Centre for Artificial Intelligence

ANNEXURE-II

Syllabi
of all courses of
B. Tech. II Semester
Artificial Intelligence (AI)/ Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning
[under the MITS-DU]
under the flexible curriculum along with their COs
(Batch admitted in academic session 2024 – 25)

Centre for Artificial Intelligence

DISCRETE STRUCTURES
(31241201/ 24241201/ 27241201/ 28241201)

COURSE OBJECTIVES

- To perceive the knowledge of basic algebra and propositional logic
- To know about the graph theory and its application in computer engineering
- To familiarize the discrete numeric function and generating function

Unit I

Finite and Infinite Sets, Mathematical Induction, Principles of Inclusion and Exclusion, Multisets, Functions and Relations, Binary Relations, Equivalence Relations and Partitions, Partial Ordering Relations and Lattices, Chains, Pigeonhole Principle.

Unit II

Propositional Logic, Syntax, Semantics of ATF (Atomic Formula), WFF (Well Formed Formulas),Validity and Satisfiability of WFF by Quine's Method, Normal and Closure Form of Propositional Calculus.

Unit III

Introduction and Basic Terminology of Graphs, Planar Graphs, Multigraphs and Weighted Graph, Shortest Path in Weighted Graph, Introduction to Eulerian Paths and Circuits, Hamiltonian Paths and Circuits. Introduction to Trees, Rooted Trees, Path Length in Rooted Trees, Spanning Trees and Cut Trees.

Unit IV

Introduction to Discrete Numeric Functions and Generating Functions, Introduction to Recurrence Relations and Recursive Algorithms, Linear Recurrence Relations With Constant Coefficients, Homogeneous Solutions, Particular Solutions and Total Solutions.

Unit V

Binary Group Codes, Communication system and its problems, Binary Symmetric Channel, Encoding and Decoding, Error detecting and correcting codes, Block codes, Distance between words, Matrix Encoding Technique, Groups codes, Construction of Decoding Table, Hamming codes.

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RECOMMENDED BOOKS

1. J. Tremblay and Manohar: Discrete Mathematical Structures with Application to Computer science. Narsingh Deo: Graph Theory.
2. Kenneth Rosen: Discrete mathematics and its applications (6th edition), 2006. McGraw-Hill
3. C. Liu, D. Mohapatra: Elements of Discrete Mathematics. 2008. Tata McGraw-Hill.
4. T. Koshy: Discrete mathematics with applications, 2003. Academic Press.
5. J. Hein: Discrete structures, logic and computability, 2009. Jones & Bartlett Publishers.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1: explain the concepts of set theory, propositional logic, graph theory, discrete numeric function and algebraic structure.
CO2: apply mathematical reasoning and logical thinking to solve problems
CO3: determine the solutions of problems pertaining to computer sciences using graph theory concepts.
CO4 solve counting and recursive problems using combinatorial analysis.
CO5: analyze error control coding techniques to enhance communication system reliability.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	3	2	1		1	2	2	2	3	2	2
CO2	2	3	3	2	3	2	1		2	2	3	2	3	2
CO3	2	2	2	2	2	1			1	1	2	3	2	2
CO4	3	3	2	3	2	2			1	1	2	2	2	1
CO5	2	3	2	2	3	2		2	2	1	2	2	3	3

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MODERN COMPUTER ARCHITECTURE
(31241202/ 24241202/ 27241202/ 28241202)

COURSE OBJECTIVES

- To understand basic principles of Computer Systems.
- To understand various logic design techniques and their applications. They should be capable of using high performance computing architecture.

Unit I

Basic of Computer Architectures: Von Neumann Model, Various Subsystems, CPU, Memory, I/O, System Bus, Arithmetic Micro-Operation, Logic Micro Operation Shift Micro-Operation Register Transfer Micro Operations, Arithmetic, Micro-Operations, Logic Micro-Operations and Shift Micro-Operations.

Unit II

Multi-core Architecture: Memory technologies, hierarchical memory systems, the locality principle and caching, direct- mapped caches, block size, cache conflicts, associative caches, write strategies, advanced optimizations, performance improvement techniques, DRAM – organization, access techniques, scheduling algorithms, and signal systems.

Unit III

Distributed Computing Systems and Concurrency: Relation to Parallel Multiprocessors/multicomputer Systems, Distributed and Concurrent Programs, Message Passing vs. Shared Memory Systems, Synchronous vs. Asynchronous Executions, Design Issues and Challenges, Distributed Computing Technologies, Clocks and Synchronization, Global State and Distributed Transactions.

Unit IV

High Performance Computing (HPC): HPC Architecture, Parallel Processing, Parallel Memory Models, Data vs. Task Parallelism, High Throughput Computing, Vectorization, Multithreading.

Unit V

High Performance Computing with CUDA: CUDA programming model, Basic principles of CUDA programming, Concepts of threads and blocks, GPU and CPU data exchange

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RECOMMENDED BOOKS

1. M. Morris Mano, Computer System & Architecture, Prentice Hall of India, 2002.
2. John L. Hennessy and David A Patterson, Computer Architecture-A quantitative approach, Morgan Kaufmann/ Elsevier, 4th Edition, 2007.
3. Hayes. J.P, Computer architecture and organization by McGraw-Hill Companies, 1998
4. Parallel Computer Architecture: A Hardware/Software Approach David Culler and J.P. Singh with Anoop Gupta, Morgan Kaufmann, 1998.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1: describe the organization of the Control unit, ALU, Memory and the I/O unit.

CO2: evaluate hierarchical memory systems, design effective caching strategies, and optimize memory performance using advanced techniques and scheduling algorithms.

CO3: compare distributed and parallel computing paradigms, address concurrency challenges, and implement synchronization techniques for distributed systems.

CO4 design parallel processing architectures and implement multithreading for high-performance computing applications.

CO5: develop parallel programs using the CUDA programming model, manage GPU-CPU data exchange, and optimize computations with threads and blocks.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	2	1		1		1		2	1	2
CO2	3	3	3	3	3	2	2	2	1	1	2	3	2	2
CO3	3	3	3	3	3	2		1	1	1		3	1	1
CO4	3	3	3	3	3	3	3	2	3	1	3	3	3	2
CO5	3	3	3	3	3	3	3	2	3	2	3	3	3	3

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OBJECT ORIENTED PROGRAMMING
(31241203/ 24241203/ 27241203/ 28241203)

COURSE OBJECTIVES

- To study the concept of object oriented programming.
- To create programs that leverage the object oriented features of the C++ Language.
- To apply object oriented programming techniques for real world problem solving.

Unit I

Introduction to Object Oriented Programming: Unstructured & Structured Programming, Object Oriented Paradigm, features and comparison with Procedural Oriented Programming approach. Specification of Class, Abstract Data Types, Visibility Modes, Defining Member Functions, Object Creation, Characteristics of Object, Scope Resolution Operator, Static Data Member, Static Member Function.

Unit II

Constructors and Destructors: Introduction, Types of Constructors- Default Constructor, User Defined Constructor, Parameterized Constructor, Copy Constructor, Constructor with Default Arguments, Rules of Constructor Definition and Usage, Destructors. Array of Objects, Object as Arguments, Inline Function, Friend Function.

Unit III

Polymorphism: Introduction, Type of Polymorphism: Compile Time Polymorphism & Run Time Polymorphism, Function Overloading, Operator Overloading: Binary and Unary Operators, Rules for Operator Overloading, Pitfalls of Operator Overloading, Data Conversion, Type Casting.

Unit IV

Inheritance: Introduction to Code Reuse, Visibility Modes, Types of Inheritance: Single Level, Multilevel, Multiple, Hybrid, Multipath. this Pointer, Ambiguity in MultiLevel Inheritance, Constructors in Derived Classes, Virtual Functions, Virtual Base Classes, Abstract Classes and Pure Virtual Functions, Nesting of Classes, Overriding Member Function, Association, Type of Association.

Unit V

Templates and Exceptions: Function Templates, Function Templates with Multiple Arguments, Class Templates, Exception Syntax, Exceptions with Arguments. Standard Template Library: Containers, Algorithms, Iterators, Vectors and Lists.

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RECOMMENDED BOOKS

1. Object Oriented Programming in C++, Robert Lafore, Sams.
2. C++ How to Program, H M Deitel and P J Deitel, Prentice Hall.
3. The Complete Reference in C++, Herbert Schildt, TMH.
4. Fundamentals of Programming C++, Richard L. Halterman.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1: describe fundamental principles of object-oriented programming.

CO2: construct and manage object life cycles using various types of constructors and destructors, while employing inline and friend functions effectively in programming.

CO3: apply compile-time and runtime polymorphism using function and operator overloading, while addressing potential challenges of operator overloading and type casting.

CO4 develop well-structured, modular programs that leverage classes, objects, and inheritance to enhance code maintainability and reusability.

CO5: design reusable and generic code using function and class templates, handle runtime errors with exception handling, and utilize the Standard Template Library for efficient data manipulation.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	3	3	1	1	1	1	1	3	1	1
CO2	3	3	3	3	3	2	2	1	1	1	2	3	2	2
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	1	2	3	3	2
CO5	3	3	3	3	3	3	2	3	3	1	3	3	3	3

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DATA STRUCTURES
(31241204/ 24241204/ 27241204/ 28241204)

COURSE OBJECTIVES

- To be familiar with the use of data structures as the foundational base for computer solutions to problems.
- To understand various techniques of searching and sorting.
- To understand basic concepts about stacks, queues, lists, trees and graphs.

Unit I

Introduction to Data Structures: Algorithms & their characteristics, asymptotic notations. arrays and its representations, index to address translation. Link list: Introduction, implementation of linked list, operations, circular link list, doubly linked list, polynomial manipulation using linked list.

Unit II

Stacks: Concepts and implementation of stacks, operations on stack, conversion of infix to postfix notation, evaluation of postfix expression, recursion.

Queues: Concepts and implementation, operations on queues, dequeue, priority queues, circular queues and application.

Unit III

Trees: Types, terminology, binary tree -representations, traversal, conversion of general tree to binary tree, binary search tree, threaded binary tree and height balanced tree.

Unit IV

Graphs: Background, graph theory terminologies, representation of graphs- sequential & linked representation, path matrix, graph traversals- BFS, DFS, spanning trees, applications of graph.

Unit V

Searching & Sorting: Linear search, binary search, bubble sort, selection sort, insertion sort, quick sort, merge sort, radix sort and heap sort, comparison between sorting techniques, hashing and collision resolution techniques.

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RECOMMENDED BOOKS

1. Data Structures, Algorithms and Applications in C++, Sartaj Sahni, 2nd Edition.
2. An Introduction to Data Structures with Applications, Jean-Paul Tremblay, Mcgraw hill.
3. Data Structures & Algorithms, Aho, Hopcroft & Ullman, original edition, Pearson Publication.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1: analyze algorithms using asymptotic notations and perform operations on arrays and linked lists.
CO2: construct stacks and queues, and use them to solve real world problems.
CO3: distinguish between different types of trees and identify the application of each.
CO4 apply graph theory concepts and algorithms.
CO5: compare various searching, sorting and hashing techniques.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	3	3	1	1	1	1	1	3	1	1
CO2	3	3	3	3	3	2	2	1	1	1	2	3	2	2
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	1	2	3	3	2
CO5	3	3	3	3	3	3	2	3	3	1	3	3	3	3

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BASIC ELECTRICAL & ELECTRONICS ENGINEERING
(31241205/ 27241205/ 28241205)

COURSE OBJECTIVES

- To introduce the fundamental principles of electrical circuits and electronics.
- To provide insights into basic semiconductor devices, including diodes, transistors, and their applications.
- To demonstrate the practical use of electrical and electronic components in real-world systems.

Unit I

Basic Concepts of Electrical Engineering -Electrical Circuit Elements: Resistors, Capacitors, and Inductors, Ohm's Law, Kirchhoff's laws, Series and Parallel Circuits ,solution of star-delta circuits, charging and discharging of capacitor, series-parallel magnetic circuits, fringing effect, comparison between electric and magnetic circuit, Concept of induced emfs, series-parallel connection of inductors, rise and decay of current in inductive circuit.

Unit II

Single-phase AC Circuits-Generation of alternating emf, instantaneous, rms, peak, average values and related other terms, vector representation of AC quantities, Steady state analysis of R, L, C series and parallel circuits, power triangle.

Unit III

Three-phase AC Circuits-Generation of three-phase emf, star connection, delta connection, relationship between line and phase quantities, power measurement in three-phase circuit, variation in wattmeter reading with power factor.

Unit IV

Single Phase Transformer-Principle of Transformers: Construction and Working, Types of transformer, EMF equation of transformer, Transformation ratio, Phasor diagram, Losses and efficiency of transformer, Applications of transformer.

Unit V

Basic Electronics- Overview of Semiconductor Physics, PN Junction Diodes: Characteristics and Applications, Zener Diodes: Voltage Regulation, Half and full wave rectifiers, special purpose diodes.

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RECOMMENDED BOOKS

1. Basic Electrical Engineering, Authors: V.K. Mehta and Rohit Mehta, Publisher: S. Chand Publishing
2. Fundamentals of Electrical Engineering I, Author: Don H. Johnson, Publisher: Rice University (Free Online Resource)
3. Electrical Engineering 101: Everything You Should Have Learned in School...but Probably Didn't, Author: Darren Ashby, Publisher: Newnes (Elsevier), Edition: 3rd Edition
4. Principles of Electronics, Author: Colin Simpson, Publisher: Cengage Learning
5. Basic Electrical Engineering, Authors: D.P. Kothari and I.J. Nagrath, Publisher: McGraw Hill Education.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1: analyze electrical and magnetic circuits to evaluate transient responses in capacitive and inductive circuits.

CO2: analyze single-phase and three-phase AC circuits, including power measurements and power factor correction.

CO3: explain the generation of three-phase EMFs

CO4: describe the construction and working principles of transformers, analyze their performance using EMF equations and phasor diagrams, and evaluate their efficiency and applications.

CO5: apply semiconductor physics principles to analyze PN junction and Zener diodes, design rectifiers, and identify the applications of special-purpose diodes in circuits.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	1	-	-	-	-	-	-	-	2	1	1
CO2	3	3	3	2	2	1	-	-	-	-	-	2	2	1
CO3	3	3	3	2	2	1	-	-	-	-	-	2	1	1
CO4	3	2	3	2	-	-	-	-	-	-	-	2	1	2
CO5	3	3	3	3	3	2	2	2	2	2	2	2	2	2

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SENSORS AND ACTUATORS
(24241205)

COURSE OBJECTIVES

- Illustrate the working principles of transducers, sensors and actuators.
- Develop and exemplify basic programming skills in Virtual Instrumentation.
- Design and implement a system using sensor and instrumentation configuration.

Unit I

Introduction: Introduction, Input output configuration, generalized functional elements, advantages of electronic measurement, Errors in measurement, Gross errors and systematic errors, Absolute and relative errors, static characteristics, dynamic characteristics, calibration.

Unit II

Transducers: Introduction, Resistive transducer, Resistive position transducer, Strain gauges, Resistance thermometer, Thermistor, Inductive transducer, Capacitive transducers, Differential output transducers and LVDT. Piezoelectric transducer, photoelectric transducer, Photovoltaic transducer. Temperature transducers.

Unit III

Sensors: Introduction, principles, classification, characterization, Smart sensors: Introduction Primary sensors Information coding/ processing, Data communication, automation. Introduction to MEMS and Microsystems, Microsystems and Microelectronics Multidisciplinary nature of micro system design and manufacture applications of micro systems, Micro sensors, Humidity and Moisture Sensors.

Unit IV

Actuators: Functional components of an actuator, Performance Characteristics of Actuators, Thermo-mechanical Actuators, Optical Actuators, Electrical actuating systems: Solid-state switches, Solenoids, Electric Motors- Principle of operation and its application: D.C motors - AC motors, Synchronous Motor; Stepper motors - Piezoelectric Actuator. Magnetic Actuators, Capacitive Actuators, Actuator as a system component, Intelligent & Self sensing actuators.

Unit V

Micro Actuators: Actuation principle, shape memory effects-one way, two way and pseudo elasticity. Types of micro actuators- Electrostatic, Magnetic, Fluidic, Inverse piezo effect, other principles. Design and fabrication process of Microsensors, Smart Sensor Technologies: Introduction, definition, development trend, characteristics of smart sensors, application areas of smart sensors, and IoT technologies.

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RECOMMENDED BOOKS

1. Patranabis.D, "Sensors and Transducers", Wheeler publisher, 1994.
2. D.V.S. Murthy: "Transducers and Instrumentation", 2nd Edition, PHI Ltd., 2014
3. Sergej Fatikow and Ulrich Rembold, "Microsystem Technology and Macrobiotics", First edition, Springer –Verlag NEwyork, Inc, 1997.
4. Jacob Fraden, "Hand Book of Modern Sensors: Physics, Designs and Application" Fourth edition, Springer, 2010.

REFERENCE BOOKS

1. Robert H Bishop, "The Mechatronics Hand Book", CRC Press, 2002.
2. Massood Tabib and Azar, "Microactuators Electrical, Magnetic, thermal, optical, mechanical, chemical and smart structures", First edition, Kluwer academic publishers, Springer, 1997.
3. Manfred Kohl, "Shape Memory Actuators", first edition, Springer.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1: describe the functional elements of measurement systems, identify different types of errors, and evaluate the static and dynamic characteristics of measurement systems.

CO2: analyze various types of transducers for diverse measurement applications.

CO3: explain the principles and applications of sensors, characterize smart sensors, and analyze the design and operation of MEMS-based systems for multidisciplinary applications.

CO4 assess the performance and suitability of selected sensors and actuators for a specific control system.

CO5: apply the principles of micro-actuation, analyze the design and fabrication of microsensors and microactuators, and explore the integration of smart sensor technologies with IoT systems for innovative applications.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	3	3	2	1						2		1
CO2	3	2	3	3	2	1				1		2	1	
CO3	3	3	3	3	2	2	2		1		1	2	2	2
CO4	3	3	3	3	3	2	2	2	3	1	2	2		2
CO5	3	3	3	3	3	2	3	2	3	1	2	3	2	2

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SUSTAINABILITY & ENVIRONMENTAL SCIENCE
(31241211/ 24241211/ 27241211/ 28241211)

COURSE OBJECTIVES

- To equip students with a comprehensive understanding of environmental science, pollution control, sustainability, and global frameworks, enabling them to analyze environmental challenges and contribute to sustainable solutions through informed decision-making and responsible practices.

Unit I

Introduction to Environmental Science: definition, importance and its components. Ecosystem and its components. Water cycle, carbon cycle, food chain, energy flow in the ecosystem. Current state of environment in India and world; Underlying reasons (root causes) of modern environmental degradation (social, psychological, cultural).

Unit II

Environmental Pollution and Management: air, water, noise, soil, thermal and radioactive. Causes, impacts, pollution control techniques and mitigation strategies. Solid waste management: Principles of waste management, different components of waste management system and introduction to management of hazardous waste like e-waste, plastic waste. Global environmental Issues: Climate change, global warming, ozone layer depletion.

Unit III

Environmental policies and laws in India: Environmental Protection Act, Water Act, Air Act. Overview of global environmental policies and frameworks: Kyoto protocol, Montreal protocol, COP summits. Introduction to clean development mechanism, carbon credit, carbon trading.

Unit IV

Sustainability concepts: definition, importance, pillars of sustainability (economic, environmental, and social). Sustainable development. Overview of UN Sustainable Development Goals (SDGs) and their global relevance. Concept of circular economy, resource efficiency, energy conservation, green buildings and sustainable manufacturing.

Unit V

Sustainable Energy solutions: New Energy Sources: Need of new sources. Different types of new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy. Introduction to sustainable transportation systems and sustainable water infrastructure.

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RECOMMENDED BOOKS

1. D. K. Asthana, Meera Asthana, A Text Book of Environmental Studies, S Chand & Co., New Delhi.
2. S. K. Dhameja, Environmental Engineering & Management, S K Kataria & Sons, New Delhi
3. C. S. Rao, Environmental Pollution Control Engineering, C.S. Rao, New Age International Publishers
4. A. K. Gupta, Environmental Sustainability and Green Technologies, PHI Learning.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO 1: Explain the fundamental concepts of environmental science, including ecosystems and the causes of environmental degradation.
CO 2: Analyze the sources, causes, and impacts of air, water, and solid waste pollution and propose appropriate mitigation strategies.
CO 3: Evaluate the effectiveness of environmental policies and global frameworks in addressing environmental challenges.
CO 4: Explain the concepts of sustainability and sustainable development goals.
CO 5: Apply various solutions for achieving sustainable development.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	-	-	1	-	-	-	-	1	-	-
CO2	2	2	2	-	-	-	3	-	-	-	-	2	-	-
CO3	-	-	1	-	-	2	2	-	-	-	-	2	2	2
CO4	-	-	-	-	-	-	2	-	-	-	-	2	-	-
CO5	2	2	2	-	-	1	3	-	-	-	-	2	2	2

माधव प्रौद्योगिकी एवं विज्ञान संस्थान, ग्वालियर (म.प्र.), भारत
MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR (M.P.), INDIA
Deemed University
(Declared under Distinct Category by Ministry of Education, Government of India)
NAAC ACCREDITED WITH A++ GRADE

Centre for Artificial Intelligence

ANNEXURE-III

Experiment list/ Lab manual for all the Laboratory Courses and Micro Project-II to be offered in B. Tech. II Semester [Artificial Intelligence (AI)/ Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning] under the flexible curriculum

(Batch admitted in academic session 2024 – 25)

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OBJECT ORIENTED PROGRAMMING LAB
(31241206/ 24241206/ 27241206/ 28241206)

List of Programs

1. Define a class representing a basic entity (e.g., a car, a person) with member variables and member functions. Create objects of the class and demonstrate their usage.
2. Implement a class with a constructor and destructor. Illustrate their roles and demonstrate how they are called during object creation and destruction.
3. Create a base class and a derived class. Demonstrate inheritance by inheriting properties and methods from the base class to the derived class using different types of inheritances.
4. Implement a polymorphic behavior using function overloading or overriding. Show how a function can behave differently based on the type of object.
5. Overload a few operators (e.g., +, -, *, =) for a custom class. Show how these operators can be used with objects of that class.
6. Implement a template class that can work with different data types. Demonstrate how to create objects of the template class with different data types.
7. Implement a program that uses exception handling to catch and handle runtime errors, such as division by zero or array out-of-bounds.
8. Utilize STL containers like vectors or lists in a program. Perform basic operations like insertion, deletion, and iteration.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1: apply the principles of object-oriented programming paradigm to programming problems.
CO2: use classes and objects to model real-world entities in a program.
CO3: apply the concepts of base classes, derived classes, and method overriding.
CO4: implement exception handling to manage errors and unexpected situations in a program.
CO5: create generic and reusable code using STL.
CO6: solve real world problems using the concepts of object-oriented programming.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	3	3	1	1	1	1	1	3	1	1
CO2	3	3	3	3	3	2	2	1	1	1	2	3	2	2
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	1	2	3	3	2
CO5	3	3	3	3	3	3	2	3	3	1	3	3	3	3
CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3

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DATA STRUCTURES LAB
(31241207/ 24241207/ 27241207/ 28241207)

List of Programs

1. Implement the following sorting algorithms on a list of integer:
    a. Selection Sort.
    b. Insertion Sort
    c. Quick Sort
    d. Merge Sort
    e. Heap Sort
2. Write a program to implement a binary search algorithm.
3. Implement Singly, Doubly and Circular Linked List.
4. Implement Stack and Queue using arrays.
5. Implement Stack and Queue using Singly linked lists.
6. Create a program which creates a Binary search tree and traverse it using Inorder, Pre-order and Post-order traversal techniques.
7. Write a program to implement Threaded Binary trees.
8. Implement a graph data structure using Adjacency matrix and list respectively.
9. Write a program which finds the spanning tree of a graph.
10. Implement BFS and DFS graph traversal techniques.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1: implement sorting techniques.
CO2: analyze the complexity of tree data structure.
CO3: choose appropriate data structures for specific scenarios.
CO4: explain the importance of binary search trees.
CO5: solve real world problems using graphs.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	3	3	1	1	1	1	1	3	1	1
CO2	3	3	3	3	3	2	2	1	1	1	2	3	2	2
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	1	2	3	3	2
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Centre for Artificial Intelligence

Basic Electrical & Electronics Engineering Lab
(31241208/ 27241208/ 28241208)

List of Experiments

1. Verify Ohm's law by measuring current across different resistors with varying applied voltages.
2. Verify Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL) in a simple electrical circuit.
3. Analyze and measure the voltage and current in series and parallel resistor configurations
4. Solve the star-delta circuit using practical measurements on the breadboard.
5. Study the charging and discharging behavior of a capacitor.
6. Analyze the behavior of R, L, and C components in series and parallel combinations in AC circuits.
7. Verify the power triangle in an RLC circuit and measure power factor.
8. Determine the resonant frequency of a series RLC circuit and observe resonance behavior.
9. Observe the forward and reverse characteristics of a PN junction diode.
10. Study the voltage regulation characteristics of a Zener diode.
11. Study the behavior of LEDs and photodiodes.
12. Study the input and output characteristics of a Bipolar Junction Transistor in common-emitter configuration.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1: Apply the fundamental concepts of electrical engineering to analyze and solve basic electrical circuits.
CO2: Analyze and measure electrical parameters (voltage and current) in series and parallel configurations
CO3: Explain the concepts related to AC circuits, including the generation of alternating current, AC circuit analysis, power calculation, and resonance in RLC circuits.
CO4: Analyze the working of Bipolar Junction Transistors (BJT),
CO5: Design and construct basic electronic circuits on breadboards

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	1	-	-	-	-	-	-	-	2	1	1
CO2	3	3	3	2	2	1	-	-	-	-	-	2	2	1
CO3	3	3	3	2	2	1	-	-	-	-	-	2	1	1
CO4	3	3	3	2	2	1	-	-	-	-	-	2	2	1
CO5	3	3	3	3	3	2	2	2	2	2	2	2	2	2

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SENSORS AND ACTUATORS LAB
(24241208)

List of Experiments

1. Study of static and dynamic characteristics of sensors.
2. Displacement measurement using LVDT.
3. Using a strain gauge transducer, strain is measured.
4. Displacement measurement with a potentiometer.
5. RTD is used to measure temperature, and its properties are shown.
6. Temperature measurement with a thermistor.
7. Pressure measurement with a load cell.
8. Speed measurement with a magnetic sensor.
9. Speed measurement with photoelectric sensors.
10. Use a pressure transducer to measure pressure.
11. Liquid level measurement with a capacitive sensor.
12. Interface of DC motors using H-bridge circuit
13. Implement and analyze speed control of a DC motor by varying the PWM duty cycle.
14. Understand the working of servo motors and control their position using PWM.
15. Study of AC Motor for wide range of speeds and loads
16. Working of stepper motor under speed and torque control.
17. Virtual demonstration of hydraulic and pneumatic actuators and their industrial applications.
18. Design and application of Micro actuators and micro valves.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1: interpret the terminology of Instrumentation and analyze various sensors.

CO2: apply signal conditioning for measurements.

CO3: explain measurement techniques for industrial and laboratory applications of different transducers.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	3	3			2		1		2		2
CO2	3	3	2	3			3	2					2	2
CO3	3	3	3	3	3	3			1	2	3	3	2	3

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Micro Project-II
(31241210/ 24241210/ 27241210/ 28241210)

List of Projects

1. Develop a system to manage student information with classes for students, courses, and grades. Implement features like adding and removing students, enrolling in courses, and calculating GPA.
2. Create a system to manage inventory with classes for products, categories, and orders. Implement features like adding and removing products, updating stock levels, and processing orders.
3. Develop a system for managing hospital records with classes for patients, doctors, and appointments. Implement features like scheduling appointments, updating patient information, and generating reports.
4. Create a quiz game with classes for questions, quizzes, and players. Implement a scoring system, random question selection, and a leaderboard for tracking player performance.
5. Design a simple social media network with classes for users, posts, and comments. Implement features like creating posts, adding friends, and commenting on posts.
6. Develop a ticket booking system for a cinema or an event with classes for shows, venues, and tickets. Include features like booking tickets, checking seat availability, and generating tickets.
7. Use a heap to implement a priority queue.
8. Develop a basic hash table with collision resolution
9. Implement a program that can parse and evaluate mathematical expressions.
10. Use a stack to implement an expression evaluator.
11. Implement a Phone directory application using doubly linked lists.
12. Implement a flight reservation system using a combination of data structures like priority queues for seat reservations and graphs for flight connections.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1: Explain the principles of OOP and their applications in solving real-world problems.
CO2: Develop and manipulate data structures like stacks and queues to solve problems.
CO3: Examine the relationships between OOP principles and data structure implementations in program design.
CO4: Design and develop a micro-project that integrates OOP concepts and appropriate data structures to solve a real-world problem.
CO5: Construct reusable and modular code using OOP principles for solving a complex programming challenge.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	3	3	1	1	1	1	1	3	1	1
CO2	3	3	3	3	3	2	2	1	1	1	2	3	2	2
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	1	2	3	3	2
CO5	3	3	3	3	3	3	2	3	3	1	3	3	3	3