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
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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	23A0406T	Digital Logic and Computer Organization	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	23A0025T	Environmental Science	2	0	0	-
			Total	15	2	10	20

Semester-3 (Theory-5, Lab-2, SC-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
Audit Course(AC)	-
Total	20

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DISCRETE MATHEMATICS & GRAPH THEORY
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0015T	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:

- To introduce the concepts of mathematical logic
- To introduce the concepts of sets, relations, and functions.
- To perform the operations associated with sets, functions, and relations.
- To introduce generating functions and recurrence relations.
- To relate practical examples to the appropriate set, function, or relation model, and interpret the associated operations and terminology in context.
- To use Graph Theory for solving problems.

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 CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0021T	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	PCC

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 mutually enriching 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:

Textbook and Teachers Manual

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 Beautifu*l - 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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DIGITAL LOGIC & COMPUTER ORGANIZATION
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0406T	3:0:0:0	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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ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS						
(Common to CSE, AI&ML, DS, CS)						
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**	
23A0506T	**3:0:0:0**	**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 popularly used
- 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.
- Use various data structures in the design of algorithms.
- 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 (Common to CSE, AI&ML, DS, CS)					
Course Code	**L: T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0507T	**3:0:0:0**	**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. Abstract Class

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(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, 11thedition, 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:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0508P	**3:0:0:0**	**3**	**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, 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

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:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0509P	**3:0:0:0**	**3**	**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. Write a JAVA program to implement constructor.

9. Write a JAVA program to implement constructor overloading.

Week-6:
10. Write a JAVA program to implement Single Inheritance
11. Write a JAVA program to implement multi level Inheritance

Week-7:
12. Write a JAVA program for abstract class to find areas of different shapes
13. Write a JAVA program give example for "super" keyword.

Week-8:
14. Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?
15. Write a JAVA program that implements Runtime polymorphism

Week-9:
16. Write a JAVA program that describes exception handling mechanism
17. Write a JAVA program Illustrating Multiple catch clauses

Week-10:
18. Write a JAVA program for creation of Java Built-in Exceptions
19. Write a JAVA program for creation of User Defined Exception

Week-11:
20. Write 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. Write a program illustrating **is Alive** and **join** ()

Week-12:
22. Write a Program illustrating Daemon Threads.
23. Write a JAVA program Producer Consumer Problem

Week-13:
24. Write 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. Write a java program that connects to a database using JDBC

Week-15:
28. Write a java program to connect to a database using JDBC and insert values into it.
29. Write 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:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**	
23A0510P	**3:0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**PCC**	

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:
1. Write a program to find the largest element among three Numbers.
2. Write a Program to display all prime numbers within an interval

3. Write a 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
5. Write a program to add and multiply complex numbers
6. Write a 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:
   7. Write a program to define a function with multiple return values.
   8. Write a program to define a function using default arguments.
   9. Write a program to find the length of the string without using any library functions.
   10. Write a program to check if the substring is present in a given string or not.
   11. Write a program to perform the given operations on a list:
       i. Addition   ii. Insertion   iii. Slicing
   12. Write a 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:
   13. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
   14. Write a program to count the number of vowels in a string (No control flow allowed).
   15. Write a program to check if a given key exists in a dictionary or not.
   16. Write a program to add a new key-value pair to an existing dictionary.
   17. Write a 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:

18. Write a 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. Python program to print each line of a file in reverse order.
20. Python program to compute the number of characters, words and lines in a file.
21. Write a program to create, display, append, insert and reverse the order of the items in the array.
22. Write a program to add, transpose and multiply two matrices.
23. Write 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 in Python, NumPy with Python, Pandas

Sample Experiments:

24. Python program to check whether a JSON string contains complex object or not.
25. Python Program to demonstrate NumPy arrays creation using array ( ) function.
26. Python program to demonstrate use of ndim, shape, size, dtype.
27. Python program to demonstrate basic slicing, integer and Boolean indexing.
28. 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
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, 2^(nd)Edition, 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:S	Credits	Exam Marks	Exam Duration	Course Type
23A0025T	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	PCC

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

Course Outcomes(CO):

On completion of this course, student will be able to
- No Outcomes

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.