departments.**

4. **Community Exit Report (One Week)**
   - During the last week of the Community Service Project, a detailed report of the outcome of the 8 weeks' works to be drafted and a copy shall be submitted to thelocal administration. This report will be a basis for the next batch of students visitingthat habitation. The same report submitted to the teacher-mentor will be evaluated bythe mentor and suitable marks are awarded for onward submission to the University. Throughout the Community Service Project, a daily logbook need to be maintained bythe students batch, which should be countersigned by the governmental agencyrepresentative and the teacher-mentor, who is required to periodically visit thestudents and guide them.