

**SAGI RAMA KRISHNAM RAJU ENGINEERING COLLEGE
(AUTONOMOUS)**

(Approved by AICTE, New Delhi, Affiliated to JNTUK, Kakinada)

Accredited by NAAC with 'A+' Grade.

Recognised as Scientific and Industrial Research Organisation

SRKR MARG, CHINA AMIRAM, BHIMAVARAM – 534204 W.G.Dt., A.P., INDIA

Regulation: R23		II / IV - B.Tech. I - Semester							
ARTIFICIAL INTELLIGENCE & DATA SCIENCE									
COURSE STRUCTURE (With effect from 2023-24 admitted Batch onwards)									
Course Code	Course Name	Category	L	T	P	Cr	C.I.E.	S.E.E.	Total Marks
B23BS2101	Discrete Mathematics and Graph Theory	BS	3	0	0	3	30	70	100
B23HS2101	Universal Human Values -II : Understanding Harmony and Ethical Human Conduct	HS	2	1	0	3	30	70	100
B23IT2101	Database Management Systems	PC	3	0	0	3	30	70	100
B23IT2102	Object Oriented Programing through Java	PC	3	0	0	3	30	70	100
B23AD2101	Advanced Data Structures & Algorithm Analysis	PC	3	0	0	3	30	70	100
B23AD2102	Advanced Data Structures & Algorithms Lab	PC	0	0	3	1.5	30	70	100
B23IT2105	Object Oriented Programming through JAVA Lab	PC	0	0	3	1.5	30	70	100
B23IT2106	Python Programming	SEC	0	1	2	2	30	70	100
B23MC2101	English Proficiency	MC	2	0	0	-	30	-	30
TOTAL			16	2	8	20	270	560	830

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23BS2101	BS	3	--	--	3	30	70	3 Hrs.

DISCRETE MATHEMATICS AND GRAPH THEORY

(Common to CSE, CSBS, AIML, IT, AIDS, CSG, CIC, CSIT)

Course Objectives: Students are expected to

1. Understand the mathematical arguments using logical connectives and quantifiers and verify the validity of arguments using propositional, predicate logic and truth tables.
2. Understand various types of relations and discuss various properties of the relations
3. Know about the concepts of counting techniques and how to solve the recurrence relations.
4. Understand the concepts in graphs and trees.

Course Outcomes: At the end of the course, Students will be able to

S.No	Outcome	Knowledge Level
1.	Use the concepts of propositional and predicate logic to verify the arguments for their validity.	K3
2.	Apply the knowledge of set theory to understand relations, functions and their properties.	K3
3.	Solve different counting problems and recurrence relations.	K3
4.	Use the concepts of graphs and their representations.	K3
5.	Determine different multi graphs and tree structures.	K3

SYLLABUS

UNIT-I (10Hrs)	<p>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, Free and Bound Variables, Inference Theory for Predicate Calculus.</p>
UNIT-II (10 Hrs)	<p>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, Lattice and its Properties. Functions: Bijective, Composition, Inverse, Permutation, and Recursive Functions.</p>
UNIT-III (12Hrs)	<p>Combinatorics and Recurrence Relations: Basis of Counting, Permutations, Permutations with repetitions, Circular and Restricted Permutations, Combinations,</p>

	<p>Restricted Combinations, Binomial and Multinomial Coefficients and Theorems.</p> <p>Recurrence Relations: Generating Functions, Function of Sequences, 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</p>
UNIT-IV (10 Hrs)	Graph Theory: Basic Concepts, Graph Theory and its Applications, Subgraphs, Graph Representations: Adjacency and Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs.
UNIT-V (08Hrs)	Multi Graphs: Multi graphs, Bipartite and Planar Graphs, Euler's Theorem, Graph Coloring and Covering, Chromatic Number, Trees and their properties, Spanning Trees- BFS and DFS Spanning Trees, Prim's and Kruskal's Algorithms.
Textbooks:	
1.	Discrete Mathematical Structures with Applications to Computer Science, J. P. Tremblay and P. Manohar, Tata McGraw Hill.
2.	Discrete Mathematics for Computer Scientists and Mathematicians, J. L. Mott, A. Kandel and T. P. Baker, 2nd Edition, Prentice Hall of India.
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. Chakraborty and B.K. Sarkar, Oxford, 2011.
5.	Discrete Mathematics and its Applications with Combinatorics and Graph Theory, K. H. Rosen, 7th Edition, Tata McGraw Hill.
e-Resources :	
1.	https://nptel.ac.in/courses/106105192
2.	https://archive.nptel.ac.in/courses/111/106/111106102/

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23HS2101	HS	2	1	--	3	30	70	3 Hrs.

UNIVERSAL HUMAN VALUES-II: UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT

(Common to all Programmes of Engineering)

Course Objectives: The objective of this course is to make the student aware of

1	Essential complementarity between 'Values' and 'Skills' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2	Harmony in the human being, family, society and nature/existence
3	Holistic perspective towards life, profession and happiness

Course Outcomes: At the end of this course student will be able to

S. No.	Outcome	Knowledge Level
1	Explain the role of value education in achieving basic human aspirations.	K2
2	Summarize needs to obtain harmony in self(I).	K2
3	Describe criteria for human-human relationship and harmony in society	K2
4	Explain four orders of nature and our existence	K2
5	Interpret significance of harmony in holistic development	K2

SYLLABUS

UNIT-I (9 Hrs)	<p>Introduction to Value Education: Understanding Value Education- Need, Basic Guidelines, Content and Process for Value Education Purpose and motivation for the course. Self-exploration as the Process for Value Education - Sharing about Oneself. Myers-Briggs Type Indicator (MBTI) Personality Test. Continuous Happiness and Prosperity – the Basic Human Aspirations and their Fulfilment. Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) - Exploring Human Consciousness. Happiness and Prosperity – Current Scenario. Method to Fulfil the Basic Human Aspirations - Exploring Natural Acceptance-understanding and living in harmony at various levels.</p>
UNIT-II (9 Hrs)	<p>Harmony in the Human Being: Understanding Human being as the Co-existence of the Self and the Body. Distinguishing between the Needs of the Self and the Body - Exploring the difference of Needs of Self (I) and Body (Happiness and Physical Facility). The Body as an Instrument of the Self (I)' (I being the doer, seer and enjoyer).</p>

	<p>Understanding Harmony in the Self(I) - Exploring Sources of Imagination in the Self(I). Harmony of the Self (I) with the Body (characteristics and activities of 'I' and harmony in 'I').</p> <p>Programme to ensure self-regulation(<i>Sanyam</i>) and Health(<i>Swasth</i>)- Exploring Harmony of Self (I) with the Body.</p>
UNIT-III (9 Hrs)	<p>Harmony in the Family and Society:</p> <p>Harmony in the Family – the Basic Unit of Human Interaction.</p> <p>'Trust' – the Foundational Value in Relationship- Exploring the Feeling of Trust- intention and competence.</p> <p>'Respect' – as the Right Evaluation- Exploring the Feeling of Respect.</p> <p>Other Feelings, Justice in Human-to-Human Relationship.</p> <p>Understanding Harmony in the Society- (society being an extension of family).</p> <p>Vision for the Universal Human Order- Exploring Systems to fulfil Human Goal.</p>
UNIT-IV (6 Hrs)	<p>Harmony in the Nature/Existence:</p> <p>Understanding the harmony in the Nature.</p> <p>Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature.</p> <p>Realizing Existence as Co-existence at All Levels - Understanding Existence as Co-existence of mutually interacting units in all pervasive space.</p> <p>Holistic perception of harmony at all levels of existence.</p>
UNIT-V (9 Hrs)	<p>Implications of the Holistic Understanding – a Look at Professional Ethics:</p> <p>Natural acceptance of human values. Definitiveness of (ethical) human conduct.</p> <p>A Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order.</p> <p>Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.</p> <p>Holistic technologies, production systems and management models- typical case studies.</p> <p>Strategies for transition towards value based life and profession (from the present state to Universal Human Order): a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers, b. At the level of society: as mutually enriching institutions and organizations.</p>
Text Books	
1.	R R Gaur, R Sangal, G P Bagaria. "Human Values and Professional Ethics", Excel Books, New Delhi, 2010
2.	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.	Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2.	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3.	The Story of Stuff (Book).
4.	The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
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 – Pandit Sunderlal
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)
e-Resources	
1.	https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf
2.	https://fdp-si.aicte-india.org/UHV-II%20Class%20Note.php
3.	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



ENGINEERING COLLEGE
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Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23IT2101	PC	3	0	0	3	30	70	3 Hrs.
DATABASE MANAGEMENT SYSTEMS								
(Common to IT, AIDS and CSBS)								
Course Objectives: The main objective of the course is to								
1.	Introduce database management systems and to give a good formal foundation on the relational model of data and usage of Relational Algebra.							
2.	Introduce the concepts of SQL as a universal Database language.							
3.	Demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization							
4.	Provide an overview of physical design of a database system, by discussing Database indexing techniques and storage techniques							
Course Outcomes: After completion of the course, the student will be able to								
S. No	Outcome							Knowledge Level
1.	Describe database fundamental concepts.							K2
2.	Apply E-R and Relational models for creating databases.							K3
3.	Apply SQL features to create, manipulate and retrieve databases.							K3
4.	Apply normalization concepts to refine relational databases.							K3
5.	Illustrate transaction management concepts.							K2
6.	Apply indexing concepts for searching databases.							K3
SYLLABUS								
UNIT-I (10 Hrs)	<p>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.</p> <p>Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.</p>							
UNIT-II (08 Hrs)	<p>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.</p> <p>BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).</p>							

UNIT-III (10 Hrs)	Structured Query Language: Basic SQL Querying Using Select and Where clauses, Arithmetic & Logical Operations, SQL Functions (Date and Time, Numeric to String Conversion). Creating Tables with Relationship, Implementation of Key and Other Integrity Constraints, Set Operations, Nested Queries, Sub Queries, Grouping, Aggregation, Ordering, Implementation of Various Types of Joins, Views (Updatable and Non-Updatable), relational set operations. [CO3, K3]
UNIT-IV (10 Hrs)	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), Multi Valued Dependencies, Fourth Normal Form(4NF), Fifth Normal Form (5NF). [CO4, K3]
UNIT-V (12 Hrs.)	Transaction Management: 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. [CO5, K2] Introduction to Indexing Techniques: B+ Trees, Operations on B+ Trees, Hash Based Indexing: [CO6, K3]
Text Books:	
1.	Database Management Systems, 3rd edition, Raghurama Krishnan, Johannes Gehrke, TMH.
2.	Database System Concepts, 5th edition, Silberschatz, Korth, Sudarsan, TMH.
Reference Books:	
1.	Introduction to Database Systems, 8th edition, C J Date, Pearson.
2.	Database Management System, 6th edition, Ramez Elmasri, Shamkant B. Navathe, Pearson
3.	Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.
e-Resources	
1.	https://nptel.ac.in/courses/106/105/106105175/
2.	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275806667282022456_shared/overview

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23IT2102	PC	3	--	--	3	30	70	3 Hrs.

OBJECT ORIENTED PROGRAMMING THROUGH JAVA

(Common to IT, AIDS and CSBS)

Course Objectives: Students are expected to

1.	To identify Java language components and how they work together in applications.
2.	To learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
3.	To learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications.
4.	To understand how to design applications with threads in Java.
5.	To understand how to use Java APIs for program development.

Course Outcomes: By the end of the course, the student will be able to:

S.No	Outcome	Knowledge Level
1.	Develop simple Java programs that incorporate fundamental programming elements.	K3
2.	Apply the concepts of Object-Oriented Programming such as classes and objects to design java programs	K3
3.	Apply the concepts of inheritance and interfaces to achieve multiple inheritance	K3
4.	Apply the concepts of multithreading and exceptions to design multithreaded error free programs	K3
5.	Model event driven GUI applications which connect with databases.	K4

SYLLABUS

UNIT-I (10Hrs)	<p>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.</p> <p>Input/Output operations: Reading input from console (Scanner).</p> <p>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.</p> <p>Control Statements: Introduction, if Expression, Nested if Expressions, if-else Expressions, Ternary Operator, Switch Statement, Iteration Statements, while Expression,</p>
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	do- while Loop, for Loop, Nested for Loop, For-Each for Loop, Break Statement, Continue Statement.
UNIT-II (10 Hrs)	<p>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, Final Class and Methods, Passing Arguments by Value and by Reference, Usage of keyword this.</p> <p>Wrapper classes: Auto boxing and unboxing.</p> <p>Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Attributes Final and Static.</p>
UNIT-III (10 Hrs)	<p>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 and lists.</p> <p>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.</p> <p>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.</p>
UNIT-IV (10 Hrs)	<p>Packages: Introduction, Defining Package, Importing Packages and Classes into Programs, Access Control, adding a public class and non-public class to an existing user defined package, adding an interface to a user defined package, Different ways of importing packages.</p> <p>Exception Handling: Introduction, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Custom Exceptions, Nested try and catch Blocks.</p> <p>Multithreaded Programming: Introduction, Thread Class, Main Thread- Creation of New Threads, Thread States, Runnable Interface, Thread Priority-Synchronization.</p> <p>Java I/O and File: Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java</p>
UNIT-V (10 Hrs)	<p>String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer. Java Database Connectivity: Introduction, JDBC Architecture, Installing MySQL and MySQL Connector/J, JDBC Environment Setup, Establishing JDBC</p>

	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.
Textbooks:	
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, 4 th Edition, Pearson
Reference Books:	
1.	The complete Reference Java, 11th edition, Herbert Schildt, TMH
2.	Murach's Java Programming, Joel Murach
e-Resources	
1.	https://nptel.ac.in/courses/106/105/106105191/
2.	https://www.geeksforgeeks.org/java/



Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD2101	PC	3	--	--	3	30	70	3 Hrs.
ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS								
(For AI & DS)								
Course Objectives: The major objective of this course is to								
1.	Provide knowledge on advance data structures frequently used in Computer Science domain							
2.	Develop skills in algorithm design techniques popularly used							
3.	Understand the use of various data structures in the algorithm design							
Course Outcomes: After completion of the course student will be able to								
S.No	Outcome							Knowledge Level
1.	Apply non-linear data structures for solving a given problem.							K3
2.	Apply divide and conquer technique to solve problems and calculate time complexity.							K3
3.	Apply different design technique algorithms like greedy, dynamic programming, backtracking and branch and bound for solving problems.							K3
4.	Apply the knowledge of complexity classes P, NP and NP-Complete for solving graph and Scheduling problems							K3
SYLLABUS								
UNIT-I (10Hrs)	AVL Trees – Creation, Insertion, Deletion operations and Applications B-Trees – Creation, Insertion, Deletion operations and Applications Heap Trees (Priority Queues) – Min and Max Heaps, Operations and Applications							
UNIT-II (10 Hrs)	Graphs – Terminology, Representations, Basic Search and Traversals, Connected Components and Biconnected Components, applications Introduction to Algorithm Analysis, Space and Time Complexity analysis, Asymptotic Notations. Divide and Conquer: The General Method, Quick Sort, Merge Sort, Strassen’s matrix multiplication, Convex Hull							
UNIT-III (10 Hrs)	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							

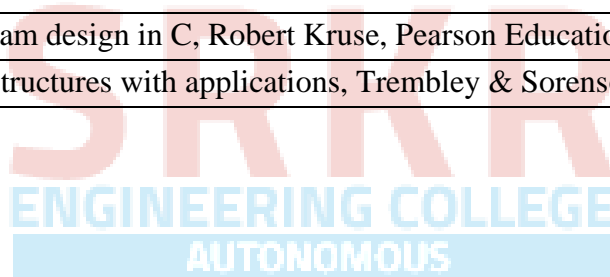
UNIT-IV (10 Hrs)	Backtracking: General Method, 8-Queens Problem, Sum of Subsets problem, Graph Coloring, 0/1 Knapsack Problem Branch and Bound: The General Method, 0/1 Knapsack Problem, Travelling Salesperson problem
UNIT-V (10 Hrs)	NP Hard and NP Complete Problems: Basic Concepts, Cook's theorem NP 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
Textbooks:	
1.	Fundamentals of Data Structures in C++, Horowitz, Ellis; Sahni, Sartaj; Mehta, Dinesh, 2nd Edition Universities Press
2.	Computer Algorithms in C++, Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, 2nd Edition University Press
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
e-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)

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD2102	PC	--	--	3	1.5	30	70	3 Hrs.
ADVANCED DATA STRUCTURES & ALGORITHMS LAB								
(For AI & DS)								
Course Objectives: Students are expected to								
1.	Acquire practical skills in constructing and managing Data structures							
2.	Apply the popular algorithm design methods in problem-solving scenarios							
Course Outcomes: After successful completion of this course, the students should be able to								
S.No	Outcome							Knowledge Level
1.	Apply Linear data structures for solving any given problem.							K3
2.	Apply Non-Linear data structures for solving any given problem.							K3
3.	Apply greedy method for solving Job sequencing and Single source shortest path problems.							K3
4.	Use dynamic programming, Backtracking and branch and bound for solving given problems.							K3
Experiments covering the Topics:								
<ul style="list-style-type: none"> • 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 								
SYLLABUS								
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.
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 Salesperson problem using Branch and Bound approach.

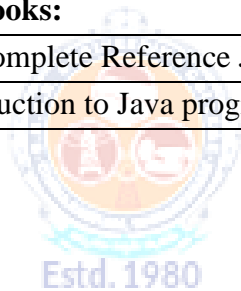
Reference Books:

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



Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23IT2105	PC	--	--	3	1.5	30	70	3 Hrs.
OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB								
(Common to IT, AIDS, and CSBS)								
Course Objectives: The major objective of this course is to								
1.	Practice object-oriented programming in the Java programming language.							
2.	Implement Classes, Objects, Methods, Inheritance, Exception, Runtime Polymorphism, User defined Exception handling mechanism.							
3.	Illustrate inheritance, Exception handling mechanism, JDBC connectivity.							
4.	Construct Threads, Event Handling, implement packages, Java FX GUI.							
Course Outcomes: By the end of the course, the student will be able to								
S.No	Outcome							Knowledge Level
1.	Apply control statements, operators, strings and arrays to design java programs							K3
2.	Apply Object Oriented Programming concepts to design java programs							K3
3.	Design multithreaded and error free java programs by applying the concepts of Exception Handling and Multithreading							K4
4.	Design interactive GUI programs by applying the concepts of JAVAFX and JDBC							K4
SYLLABUS								
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 $ax^2+bx=0$. Calculate the discriminate D and basing on value of D, describe the nature of root.							
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 StringBuffer to delete, remove character.							
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 implements method overloading. c) Write a JAVA program to implement constructor. d) Write a JAVA program to implement constructor overloading.							
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							
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							

6	<p>a) Write a JAVA program that describes exception handling mechanism</p> <p>b) Write a JAVA program Illustrating Multiple catch clauses</p> <p>c) Write a JAVA program for creation of Java Built-in Exceptions</p> <p>d) Write a JAVA program for creation of User Defined Exception</p>
7	<p>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)</p> <p>b) Write a program illustrating is Alive and join ()</p> <p>c) Write a Program illustrating Daemon Threads.</p>
8	<p>a) Write a JAVA program that import and use the user defined packages</p> <p>b) Without writing any code, build a GUI that display text in label and image in an Image View (use JavaFX)</p> <p>c) Build a Tip Calculator app using several JavaFX components and learn how to respond to user interactions with the GUI</p>
9	<p>a) Write a java program that connects to a database using JDBC</p> <p>b) Write a java program to connect to a database using JDBC and insert values into it.</p> <p>c) Write a java program to connect to a database using JDBC and delete values from it</p>
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Reference Books:	
1	The complete Reference Java, 11th edition, Herbert Schildt, TMH
2	Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson



Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
23BIT2106	SEC	--	1	2	2	30	70	3 Hrs.

PYTHON PROGRAMMING
(Common to AIDS, IT & CSBS)

Course Objectives: The major objective of this course is to

1	Introduce core programming concepts of Python programming language
2	Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
3	Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications using these

Course Outcomes: After completion of the course student will be able to

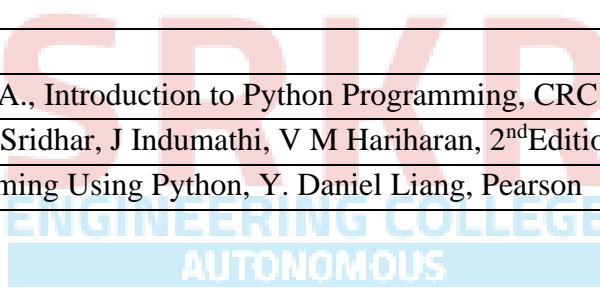
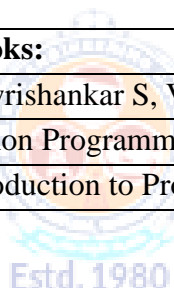
S.No	Outcome	Knowledge Level
1	Demonstrate Basic Python Programming Concepts for solving problems	K3
2	Analyze Python Functions and Modules for real time applications	K4
3	Evaluate data collection concepts on Data Handling.	K4
4	Make use of NumPy, Pandas for data preprocessing.	K3

SYLLABUS

Unit-I	<p>History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.</p> <p>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.</p> <p>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.</p>
	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

Unit-II	<p>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.</p> <p>Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.</p> <p>Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement</p>
	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.
Unit-III	<p>Dictionaries: Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.</p> <p>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.</p>
	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
Unit-IV	<p>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.</p> <p>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.</p>
	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.

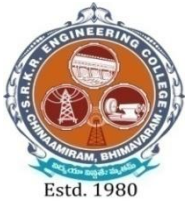
23	Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.
Unit-V	Introduction to Data Science: Functional Programming, JSON and XML in Python, NumPy with Python, 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
Reference Books:	
1	Gowrishankar S, Veena A., Introduction to Python Programming, CRC Press.
2	Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2 nd Edition, Pearson, 2024
3	Introduction to Programming Using Python, Y. Daniel Liang, Pearson



Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23MC2101	MC	2	--	--	--	30	--	--
ENGLISH PROFICIENCY								
(Common to ME, IT, CSIT, AIDS& AIML)								
Course Outcomes: After completion of this course, students will be able to								
S.No	Outcome							Knowledge Level
1.	Interpret IELTS & TOEFL listening comprehension texts.							K2
2.	Demonstrate essential speaking skills in academic, professional, and real-life contexts.							K2
3.	Interpret the written discourse by applying effective reading strategies.							K2
4.	Construct coherent and cohesive paragraphs, e-mails, letters, and essays.							K3
SYLLABUS								
UNIT-I	Listening Skills Listening as a receptive skill Listening skills for IELTS, TOEFL, Duolingo, PTE, and other competitive examinations.							
UNIT-II	Speaking Skills JAM/ Extempore Debate / Group Discussion Presentation Skills							
UNIT-III	Reading Skills Types of Reading(Intensive and Extensive Reading, Skimming, Scanning) Reading/Summarizing News Paper Articles							
UNIT-IV	Writing Skills Essay Writing(Argumentative, Analytical and Descriptive essays for GRE, TOEFL & IELTS) E-Mail / Letter Writing Resume Writing							
UNIT-V	Integrated Language Skills Listening Skills for Speaking and Writing Reading Skills for Writing and Speaking							
Text Books:								
1.	Interchange (5 th edition) by Jack C.Richards, CUP, 2017.							
Reference Books:								
1.	Fundamentals of Technical Communication (1 st edition) by Meenakshi Raman, Sangeeta Sharma							

	of OUP, 2014.
2.	The Oxford Guide to Writing and Speaking (3 rd edition) by John Seely OUP, 2013.
3.	Effective Technical Communication (2 nd edition) by M. Ashraf Rizwi. TataMcGrawhill, 2017.
e-Resources:	
1	BBC Learning English - Learn English with BBC Learning English - Homepage
2	Grammar Learn English (britishcouncil.org)
3	Duolingo English Test
4	IELTS Test Preparation Materials - Videos, Practice tests, Articles and More (idp.com)





**SAGI RAMA KRISHNAM RAJU ENGINEERING COLLEGE
(AUTONOMOUS)**

(Approved by AICTE, New Delhi, Affiliated to JNTUK, Kakinada)

Accredited by NAAC with 'A+' Grade.

Recognised as Scientific and Industrial Research Organisation

SRKR MARG, CHINA AMIRAM, BHIMAVARAM – 534204 W.G.Dt., A.P., INDIA

Regulation: R23		II / IV - B.Tech. II - Semester							
ARTIFICIAL INTELLIGENCE & DATA SCIENCE									
COURSE STRUCTURE									
(With effect from 2023-24 admitted Batch onwards)									
Course Code	Course Name	Category	L	T	P	Cr	C.I.E.	S.E.E.	Total Marks
B23HS2201	Managerial Economics and Financial Analysis	HS	2	0	0	2	30	70	100
B23BS2202	Statistical methods for Data science	ES	3	0	0	3	30	70	100
B23AD2201	Introduction to Data Science	PC	3	0	0	3	30	70	100
B23AD2202	Artificial Intelligence	PC	3	0	0	3	30	70	100
B23AD2203	Computer Organization	ES	3	0	0	3	30	70	100
B23AD2204	Artificial Intelligence Lab	PC	0	0	3	1.5	30	70	100
B23AD2205	Data Science using Python Lab	PC	0	0	3	1.5	30	70	100
B23AD2206	Full Stack Development-1	SEC	0	1	2	2	30	70	100
B23AD2207	Design Thinking & Innovation	ES	1	0	2	2	30	70	100
B23MC2202	Environmental Science	MC	2	0	0	-	30	-	30
TOTAL			17	1	10	21	300	630	930

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23HS2201	HS	2	--	--	2	30	70	3Hrs.
MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS								
(Common to AIDS, CSE, CIC, CSG, CSIT, CE, ECE, EEE, ME)								
Course Objectives: Students are expected to								
1.	Understand the concept and nature of Managerial Economics, its relationship with other disciplines, the Concept of Demand and Demand forecasting							
2.	Familiarize about the Concepts of Cost and Break-Even Analysis							
3.	Learn about accounting cycle and preparation of Financial Statements							
4.	Understand the nature of markets and the Pricing Methods							
5.	Know the concept of Capital, Sources of Raising Finance and Depreciation							
Course Outcomes: At the end of the course the student will be able to								
S.No	Outcome							Knowledge Level
1.	Interpreting the importance of Managerial Economics, demand analysis and methods of demand forecasting							K2
2.	Describe about the usefulness of Cost Analysis and Break Even Analysis							K2
3.	Apply the principles of accounting to convert the transactions and events into Journal, Ledger and Trail balance							K3
4.	Compute the results of Business by preparing Final Accounts							K3
5.	Illustrate the nature of markets and pricing theories							K2
6.	Explain the Types of capital, their sources and importance & estimation of Depreciation							K2
SYLLABUS								
UNIT-I (12 Hrs)	Introduction to Managerial Economics and demand Analysis: Managerial Economics: Definition of Economics & Classification of Economics (Micro & Macro), Meaning, Nature, & Scope of Managerial Economics. Demand Analysis: Concept of Demand, Determinants of Demand, Demand schedule, Demand curve, Law of Demand and its exceptions. Elasticity of Demand, Types of Elasticity of Demand. Importance of Demand Forecasting and its Methods.							
UNIT-II (8 Hrs)	Cost Analysis: Importance of cost analysis, Types of Cost- Actual cost Vs Opportunity cost, Fixed cost Vs Variable cost, Explicit Vs Implicit cost, Historical cost Vs Replacement cost, Incremental cost Vs Sunk cost; Elements of costs – Material, Labour, Expenses; Methods of costing - Job costing, contract costing, Process costing, Batch costing, Unit costing, Service costing, Multiple costing. Break-even analysis: Determination of Break-even Point Applications, Assumptions and Limitations of Break-even analysis (Theory							

	only).
UNIT-III (12 Hrs)	Introduction to Financial Accounting: Importance of Accounting - Double Entry System of Accounting - Types of Accounts - Journal, Ledger, Trail Balance, Trading Account, Profit and Loss Account and Balance Sheet (Final Accounts with Simple adjustments).
UNIT-IV (8 Hrs)	Introduction to Markets & Pricing Policies Market Structures: Salient Features of Perfect Competition, Monopoly, Monopolistic competition, Oligopoly and Duopoly. Pricing: Importance of pricing and its meaning; Methods of Pricing: Cost Based -Full cost, Mark-up, Marginal & Break-even; Demand Based -Penetrating, Skimming; Competition Based -Going rate, Sealed Bid, Discount; Internet Pricing -Flat-rate, Usage sensitive.
UNIT-V (8 Hrs)	Capital & Depreciation: Types of Capital-Fixed capital & Working Capital, Components of Working Capital, Factors influencing Working capital. Methods of Raising Finance - Short term, Medium term and Long term. Depreciation – Meaning, Importance and causes of depreciation; Methods of Depreciation-Straight line and Diminishing Balancing methods (Theory only).
Text Books:	
1.	AR Aryasri, Managerial Economics and Financial Analysis, TMH Pvt. Ltd, New Delhi
2.	Dr. N. Appa Rao, Dr. P. Vijaya kumar: Managerial Economics and Financial Analysis, Cengage Publications, NewDelhi
Reference Books:	
1.	Dr.B.Kuberudu & T.V.Ramana :Managerial Economics and Financial anaysis, Himalaya Publishing House
2.	Varshney R.L, K.L Maheswari, Managerial Economics, S. Chand & Company Ltd,
3.	Shashi K.Gupta & R.K.Sharma Management Accounting, Kalyani Publishers
4.	Maheswari S.N, An Introduction to Accountancy, Vikas Publishing House Pvt Ltd

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23BS2202	ES	3	0	0	3	30	70	3 Hrs.

STATISTICAL METHODS FOR DATA SCIENCE

(For AI & DS)

Course Objectives: Students are expected to

1. Analyze the data visualization techniques and probability distributions
2. Know about the parametric estimation and testing the hypothesis
3. Learn the linear, multiple and logistic regression techniques
4. Understand the various time series methods

Course Outcomes: Upon the completion of this course, Students will be able to

S.No	Outcome	Knowledge Level
1.	Apply the techniques of data visualization and interpret few probability distributions.	K3
2.	Compute the confidence interval and choose a test-statistic for testing the parameters of the population	K3
3.	Determine regression lines and model a best suitable curve for a given data using method of least squares	K3
4.	Find various time series methods and apply in different fields	K3
5.	Compute the logistic regression setup and interpret the results	K3

SYLLABUS

UNIT-I (10Hrs)	<p>Data Visualization and Distributions: Data Visualization Techniques: Introduction to Statistical methods- Exploratory Data Analysis- Charts (Line, Pie, Bar); Plots (Bubble, Scatter); Maps (Heat, Dot Distribution); Diagrams (Trees and Matrices)-Principal Components Analysis. Introduction to Data Distributions - Probability Distributions–Discrete (Binomial, Poisson), Continuous Distributions (Normal, Exponential).</p>
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UNIT-II (10 Hrs)	<p>Hypothesis Testing Introduction to Parametric Estimation-Point and Interval Estimation, Interval Estimation for t, F and χ^2 distributions. Hypothesis Testing –Formulation of Null and Alternative Hypothesis–Errors in Sampling- Type I and Type II Errors- Standard Error-Level of Significance-One tail and two-tailed tests Choosing a Statistic-Parametric test: t-test for single and difference of Means –Pair wise comparisons.</p>
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UNIT-III (10 Hrs)	Linear Regression and Multiple Regression Regression: Definition-Lines of Regression-Regression Coefficients-Linear Regression, Polynomial Regression: Fitting of a Straight Line-Fitting of a Parabola- Curvilinear Regression: Fitting of an Exponential Curves: $y = ae^{bx}$, $y = ab^x$ and power curve $y = ax^b$. Practical Examples - The nature of the 'relationship' - Multiple Linear Regression - Important measurements of the regression estimate - Multiple Regression with Categorical Explanatory Variables - Inference in Multiple Regression - Variable Selection.
UNIT-IV (10 Hrs)	Time Series Time Series: Significance of Time Series, Components of Time Series Analysis: Trend, Seasonality, Cyclical, Irregularity, Stationary TS, Non- Stationary TS. Methods to Check Stationarity: Augmented Dickey-Fuller (ADF) Test or Unit Root Test, Kwiatkowski-Phillips- Schmidt-Shin (KPSS) Test; Converting Non-Stationary Into Stationary: Detrending, Differencing, Transformation; Time Series: The Moving Average (MA) (or) Rolling Mean: Simple Moving Average (SMA), Cumulative Moving Average (CMA), Exponential Moving Average (EMA), Auto-Correlation Function (ACF), Partial Auto-Correlation (PACF).
UNIT-V (10 Hrs)	Logistic Regression The classification problem - Logistic Regression Setup - Interpreting the Results - Comparing Models - Classification Using Logistic Regression.
Textbooks:	
1.	Elizabeth Purdom, "Statistical methods for Data science"
2.	S. C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.
Reference Books:	
1.	Manoj Kumar Srivastava and Namita Srivastava, Statistical Inference – Testing of Hypotheses, Prentice Hall of India, 2014.
2.	Robert V Hogg, Elliot A Tannis and Dale L. Zimmerman, Probability and Statistical Inference, 9 th edition, Pearson publishers, 2013.
3.	Applied Statistics for Engineers and Scientists, by Joseph Petrucci, Balgobin Nandram, and Minghui Chen
4.	Probability and Statistics for Data Science by Carlos Fernandez-Granda
5.	An Introduction to Mathematical Statistics and its Applications by Larsen & Marx. Pearson.
e-Resources	
1.	epurdom.github.io/Stat131A/Rsupport/index.html .
2.	https://archive.nptel.ac.in/courses/111/105/111105077/

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD2201	PC	3	--	--	3	30	70	3 Hrs.

INTRODUCTION TO DATA SCIENCE

(For AI&DS)

Course Objectives:

1.	Knowledge and expertise to become a data scientist.
2.	Essential concepts of statistics and machine learning that are vital for data science.
3.	Significance of exploratory data analysis (EDA) in data science.
4.	Critically evaluate data visualizations presented on the dashboards.
5.	Suitability and limitations of tools and techniques related to data science process.

Course Outcomes: By the end of the course, student will be able to

S.No	Outcome	Knowledge Level
1.	Describe the knowledge on concepts of data science.	K2
2.	Demonstrate the level of machine learning in Data science.	K2
3.	Apply the concept of databases on Data Science.	K3
4.	Analyze data visualization tools.	K4

SYLLABUS

UNIT-I (10Hrs)	<p>Introduction to Data science, benefits and uses, facets of data, data science process in brief, big data ecosystem and data science</p> <p>Data Science process: Overview, defining goals and creating project charter, retrieving data, cleansing, integrating and transforming data, exploratory analysis, model building, presenting findings and building applications on top of them.</p>
UNIT-II (10 Hrs)	<p>Machine learning in Data science: Applications of machine learning in Data science, role of ML in DS, Python tools like sklearn, modelling process for feature engineering, model selection, validation and prediction, types of ML, semi-supervised learning.</p>
UNIT-III (10 Hrs)	<p>NoSQL movement for handling Bigdata: Distributing data storage and processing with Hadoop framework, case study on risk assessment for loan sanctioning, ACID principle of relational databases, CAP theorem, base principle of NoSQL databases, types of NoSQL databases.</p>
UNIT-IV (10 Hrs)	<p>Tools and Applications of Data Science: Introducing Neo4j for dealing with graph databases, graph query language Cypher, Applications graph databases, Python</p>

	libraries like nltk and SQLite for handling Text mining and analytics, case study on classifying Reddit posts
UNIT-V (10 Hrs)	Data Visualization and Prototype Application Development: Data Visualization options using seaborn and matplotlib Libraries, Cross filter. Applying the Data Science process for real world problem solving scenarios as a detailed case study.
Textbooks:	
1.	Davy Cielen, Arno D.B.Meysman, and Mohamed Ali, “Introducing to Data Science using Python tools”, Manning Publications Co, Dreamtech press, 2016 .
2.	Prateek Gupta, “Data Science with Jupyter” BPB publishers, 2019 for basics .
Reference Books:	
1.	Joel Grus, “Data Science From Scratch”, OReilly, 2019
2.	Doing Data Science: Straight Talk From The Frontline, 1 st Edition, Cathy O’Neil and Rachel Schutt, O’Reilly, 2013 .
e-Resources	
1.	https://swayam.gov.in/nd1_noc19_cs60/preview
2.	https://towardsdatascience.com/



Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD2202	PC	3	--	--	3	30	70	3 Hrs.
ARTIFICIAL INTELLIGENCE								
(For AIDS)								
Course Objectives:								
1	The student should be made to study the concepts of Artificial Intelligence.							
2	The student should be made to learn the methods of solving problems using Artificial Intelligence.							
3	The student should be made to study the concepts of Expert Systems.							
4	The student should be made to study the concepts of Artificial Intelligence.							
Course Outcomes: At the end of this course, the student will be able to								
S.No	Outcome							Knowledge Level
1.	Describe the basic foundations & applications of AI							K2
2.	Apply the problem-solving strategies to generate best AI solutions using state space search for real time problems							K3
3.	Use propositional, predicate & Fuzzy logic concepts to process knowledge base							K3
4.	Apply Knowledge representation & uncertainty techniques to represent real time knowledge base problems							K3
5.	Classify various planning mechanisms, expert systems and its applications							K3
SYLLABUS								
UNIT-I (10 Hrs)	Introduction , history, intelligent systems, foundations of AI, intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation, applications, tic-tac-toe game playing.							
UNIT-II (10 Hrs)	Problem solving state-space search and control strategies: Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterative deepening A*, constraint satisfaction Problem reduction and game playing: Introduction, problem reduction, game playing, alpha beta pruning, two-player perfect information games.							
UNIT-III (10 Hrs)	Logic concepts: Introduction, propositional calculus, propositional logic, natural deduction system, axiomatic system, semantic tableau system in propositional logic, resolution refutation in propositional logic, predicate logic. Uncertainty, Fuzzy Logic,							

	Membership Functions, Fuzzy set operations.
UNIT-IV (8 Hrs)	Knowledge representation: Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, knowledge representation using frames Advanced knowledge representation techniques: Introduction, conceptual dependency theory, script structure. Reasoning under uncertainty, review of probability, Bayes' probabilistic interferences and Dempster Shafer theory.
UNIT-V (12 Hrs)	Planning , components of Planning system, Goal Stack Planning, Non Linear planning with constraint posting, Hierarchical planning, Reactive systems. Expert system and applications: Introduction phases in building expert systems, expert system versus traditional systems, Architecture of expert systems, Roles of expert systems – Knowledge Acquisition Meta knowledge Heuristics. Typical expert systems – MYCIN, DART, XCON: Expert systems shells.
Textbooks:	
1.	Artificial Intelligence- Saroj Kaushik, CENGAGE Learning.
2.	Artificial intelligence, A modern Approach, 2nded, Stuart Russel, Peter Norvig, PEA.
Reference Books:	
1.	Artificial Intelligence- Deepak Khemani, TMH,2013.
2.	Introduction to Artificial Intelligence, Patterson, PHI.
3.	Artificial intelligence, structures and Strategies for Complex problem solving, George F Luger, 5 th ed,PEA.
e-Resources	
1.	https://ai.google/
2.	https://swayam.gov.in/nd1_noc19_me71/preview

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD2203	ES	3	--	--	3	30	70	3 Hrs.

COMPUTER ORGANIZATION

(For AI&DS)

Course Objectives: Students are expected to learn

1. Principles and the Implementation of Computer Arithmetic
2. Operation of CPUs including RTL, ALU, Instruction Cycle, and Busses
3. Functionality of central processing unit and control units
4. Memory System and I/O Organization

Course Outcomes: After completion of the course, the student will be able to

S.No	Outcome	Knowledge Level
1.	Identify set of digital components, functional components and micro-operations in a basic computer system.	K3
2.	Demonstrate various instructions and arithmetic operations	K3
3.	Illustrate knowledge of functional components on central processing unit and various control units.	K2
4.	Determine different memory components in a computer for better memory organization	K3
5.	Explain different ways of communication with I/O devices and standard I/O interface	K2

SYLLABUS

UNIT-I (10 Hrs)	<p>Introduction: Basic Logic functions, Logic gates, Boolean functions, Canonical forms, Simplification of Boolean functions (up to 4 variable), Basics of Flipflops, Registers, Decoders and multiplexers.</p> <p>Basic Structure of Computers: Computer Types, Functional units, Basic operational concepts, Bus structures.</p> <p>Register Transfer and Micro operations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro operations, Shift Micro operations, Arithmetic Logic Shift Unit.</p>
UNIT-II (08 Hrs)	<p>Basic Computer Organization and Design: Instruction Codes, Computer Register, Computer Instructions, Instruction Cycle, Memory – Reference Instructions. Input – Output and Interrupt, Complete Computer Description</p> <p>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</p>

UNIT-III (10 Hrs)	Central Processing Unit: General Register Organization, STACK Organization. Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Execution of a Complete Instruction, Multiple-Bus Organization, Micro programmed Control: Control Memory, Address Sequencing, Micro Program example, Hardwired Control and Micro programmed Control.
UNIT-IV (10 Hrs)	The Memory Organization: Memory Hierarchy, Main memory, Auxiliary memory, Associate Memory, Cache Memory, and Virtual memory, Memory Management Requirements, Secondary Storage.
UNIT-V (12 Hrs.)	Input / Output Organization: Accessing I/O Devices, Interrupts, Processor Examples, modes of transfers, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces.
Text Books:	
1.	Computer System Architecture M. M. Mano: 3rd ed., Prentice Hall of India, New Delhi, 1993
2.	Digital Design, 6th Edition, M. Morris Mano, Pearson Education.
3.	Computer Organization, Carl Hamacher, Zvonko Vranesic, Safwat Zaky, 5/e, McGraw Hill, 2002.
Reference Books:	
1.	Computer Organization and Architecture, William Stallings, 6/e, Pearson, 2006.
2.	Structured Computer Organization, Andrew S. Tanenbaum, 4/e, Pearson, 2005.
3.	Fundamentals of Computer Organization and Design, Sivarama P. Dandamudi, Springer, 2006.
e-Resources	
1.	https://nptel.ac.in/courses/106/105/106105163/
2.	http://www.cuc.ucc.ie/CS1101/David%20Tarnoff.pdf

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD2204	PC	--	--	3	1.5	15	35	3 Hrs.

ARTIFICIAL INTELLIGENCE LAB

(For AIDS)

Course Objectives: On completing this course student will be able to

1	Study the concepts of Artificial Intelligence
2	Learn the methods of solving problems using Artificial Intelligence
3	Introduce the concepts of Expert Systems and machine learning

Course Outcomes: By the end of the course, the student should have the ability to

S.No	Outcome	Knowledge Level
1	Design and carry out evaluation of different AI algorithms on problem formalization and state the conclusions that the evaluation supports.	K4

SYLLABUS

1	Pandas Library a) Write a python program to implement Pandas Series with labels. b) Create a Pandas Series from a dictionary. c) Creating a Pandas Data Frame. d) Write a program which makes use of the following Pandas i) describe () ii) head () iii) tail () iv) info ()
2	Pandas Library: Visualization a) Write a program which use pandas' inbuilt visualization to plot following graphs: i. Bar plots ii. Histograms iii. Line plots iv. Scatter plots
3	Write a Program to Implement Breadth First Search using Python.
4	Write a program to implement Best First Searching Algorithm
5	Write a Program to Implement Depth First Search using Python.
6	Write a program to implement the Heuristic Search
7	Write a python program to implement A* and AO* algorithm. (Ex: find the shortest path)
8	Write a Program to Implement Water-Jug problem using Python.
9	Write a Program to Implement Alpha-Beta Pruning using Python.
10	Write a Program to implement 8-Queens Problem using Python.
11	Write a Program to Implement Water-Jug problem using Python.
12	Write a program to schedule a meeting among a 5 busy people using Default Reasoning the output should give the time, place and day of the meeting.
13	Write a program to implement the Unification algorithm
14	Develop a knowledge base system consisting of facts and rules about some specialized knowledge domain

15	Write a program to implement 8 puzzle programs using different heuristics. Using it play the game Tic-Tac-Toe at the end the game the program should display the no. of nodes generated, cutoff values at each stage in the form of a table.
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Reference Books:

1	Prateek Joshi, Artificial Intelligence with Python, Packt Publishing, 2017.
2	Xiao, Perry. Artificial intelligence programming with Python: from zero to hero. John Wiley & Sons, 2022.
3	Artificial Intelligence- Saroj Kaushik, CENGAGE Learning.
4	Artificial intelligence, A modern Approach, 2nded, Stuart Russel, Peter Norvig, PEA.
5	Artificial Intelligence- Deepak Khemani, TMH,2013.
6	Introduction to Artificial Intelligence, Patterson, PHI.
7	Artificial intelligence, structures and Strategies for Complex problem solving, George FLugar, 5th ed,PEA.



Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD2205	PC	--	--	3	1.5	30	70	3 Hrs.

DATA SCIENCE USING PYTHON LAB

(For AI & DS)

Course Objectives: On completing this course student will be able to

- | | |
|---|---|
| 1 | The main objective of the course is to inculcate the basic understanding of Data Science and its practical implementation using Python. |
|---|---|

Course Outcomes: By the end of the course, the student should have the ability to:

S.No	Outcome	Knowledge Level
1	Apply Numpy library to perform basic data operations.	K3
2	Use Pandas for Data preparation and Exploration.	K3
3	Demonstrate data preprocessing and visualization using Python tools.	K3
4	Demonstrate Python tools like Sci Kit-Learn, NLTK/Spicy/Py NLPI for NLP.	K3

SYLLABUS

1	Creating a NumPy Array <ol style="list-style-type: none"> a) Basic n-d array b) Array of zeros c) Array of ones d) Random numbers in n-d array e) An array of your choice f) Imatrix in NumPy g) Evenly spaced n-D array
2	The Shape and Reshaping of NumPy Array <ol style="list-style-type: none"> a) Dimensions of NumPy array b) Shape of NumPy array c) Size of NumPy array d) Reshaping a NumPy array e) Flattening a NumPy array f) Transpose of a NumPy array
3	Expanding and Squeezing a NumPy Array <ol style="list-style-type: none"> a) Expanding a NumPy array b) Squeezing a NumPy array c) Sorting in NumPy Arrays
4	Indexing and Slicing of NumPy Array <ol style="list-style-type: none"> a) Slicing 1-D NumPy arrays b) Slicing 2-D NumPy arrays c) Slicing 3-D NumPy arrays

	d) Negative slicing of NumPy arrays
5	Stacking and Concatenating Numpy Arrays a) Stacking n-d array Concatenating ndarrays b) Broadcasting in Numpy Arrays
6	Perform following operations using pandas a) Creating dataframe b) concat() c) Setting conditions d) Adding a new column
7	Perform following operations using pandas a) Filling NaN with string b) Sorting based on column values c) groupby()
8	Read the following file formats using pandas a) Text files b) CSV files c) Excel files d) JSON files
9	Read the following file formats a) Pickle files b) Image files using PIL c) Multiple files using Glob d) Importing data from database
10	Demonstrate web scraping using python
11	Perform following preprocessing techniques on loan prediction dataset a) Feature Scaling b) Feature Standardization c) Label Encoding d) One Hot Encoding
12	Perform following visualizations using matplotlib a) Bar Graph b) Pie Chart c) Box Plot d) Histogram e) Line Chart and Subplots f) Scatter Plot
13	Getting started with NLTK, install NLTK using PIP
14	Python program to implement with Python Sci Kit-Learn & NLTK
15	Python program to implement with Python NLTK/Spicy/Py NLPI.
e-Resources	
1	https://www.analyticsvidhya.com/blog/2020/04/the-ultimate-numpy-tutorial-for-data-science-

	beginners/
2	https://www.analyticsvidhya.com/blog/2021/07/data-science-with-pandas-2-minutes-guide-to-key-concepts/
3	https://www.analyticsvidhya.com/blog/2020/04/how-to-read-common-file-formats-python/
4	https://www.analyticsvidhya.com/blog/2016/07/practical-guide-data-preprocessing-python-scikit-learn/
5	https://www.analyticsvidhya.com/blog/2020/02/beginner-guide-matplotlib-data-visualization-exploration-python/6 .
6	https://www.nltk.org/book/ch01.html



Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD2206	SEC	--	1	2	2	30	70	3 Hrs.

FULL STACK DEVELOPMENT-1

(For AI&DS)

Course Objectives:


1	Build a web page by applying appropriate CSS styles to HTML elements
2	Experiment with JavaScript to develop dynamic web pages and validate forms

Course Outcomes: After completion of the course, the student will be able to

S. No	Outcome	Knowledge Level
1	Develop static web pages using HTML and Cascading Style Sheet	K3
2	Develop a dynamic web page for validations using JavaScript	K3
3	Model a Basic web server using node.js	K3

SYLLABUS

	<p>Lists, Links and Images</p> <p>a. Write a HTML program, to explain the working of lists. Note: It should have an ordered list, unordered list, nested lists and ordered list in an unordered list and definition lists.</p> <p>b. Write a HTML program, to explain the working of hyperlinks using <a> tag and href, target Attributes.</p> <p>1 c. Create a HTML document that has your image and your friend's image with a specific height and width. Also when clicked on the images it should navigate to their respective profiles.</p> <p>d. Write a HTML program, in such a way that, rather than placing large images on a page, the preferred technique is to use thumbnails by setting the height and width parameters to something like to 100*100 pixels. Each thumbnail image is also a link to a full-sized version of the image. Create an image gallery using this technique</p>
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2	<p>HTML Tables, Forms and Frames</p> <p>a. Write a HTML program, to explain the working of tables. (use tags: <table>, <tr>, <th>, <td> and attributes: border, rowspan, colspan)</p> <p>b. Write a HTML program, to explain the working of tables by preparing a timetable. (Note: Use <caption> tag to set the caption to the table & also use cell spacing, cell padding, border, rowspan, colspan etc.).</p> <p>c. Write a HTML program, to explain the working of forms by designing Registration form. (Note: Include text field, password field, number field, date of birth field, checkboxes, radio buttons, list boxes using <select>&<option> tags, <text area> and two buttons ie: submit and reset. Use tables to provide a better view).</p> <p>d. Write a HTML program, to explain the working of frames, such that page is to be divided into 3 parts on either direction. (Note: first frame image, second frame paragraph, third frame  hyperlink. And also make sure of using “no frame” attribute such that frames to be fixed).</p>
3	<p>HTML 5 and Cascading Style Sheets, Types of CSS</p> <p>a. Write a HTML program, that makes use of <article>, <aside>, <figure>, <figcaption>, <footer>, <header>, <main>, <nav>, <section>, <div>, tags.</p> <p>b. Write a HTML program, to embed audio and video into HTML web page.</p> <p>c. Write a program to apply different types (or levels of styles or style specification formats) - inline, internal, external styles to HTML elements. (identify selector, property and value).</p>
4	<p>Selector forms</p> <p>a. Write a program to apply different types of selector forms</p> <ul style="list-style-type: none"> ● Simple selector (element, id, class, group, universal) ● Combinator selector (descendant, child, adjacent sibling, general sibling) ● Pseudo-class selector ● Pseudo-element selector ● Attribute selector
5	<p>CSS with Color, Background, Font, Text and CSS Box Model</p> <p>a. Write a program to demonstrate the various ways you can reference a color in CSS.</p> <p>b. Write a CSS rule that places a background image halfway down the page, tilting it horizontally. The image should remain in place when the user scrolls up or down.</p> <p>c. Write a program using the following terms related to CSS font and text:</p> <p>i. font-size ii. font-weight iii. font-style iv. text-decoration v. text-transformation vi. text-alignment</p> <p>d. Write a program, to explain the importance of CSS Box model using</p> <p>i. Content ii. Border iii. Margin iv. padding</p>
6	<p>Applying JavaScript - internal and external, I/O, Type Conversion</p> <p>a. Write a program to embed internal and external JavaScript in a web page.</p> <p>b. Write a program to explain the different ways for displaying output.</p> <p>c. Write a program to explain the different ways for taking input.</p> <p>d. Create a webpage which uses a prompt dialogue box to ask a voter for his name and age. Display the information in table format along with either the voter can vote or not</p>

7	<p>JavaScript Pre-defined and User-defined Objects</p> <ol style="list-style-type: none"> Write a program using document object properties and methods. Write a program using window object properties and methods. Write a program using array object properties and methods. Write a program using math object properties and methods. Write a program using string object properties and methods. Write a program using regex object properties and methods. Write a program using date object properties and methods. Write a program to explain user-defined object by using properties, methods, accessors, constructors and display.
8	<p>JavaScript Conditional Statements and Loops</p> <ol style="list-style-type: none"> Write a program which asks the user to enter three integers, obtain the numbers from the user and output HTML text that displays the larger number followed by the words “LARGER NUMBER” in an information message dialog. If the numbers are equal, output HTML text as “EQUAL NUMBERS”. Write a program to display weekdays using switch case. Write a program to print 1 to 10 numbers using for, while and do-while loops. Write a program to display the denomination of the amount deposited in the bank in terms of 100’s, 50’s, 20’s, 10’s, 5’s, 2’s & 1’s. (Eg: If deposited amount is Rs.163, the output should be 1-100’s, 1-50’s, 1- 10’s, 1-2’s & 1-1’s)
9	<p>JavaScript Functions and Events</p> <ol style="list-style-type: none"> Design a appropriate function should be called to display <ul style="list-style-type: none"> ● Factorial of that number ● Fibonacci series up to that number ● Prime numbers up to that number ● Is it palindrome or not Design a HTML having a text box and four buttons named Factorial, Fibonacci, Prime, and Palindrome. When a button is pressed an appropriate function should be called to display <ul style="list-style-type: none"> ● Factorial of that number ● Fibonacci series up to that number ● Prime numbers up to that number ● Is it palindrome or not
10	<p>Write a program to validate the following fields in a registration page</p> <ol style="list-style-type: none"> Name (start with alphabet and followed by alphanumeric and the length should not be less than 6 characters) Mobile (only numbers and length 10 digits) E-mail (should contain format like <u>xxxxxxx@xxxxxx.xxx</u>)
11	<p>Node.js Create a Web Server in node.js and test restarting a node Application.</p>
Reference Books:	
1	Programming the World Wide Web, 7th Edition, Robert W Sebesta, Pearson, 2013.

2	Web Programming with HTML5, CSS and JavaScript, John Dean, Jones & Bartlett Learning, 2019 (Chapters 1-11).
3	Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2 nd edition, APress, O'Reilly.



Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD2207	ES	1	--	2	2	30	70	3 Hrs.

DESIGN THINKING & INNOVATION
(Common to all Programmes of Engineering)

Course Objectives:

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

Course Outcomes: After completion of this course, students will be able to

S.No	Outcome	Knowledge Level
1.	Define the concepts related to design thinking.	K1
2.	Explain the fundamentals of Design Thinking and innovation.	K2
3.	Apply the design thinking techniques for solving problems in various sectors.	K3
4.	Analyse to work in a multidisciplinary environment.	K4
5.	Evaluate the value of creativity.	K5

SYLLABUS

UNIT-I (10Hrs)	Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.
UNIT-II (10 Hrs)	Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development. Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.
UNIT-III (10 Hrs)	Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity. Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.
UNIT-IV (10 Hrs)	Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies.

	Activity: Importance of modeling, how to set specifications, Explaining their own product design.
UNIT-V (10 Hrs)	Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes. Activity: How to market our own product, about maintenance, Reliability and plan for startup.
Textbooks:	
1.	Tim Brown, Change by design, 1/e, Harper Bollins, 2009.
2.	Idris Mootee, Design Thinking for Strategic Innovation, 1/e, Adams Media, 2014.
Reference Books:	
1.	David Lee, Design Thinking in the Classroom, Ulysses press, 2018.
2.	Shrrutin N Shetty, Design the Future, 1/e, Norton Press, 2018.
3.	William lidwell, Kritinaholden, &Jill butter, Universal principles of design, 2/e, Rockport Publishers, 2010.
4.	Chesbrough.H, The era of open innovation, 2003.
e-Resources:	
1.	https://nptel.ac.in/courses/110/106/110106124/
2.	https://nptel.ac.in/courses/109/104/109104109/
3.	https://swayam.gov.in/nd1_noc19_mg60/preview
4.	https://onlinecourses.nptel.ac.in/noc22_de16/preview

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23MC2202	MC	2	--	--	--	30	--	--

ENVIRONMENTAL SCIENCE

(Common to AIDS, AIML, CE, CSBS, CSIT, IT and ME.)

Course Objectives: The objective of the course is to impart:

1.	Overall view on natural resources.
2.	Awareness on ecosystem and its services.
3.	Various environmental challenges induced due to unplanned anthropogenic activities.
4.	Consciousness on the social issues, environmental legislation and global treaties

Course Outcomes: At the end of the course, the students will be able to

S. No	Outcome	Knowledge Level
1	Describe natural resources and their interaction	K2
2	Illustrate ecosystem types, biodiversity and conservation strategies	K2
3	Summarize contaminants of environment and preventive methods	K2
4	Explain protection of environment by employing constitutional provisions	K2
5	Explain global scenario of surroundings and social conditions	K2

SYLLABUS

UNIT-I (8 Hrs)	<p>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: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources</p>
UNIT-II (8 Hrs)	<p>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)</p> <p>Biodiversity and Its Conservation : Introduction and Definition - genetic, species and</p>

	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-spots 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.
UNIT-III (6 Hrs)	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
UNIT-IV (6 Hrs)	Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy watershed management – Resettlement and rehabilitation of people; its problems and concerns – Carbon credits, Mission LiFE. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust –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.
UNIT-V (6 Hrs)	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.	Erach Bharucha, 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. Azeem Unnisa, Environmental Studies, Academic Publishing Company, 2021.
4.	K. Raghavan Nambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, SciTech Publications (India), Pvt. Ltd, 2010.
5	K. V. S. G. Murali Krishna, The Book of Environmental Studies, Savera Publishing House.
6	Environmental Studies, R. Rajagopalan, 2 nd Edition, 2011, Oxford University Press.

Reference Books:	
1.	Deeksha Dave and S.S. Katewa, Textbook of Environmental Studies, 2/e, Cengage Learning.
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.
e-Resources	
1.	https://onlinecourses.nptel.ac.in/noc23_hs155/preview
2.	https://www.edx.org/learn/environmental-science/rice-university-ap-r-environmental-science-part-3-pollution-and-resources?index=product&objectID=course-3a6da9f2-lec07.pdf (iasri.res.in)
3.	http://ecoursesonline.iasri.res.in/Courses/Environmental%20Science-I/Data%20Files/pdf/lec07.pdf
4.	https://www.youtube.com/watch?v=5QxxaVfgQ3k

