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

DEPARTMENT OF CSE (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE)
COURSE STRUCTURE – BR23 REGULATIONS
For UG - B.Tech: CSE (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE)
II Year Course Structure

Semester–I							
S.No.	Course Category	Course Code	Course Name	L	T	P	Credits
1.	BSC	23BS3T09	Discrete Mathematics & Graph Theory	3	0	0	3
2.	HSMC	23HM3T02	Universal human values – understanding harmony andEthical human conduct	2	1	0	3
3.	ESC	23ES3T10	Database Management Systems	3	0	0	3
4.	PCC	23CS3T02	Advanced Data Structures And Algorithm Analysis	3	0	0	3
5.	PCC	23CS3T03	Object Oriented Programming Through Java	3	0	0	3
6.	PCC	23CS3L02	Advanced Data Structures and Algorithm Analysis Lab	0	0	3	1.5
7.	PCC	23CS3L03	Object Oriented Programming Through Java Lab	0	0	3	1.5
5	SEC	23CS3S03	Python programming	0	1	2	2
9.	Audit Course	23AC3T01	Environmental Science	2	0	0	-
Total				**16**	**2**	**8**	**20**

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Andhra Pradesh, India

II Year – I Semester	Subject code: 23BS3T09	L	T	P	C
		3	0	0	3

DISCRETE MATHEMATICS AND GRAPH THEORY

(CSE, CSE-AIML, AIML, CSE-AI&DS and IT)

Course Objectives:

1. To introduce the students to the topics and techniques of discrete methods and combinatorial reasoning.
2. To introduce a wide variety of applications. The algorithmic approach to the solution of problems is fundamental in discrete mathematics, and this approach reinforces the close ties between this Discipline and the area of computer science.

Course Outcomes:

Students are able to

CO Number	Course Outcome	Blooms Level
CO1	Identify programming errors efficiently through enhanced logical capabilities.	BL2
CO2	Discover set theory, graph of the relations which are used in data structures.	BL2
CO3	Demonstrate knowledge of mathematical modeling and a general solution of recurrence equation.	BL4
CO4	Summarize the concepts in graph theory.	BL3
CO5	Develop graph theory concepts in core subjects such as data structures and network theory effectively.	BL3

A.D. Madhuri
(Chairman-BOS)

Dr. G.V.S.R. Deekshitulu
(University Nominee)

Dr. T.S.R. Murthy
(SubjectExpert)

Dr. U. VenuGopalam
(Subject Expert)

Mrs. M.B. Rajeswari
(Member, BOS)

UNIT–I:
Mathematical Logic:

Propositional Calculus: Statements and Notations, Connectives, Well Formed Formulas, Truth Tables, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Normal Forms, Theory of Inference for Statement Calculus, Consistency of Premises, Indirect Method of Proof, Predicate Calculus: Predicates, Predicative Logic, Statement Functions, Variables and Quantifiers.

UNIT-II:
Set Theory:

Sets: Operations on Sets, Principle of Inclusion-Exclusion, Relations: Properties, Operations, Partition and Covering, Transitive Closure, Equivalence, Compatibility and Partial Ordering, Hasse Diagrams,

Functions: Bijective, Composite, Inverse and Recursive Functions.

UNIT-III:
Combinatorics and Recurrence Relations:

Basics of Counting, Binomial and Multinomial Coefficients and Theorems (without proof)- Pigeonhole principle (without proof).

Recurrence Relations: Generating Functions, Partial Fractions, Calculating Coefficient of Generating Functions, Recurrence Relations, Formulation as Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, Method of Characteristic Roots, Solving Inhomogeneous Recurrence Relations

UNIT-IV:
Graph Theory:

Basic Concepts, Graph Theory and its Applications, Sub graphs,
Graph Representations: Adjacency and Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs.

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Unit-V:
Multi Graphs:

Multi graphs, Bipartite and Planar Graphs, Euler's Theorem (without proof), Graph Coloring and Covering, Chromatic Number, Spanning Trees, Prim's and Kruskal's Algorithms, BFS and DFS Spanning Trees.

Textbooks:

1. Discrete Mathematical Structures with Applications to Computer Science, **J. P.Tremblay** and **P. Manohar**, **Tata McGraw Hill**.
2. Elements of Discrete Mathematics-A Computer Oriented Approach, **C. L.Liu** and **D.P. Mohapatra, 3rd Edition, Tata McGraw Hill.**
3. Theory and Problems of Discrete Mathematics, Schaum's Outline Series, **SeymourLipschutz** and **Marc Lars Lipson**, **3rd Edition, McGraw Hill**.

Reference Books:

1. Elements of Discrete Mathematics-A Computer Oriented Approach, **C. L.Liu and D.P. Mohapatra, 3rd Edition, Tata McGraw Hill.**
2. Theory and Problems of Discrete Mathematics, Schaum's Outline Series, **Seymour Lipschutz and Marc Lars Lipson, 3rd Edition, McGraw Hill.**
3. Discrete Mathematical Structures, **Bernand Kolman, Robert C. Busby and Sharon Cutler Ross, PHI.**
4. Discrete Mathematics, **S.K. Chakraborthy and B.K. Sarkar, Oxford,2011.**

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II Year - I Semester	Code: 23HM3T02	L	T	P	C
		2	1	0	3

UNIVERSAL HUMAN VALUES-UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT
(Common to all)

Course Objectives:

The learning objectives of this course are 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 lifeand profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holisticperspective 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: Students are able to

CO Number	Course Outcome	Blooms Level
CO1	Define the terms like Natural Acceptance, Happiness and Prosperity	BL1,2
CO2	Identify one's self, and one's surroundings (family, society nature).	BL1,2
CO3	Apply what they have learnt to their own self in different day-to-day settings inreal life	BL3
CO4	Relate human values with human relationship and human society.	BL4
CO5	Justify the need for universal human values and harmonious existence	BL5
CO6	Develop as socially and ecologically responsible engineers	BL3,6

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(Subject Expert)

Dr. B.Charwak
(Subject Expert)

Mr. M.Raja
(Member)

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

UNIT I Introduction to Value Education (6 lectures and 3 tutorials for practicesession)

Lecture 1: Right Understanding, Relationship and Physical Facility (HolisticDevelopment 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

UNIT II Harmony in the Human Being (6 lectures and 3 tutorials for practice session)

Lecture 7: Understanding Human being as the Co-existence of the self and thebody.
Lecture 8: Distinguishing between the Needs of the self and the body
Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self andbody.
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 selfLecture 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

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UNIT I11

Harmony in the Family and Society (6 lectures and 3 tutorials for practicesession)

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 fulfil Human Goal

UNIT I V Harmony in the Nature/Existence (4 lectures and 2 tutorials for practicesession)

Lecture 19: Understanding Harmony in the Nature
Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment amongthe 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.

UNIT V Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)

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 andUniversal 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

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Practice Sessions for UNIT I – Introduction to Value EducationPS1 Sharing about Oneself

PS2 Exploring Human ConsciousnessPS3 Exploring Natural Acceptance

Practice Sessions for UNIT II – Harmony in the Human BeingPS4 Exploring the difference of Needs of self and body

PS5 Exploring Sources of Imagination in the selfPS6 Exploring Harmony of self with the body

Practice Sessions for UNIT III – Harmony in the Family and SocietyPS7 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 ProfessionalEthics

PS12 Exploring Ethical Human Conduct

PS13 Exploring Humanistic Models in Education

PS14 Exploring Steps of Transition towards Universal Human Order

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Text Books:

The Textbook

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

The Teacher's Manual

R R Gaur, R Asthana, G P Bagaria,*Teachers' Manual for A Foundation Course in Human Values andProfessional 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)

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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 elementsto 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 studentto 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 onbasic 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 essentia

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Online Resources:

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%2023.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

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II Year - I Semester	Code: 23ES3T10	L	T	P	C
		3	0	0	3

DATABASE MANAGEMENT SYSTEMS

Course Objectives:

The main objectives of the course is to

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

Course Outcomes:

CO Number	Course Outcome	Blooms Level
CO1	Students will be able to Populate and query a database using SQL DDL/DML Commands	BL3
CO2	Students will be able to Declare and enforce integrity constraints on a database	BL3
CO3	Students will be able to Writing Queries using advanced concepts of SQL	BL4
CO4	Students will be able to Programming PL/SQL including procedures, functions, cursors and triggers	BL3
CO5	Students will be able to Database connectivity- ODBC/JDBC	BL3

UNIT I: Introduction:

Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

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

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UNIT III

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.

UNIT IV

Schema Refinement (Normalization):
Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form(BCNF), MVD, Fourth normal form(4NF), Fifth Normal Form (5NF).

UNIT V

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-Resources:

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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II Year - I Semester	Code: 23CS3T02	L	T	P	C
		3	0	0	3

ADVANCED DATA STRUCTURES AND ALGORITHM ANALYSIS
(Common to CSE/IT/CSE(AI&DS)/CSE(AI&ML)/AIML)

Course Objectives:
The main objectives of the course is to
- provide knowledge on advance data structures frequently used in Computer Science domain
- Develop skills in algorithm design techniques popularly used
- Understand the use of various data structures in the algorithm design

Course Outcomes: Students are able to

CO Number	Course Outcome	Blooms Level
CO1	Analyze the time and space complexities of algorithms and perform the tree operations.	BL4
CO2	Understand the concepts of graphs and bi connected components.	BL2
CO3	Apply Greedy algorithm and Dynamic programming to schedule jobs efficiently	BL3
CO4	Solve 0/1 Knapsack problem using back tracking and graph coloring problems.	BL3
CO5	Formulate the problem of scheduling identical processors and NP hardness	BL6

UNIT I **10Hrs**
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

UNIT II **8Hrs**
Heap Trees (Priority Queues) – Min and Max Heaps, Operations and Applications, Graphs – Terminology, Representations, Basic Search and Traversals, Connected, Components and Biconnected Components, applications,

UNIT III **15Hrs**
Divide and Conquer: The General Method, Quick Sort, Merge Sort, Strassen's matrix multiplication, Convex Hull.
Greedy Method: General Method, Job Sequencing with deadlines, Knapsack Problem, Minimum cost spanning trees, Single Source Shortest Path.

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UNIT IV **12Hrs**

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.

Backtracking: General Method, 8-Queens Problem, Sum of Subsets problem, Graph Coloring, 0/1 Knapsack Problem.

UNIT V **15Hrs**

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

NP Hard and NP Complete Problems: Basic Concepts, Cook's theorem NP Hard Graph Problems: Clique Decision Problem (CDP), Chromatic Number Decision Problem (CNDP), Travelling 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, 2ndEdition Universities Press
2. Computer Algorithms in C++, Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, 2nd Edition University Press
3. Data Structers and alogrthims in C++: Adan,drozdek
4. Design and Anlysis of Computer Algorthims:AHO/ULLMAN
5. Fundamentals of Computer Algorthims: ELLIS HOROWITZ,SARTAJ SAHNI, RAJASEKHARAN

Reference Books:

1. Data Structures and program design in C, Robert Kruse, Pearson Education Asia
2. An introduction to Data Structures with applications, Trembley& Sorenson, McGraw Hill
3. The Art of Computer Programming, Vol.1: Fundamental Algorithms, Donald E Knuth, Addison-Wesley, 1997.
4. Data Structures using C & C++: Langsam, Augenstein &Tanenbaum, Pearson, 1995
5. Algorithms + Data Structures & Programs:, N.Wirth, PHI
6. Fundamentals of Data Structures in C++: Horowitz Sahni& Mehta, Galgottia Pub.
7. Data structures in Java:, Thomas Standish, Pearson Education Asia
8. Design and Analysis of Computer Algorithms, Aho Ullman.
9. Data Structures and Algorithms in C++, Adan, Drozedek

Online Learning Resources:

1. https://www.tutorialspoint.com/advanced_data_structures/index.asp
2. http://peterindia.net/Algorithms.html
3. Abdul Bari,Introduction to Algorithms (youtube.com)

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II Year - I Semester	Code: 23CS3T03	L	T	P	C
		3	0	0	3

OBJECT ORIENTED PROGRAMMING THROUGH JAVA
(Common to CSE/IT/CSE(AI&DS)/CSE(AI&ML)/AIML)

Course Objectives:
The learning objectives of this course are 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.
  Llearn 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: Students are able to

CO Number	Course Outcome	Blooms Level
CO1	Illustrate a primitive data types , operators and flow of control and how they work together in applications	BL3
CO2	Apply the concepts of object-oriented programming and class concepts.	BL3
CO3	Apply the concept of inheritance and Interfaces	BL3
CO4	Create a packages, files and Exception handling	BL6
CO5	Able to apply the concept of multithreading and JDBC	**BL3**

UNIT I

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, 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 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.

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UNIT II

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.

UNIT III

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: 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.

UNIT IV

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, Autoboxing 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.

Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Unchecked Exceptions, Checked Exceptions, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable.

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)

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II Year - I Semester	Code: 23CS3L02	L	T	P	C
		0	0	3	1.5

ADVANCED DATA STRUCTURES AND ALGORITHM ANALYSIS LAB
(Common to CSE/IT/CSE(AI&DS)/CSE(AI&ML)/AIML)

Course Objectives:
The objectives of the course is to
- acquire practical skills in constructing and managing Data structures
- apply the popular algorithm design methods in problem-solving scenarios

Course Outcomes: Students are able to

CO Number	Course Outcome	Blooms Level
CO1	Analyse AVL Trees and B-Tree	BL4
CO2	Apply algorithms of advance data structures used in heap tree, graph and divide and conquer	BL3
CO3	Apply greedy method techniques and shortest path algorithm	BL3
CO4	Implement to queens and 0/1 knapsack problems	BL3
CO5	Describe various branch and bound approaches	BL2

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:
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.
2. Construct B-Tree an order of 5 with a set of 100 random elements stored in array. Implement searching, insertion and deletion operations.
3. Construct Min and Max Heap using arrays, delete any element and display the content of the Heap.
4. Implement BFT and DFT for given graph, when graph is represented by
a) Adjacency Matrix b) Adjacency Lists
5. Write a program for finding the biconnected components in a given graph.

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6. Implement Quick sort and Merge sort and observe the execution time for various input sizes (Average, Worst and Best cases). 7. Compare the performance of Single Source Shortest Paths using Greedy method when the graph is represented by adjacency matrix and adjacency lists. 8. Implement Job Sequencing with deadlines using Greedy strategy. 9. Write a program to solve 0/1 Knapsack problem Using Dynamic Programming. 10. Implement N-Queens Problem Using Backtracking. 11. Use Backtracking strategy to solve 0/1 Knapsack problem. 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, Sartaj Sahni, Sanguthevar Rajasekaran, 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
Online Learning Resources: 1. http://cse01-iiith.vlabs.ac.in/ 2. http://peterindia.net/Algorithms.html 3. https://myacademy.oracle.com/ 4. https://gradwise.in/

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

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II Year – I Semester	Code: 23CS3L03	L	T	P	C
		0	0	3	1.5

OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB
(Common to CSE/IT/CSE(AI&DS)/CSE(AI&ML)/AIML)

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: Students are able to

CO Number	Course Outcome	Blooms Level
CO1	Illustrate a primitive data types , operators and flow of control and how they work together in applications	BL3
CO2	Apply the concepts of object-oriented programming and class concepts.	BL3
CO3	Apply the concept of inheritance and Interfaces	BL3
CO4	Create a packages, files and Exception handling	BL6
CO5	Able to apply the concept of multithreading and JDBC	**BL3**

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, Java FX GUI

Sample Experiments:
Exercise – 1:
a) Write a JAVA program to display default value of all primitive data type of JAVA
b) Write a java program that display the roots of a quadratic equation ax2+bx=0. Calculate the discriminate D and basing on value of D, describe the nature of root.

Exercise - 2
a) Write a JAVA program to search for an element in a given list of elements using binary search mechanism.
b) Write a JAVA program to sort for an element in a given list of elements using bubble sort
c) Write a JAVA program using String Buffer to delete, remove character.

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Exercise - 3 a) Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method. b) Write a JAVA program implement method overloading. c) Write a JAVA program to implement constructor. d)Write a JAVA program to implement constructor overloading.
Exercise - 4 a) Write a JAVA program to implement Single Inheritance b) Write a JAVA program to implement multi level Inheritance c) Write a JAVA program for abstract class to find areas of different shapes
Exercise - 5 a) Write a JAVA program give example for "super" keyword. b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved? c) Write a JAVA program that implements Runtime polymorphism
Exercise - 6 a) Write a JAVA program that describes exception handling mechanism b) Write a JAVA program Illustrating Multiple catch clauses c) Write a JAVA program for creation of Java Built-in Exceptions d) Write a JAVA program for creation of User Defined Exception
Exercise - 7 a) 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) b) Write a program illustrating is Alive and join () c) Write a Program illustrating Daemon Threads. d) Write a JAVA program Producer Consumer Problem
Exercise – 8 a) Write a JAVA program that import and use the user defined packages b) Without writing any code, build a GUI that display text in label and image in an Image View (use Java FX) c) Build a Tip Calculator app using several JavaFX components and learn how to respond to user interactions with the GUI

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Exercise – 9 a) Write a java program that connects to a database using JDBC b) Write a java program to connect to a database using JDBC and insert values into it. c) Write a java program to connect to a database using JDBC and delete values from it
Text Books: 1) JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford. 2) Joy with JAVA, Fundamentals of Object Oriented Programming, Debasis Samanta, Monalisa Sarma, 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
1) https://nptel.ac.in/courses/106/105/106105191/ 2)https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview 3. https://myacademy.oracle.com/ 4. https://gradwise.in/

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

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II Year - I Semester	Code: 23CS3S03	L	T	P	C
		0	1	2	2

PYTHON PROGRAMMING
(Common to CSE/IT/CSE(AI&DS)/CSE(AI&ML)/AIML)

Course Objectives:
The main objectives of the course are 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 Programming

and to create practical and contemporary applications using these

Course Outcomes: Students are able to

CO Number	Course Outcome	Blooms Level
CO1	Apply python programming concepts and the basic operations like operators and data types and control flow	BL3
CO2	Apply concepts of functions, string and create list and List Methods	BL3
CO3	Apply Python data structures like Lists, Tuples, Sets and dictionaries	BL3
CO4	Apply file Functions, array and matrices concepts	BL3
CO5	Apply concept of data science , functional programming and XML in python	BL3

UNIT I **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.

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UNIT II **9Hrs**

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:

1. Write a program to define a function with multiple return values.
2. Write a program to define a function using default arguments.
3. Write a program to find the length of the string without using any library functions.
4. Write a program to check if the substring is present in a given string or not.
5. Write a program to perform the given operations on a list:
i. addition ii. Insertion iii. slicing
6. Write a program to perform any 5 built-in functions by taking any list.

UNIT III **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:

1. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
2. Write a program to count the number of vowels in a string (No control flow allowed).
3. Write a program to check if a given key exists in a dictionary or not.
4. Write a program to add a new key-value pair to an existing dictionary.
5. Write a program to sum all the items in a given dictionary.

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UNIT IV **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: 1. 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. 2. Python program to print each line of a file in reverse order. 3. Python program to compute the number of characters, words and lines in a file. 4. Write a program to create, display, append, insert and reverse the order of the items in the array. 5. Write a program to add, transpose and multiply two matrices. 6. 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

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Regulation	BR23				
II Year I Semester	Course Code: 23AC3T01	L	T	P	C
		2	0	0	--
Course Title:	ENVIRONMENTAL SCIENCE				

Textbooks:

1. ErachBharucha,Text book of Environmental Studies for Undergraduate Courses,Universities Press (India) Private Limited, 2019.
2. Palaniswamy, Environmental Studies, 2/e, Pearson education, 2014.
3. S.AzeemUnnisa, Environmental Studies, Academic Publishing Company, 2021.
4. K.RaghavanNambiar, "Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", SciTech Publications (India), Pvt. Ltd, 2010.

Reference Books:

1. Deeksha Dave and E.Sai Baba Reddy, Textbook of Environmental Science, 2/e, Cengage Publications, 2012.
2. M.Anji Reddy, "Textbook of Environmental Sciences and Technology", BS Publication, 2014.
3. J.P. Sharma, Comprehensive Environmental studies, Laxmi publications, 2006.
4. J. Glynn Henry and Gary W. Heinke, Environmental Sciences and Engineering, Prentice Hall of India Private limited, 1988.
5. G.R. Chatwal, A Text Book of Environmental Studies, Himalaya Publishing House, 2018.
6. Gilbert M. Masters and Wendell P. Ela, Introduction to Environmental Engineering and Science, 1/e, Prentice Hall of India Private limited, 1991.

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc23_hs155/preview
- https://www.edx.org/learn/environmental-science/rice-university-ap-r-environmentalscience part-3-pollution-and-resources?index=product&objectID=course-3a6da9f2-d84c-4773-8388-1b2f8f6a75f2&webview=false&campaign=AP%C2%AE+Environmental+Science++Part+3%3A+Pollution+and+Resources&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fenvironmental-science
- http://ecoursesonline.iasri.res.in/Courses/Environmental%20Science-I/Data%20Files/pdf/lec07.pdfhttps://www.youtube.com/watch?v=5QxxaVfgQ3k

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				P.Rajesh	

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