Centre for Artificial Intelligence

ANNEXURE-I

Syllabi
of all courses of
B. Tech. III 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

PROBABILITY AND RANDOM PROCESSES
(31242101/ 24242101/ 27242101/ 28242101)

COURSE OBJECTIVES

- To learn central tendency, skewness and kurtosis.
- To describe probability theory and distribution
- To familiarize with correlation and regression
- To know about the hypothesis analysis
- To explore the theory of attributes and rules of association

Unit I

Measure of Central Tendency: Measures of Averages and Standard Deviation, Moments about origin and mean, Moment Generating Function, Skewness and Kurtosis.

Unit II

Probability & Regression: Definition of Probability: Classical and Axiomatic Approaches, Laws of Total and Compound Probability, Conditional Probability, Curve Fitting, Correlation and Regression.

Unit III

Probability Distribution: Probability Distribution Function, Probability Density Function, Central Limit Theorem, Binomial Distribution, Poisson Distribution, Normal Distribution, Exponential Distribution, Uniform Distribution.

Unit IV

Testing of Hypothesis: Testing of Hypothesis, Chi-squared test, t-test, F-test, Z-test, Analysis of Variance: One-way and Two-way Classifications.

Unit V

Random Variables & Processes: Concept of Random Variable, One-Dimensional Random Variable, Two-Dimensional Random Variable, Distribution Function, Joint Probability Distribution Function, Marginal Probability Distribution, Cumulative Probability Distribution, Conditional Distribution Function.

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RECOMMENDED BOOKS

1. M Ray and H.S. Sharma: Mathematical Statistics, Ram Prasad Publications, 3rd Edition, 2017.
2. V.K. Kapoor, S.C. Gupta: Statistical Methods, S. Chand & Company, 11th Edition, 2018.
3. T. Veerarajan: Probability, Statistics and Random Processes, McGraw-Hill, 3rd Edition, 2008.
4. S. M. Rose: Introduction to Probability Models, Elsevier, 10th Edition, 2011.

COURSE OUTCOMES

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

CO1: Gain knowledge of measures of central tendency
CO2: Evaluate the skewness, kurtosis, curve fitting, correlation and regression.
CO3: Interpret the theory of probability and its distributions
CO4 Examine the test of hypothesis.
CO5: Compute random variables with random process

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

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DESIGN & ANALYSIS OF ALGORITHMS

(31242102/24242102/27242102/28242102)

COURSE OBJECTIVES

- To introduce the topic of algorithms as a precise mathematical concept.
- To study the techniques like recursion, divide and conquer, dynamic programming, greedy approach, backtracking and branch and bound.
- To practice their skills on many well-known algorithms and data structures designed to solve real-life problems.

Unit I

Introduction to Computational Model: Algorithms and its Importance, Recurrences and Asymptotic Notations, Mathematical Analysis of Non-Recursive and Recursive Algorithms.

Unit II

Divide and Conquer Method: Introduction and its Examples such as Finding the Maximum and Minimum, Binary Search, Merge Sort, Quick Sort and Strassen's Matrix Multiplication.
Greedy Method: Introduction, Characteristics, Examples of Greedy Methods such as Single-Source Shortest Paths, Minimum Cost Spanning Trees: Prim's and Kruskal's Algorithm, Knapsack Problem, Dijkstra's Single Source Shortest Path Algorithm, Optimal Storage on Tapes.

Unit III

Dynamic Programming: Introduction, The Principle of Optimality, Examples of Dynamic Programming Methods such as – 0/1 Knapsack, Traveling Salesman Problem, Floyd-Warshall's All Pairs Shortest Path, Longest Common Subsequence and Reliability Design, Matrix Chain Multiplication.

Unit IV

Backtracking: Concept and its Examples like 4-Queens Problem, Knapsack problem Hamiltonian Circuit Problem, Graph Coloring Problem etc.
Branch & Bound: Introduction and its Examples like - Traveling Salesperson Problem etc.
NP-Completeness: Introduction, Class P and NP, Polynomial Reduction, NP-Hard and NP-Complete Problems.

Unit V

Algorithms in Machine Learning and Data Science: Gradient Descent and Stochastic Gradient Descent. Parallel and Distributed Algorithms: MapReduce. Algorithms in Blockchain: Proof-of-Work and Proof-of-Stake Algorithms. Quantum Algorithms: Quantum Search Algorithms (Grover's Algorithm).

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RECOMMENDED BOOKS

1. Fundamentals of Computer Algorithms, Horowitz & Sahani, Universities press.
2. Introduction to Algorithms, Coremen Thomas, Leiserson CE, Rivest RL, PHI.
3. Design & Analysis of Computer Algorithms, Ullmann, Pearson.
4. Algorithm Design, Michael T Goodrich, Robarto Tamassia, Wiley India.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1	Analyze algorithm complexity using asymptotic notations.
CO2	Implement divide & conquer and greedy algorithmic approaches for problem solving.
CO3	Develop dynamic programming solutions for optimization problems.
CO4	Solve problems using backtracking and branch & bound, and classify problems under NP, NP-Complete, and NP-Hard.
CO5	Explore algorithms used in machine learning, blockchain, distributed systems, and quantum computing.

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	2			1		1	1	3	2
CO2	3	3	3	3	2	2			1		1	1	3	2
CO3	3	3	3	3	3	2		1	2	2	1	3	3	3
CO4	3	3	3	3	3	2		1	2	2	1	3	3	2
CO5	3	3	3	3	3	3	3	1	3	2	3	3	3	2

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KNOWLEDGE REPRESENTATION AND REASONING (31242103)

COURSE OBJECTIVES

- To introduce the principles and techniques used in knowledge representation and inference in AI systems.
- To familiarize students with formal logic systems such as propositional and predicate logic.
- To understand reasoning techniques like rule-based, probabilistic, and non-monotonic reasoning.

Unit I

Introduction to Knowledge Representation: Introduction to KRR in AI, Types of knowledge: Declarative, Procedural, Meta-knowledge, KR properties: Representational adequacy, Inferential adequacy and efficiency, Overview of KR languages, Syntax and semantics of propositional logic.

Unit II

Predicate Logic and Rule-Based Systems: First-order predicate logic: syntax and semantics, Unification and resolution, Forward and backward chaining, Rule-based systems and inference engines, Production systems and expert systems.

Unit III

Structured Representation: Semantic networks and inheritance, Frames and scripts, Conceptual dependency theory, Ontologies: construction and usage, Description Logics.

Unit IV

Reasoning Paradigms: Non-monotonic reasoning: default logic, circumscription, Probabilistic reasoning: Bayesian networks, Fuzzy logic and reasoning, Truth maintenance systems (TMS), Case-based reasoning.

Unit V

Current Trends and Technological Advancements in KRR: Knowledge Graphs (e.g., Google Knowledge Graph, DBpedia, Wikidata), Ontology alignment and reasoning using OWL/RDF, Neural-symbolic integration and differentiable reasoning, Large Language Models (LLMs) and implicit knowledge representation, KRR in real-world applications: intelligent agents, chatbots, robotics.

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RECOMMENDED BOOKS

1. Ronald Brachman and Hector Levesque, Knowledge Representation and Reasoning, Morgan Kaufmann, 2004.
2. Elaine Rich and Kevin Knight, Artificial Intelligence, McGraw-Hill, 3rd Edition, 2010.
3. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson, 4th Edition, 2021.
4. John F. Sowa, Knowledge Representation: Logical, Philosophical, and Computational Foundations, Brooks/Cole, 2000.
5. Frank van Harmelen, Vladimir Lifschitz, and Bruce Porter (Eds.), Handbook of Knowledge Representation, Elsevier, 2007.

COURSE OUTCOMES

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

CO1: Explain the foundational concepts of knowledge representation and use propositional logic to model basic knowledge and inference.

CO2: Apply first-order predicate logic and implement rule-based reasoning methods.

CO3: Design structured knowledge representations using semantic networks, frames, and ontologies.

CO4 Evaluate and implement reasoning techniques under uncertainty using non-monotonic, probabilistic, and fuzzy logic.

CO5: Assess modern advancements in KRR, including neural-symbolic systems, knowledge graphs, and their applications in real-world AI systems.

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

Centre for Artificial Intelligence
CONTROL SYSTEMS
(24242103)

COURSE OBJECTIVES

- To understand fundamental concepts of control systems and mathematical modeling of the system.
- To understand the concepts of time response and frequency response analysis of Control Systems.
- To understand the concepts of state variable models, controllability and observability as applicable to linear time invariant systems

Unit I

Introduction to Laplace Transformation, Control system modeling: Basic Elements of Control System, Open loop and Closed loop systems, Transfer function, Modelling of Electric systems, Translational and rotational mechanical systems, Block diagram reduction Techniques, Signal flow graph.

Unit II

Time response analysis: Standard test signals, time response of first order systems, Impulse and Step Response analysis of second order systems, time domain specifications, steady state response, steady state errors and error constants, effects of P, PI, PD and PID.

Unit III

Stability analysis: stability, Routh-Hurwitz Criterion, Root Locus Technique, Construction of Root Locus, effects of adding poles and zeros to G(s)H(s) on the root loci.

Unit IV

State variable analysis: State space representation of Continuous Time systems, State equations, Transfer function from State variable representation, Solutions of the state equations, canonical variable diagonalization, system analysis by transfer function and state space methods for continuous systems. Concept of controllability and observability, design of state feedback controllers, Pole placement by state feedback, set point tracking controller, Compensators – Lead, Lag, and Lead Compensators.

Unit V

Intelligent Control Systems, Model Predictive Control (MPC), Adaptive and Self-Tuning Controllers, Control in Autonomous Systems, Cyber-Physical Systems (CPS) and Networked Control Systems (NCS), Data-Driven and Machine Learning-Based Control.

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RECOMMENDED BOOKS

1. Automatic control systems, Benjamin. C. Kuo, Prentice Hall of India.
2. Modern Control Engineering, Kotsuhiko Ogata, Prentice Hall of India.
3. Control Systems Engineering, I.J. Nagrath & M. Gopal, New Age Pub. Company.
4. Control System – Principles and Design, M. Gopal, Tata McGraw Hill.
5. Feedback and Control Systems, Schaum's Outline Series, Tata McGraw Hill.
6. Digital Control and State Variable Methods, M. Gopal, Tata Mcgraw Hill.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1: Explain Laplace transforms, control system modeling, and block diagram simplification.
CO2: Analyze time response of systems and evaluate P, PI, PD, and PID controller effects.
CO3: Examine system stability using Routh-Hurwitz and construct root locus plots.
CO4 Develop state-space models and design controllers using controllability and observability.
CO5: Explore intelligent, adaptive, and machine learning-based control techniques.

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	1	1	1	1	1	1	1	2	2	2
CO2	3	3	2	2	1	1	1	1	1	1	1	2	2	3
CO3	3	3	3	2	2	1	1	1	2	1	1	2	2	3
CO4	3	3	3	2	2	1	1	1	2	2	2	2	3	3
CO5	2	2	3	2	3	2	2	1	2	2	2	3	3	3

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DATABASE MANAGEMENT SYSTEM

(27242103/ 28242103)

COURSE OBJECTIVES

- To understand the different issues involved in the design and implementation of a database system.
- To study the physical and logical database designs, database modelling, relational, hierarchical and network models.
- To understand and use data manipulation language to query, update and manage a database.

Unit I

DBMS: Database Approach v/s Traditional File Approach, Advantages of Database System, Database Users and Administrator, Database System Environment, Application Architectures, Schemas, Instances, Data Independence, Data Models: Hierarchical Data Model, Network Data Model & Relational Data Model, Comparison between Models. Entities and Relationship Model: Entity types, Entity sets, Attributes and Keys, Relationship Types and Sets, Constraints, Design issue, E-R Diagram, Weak Entity Sets.

Unit II

Relational Model: Structure of Relational Databases: Relation, Attribute, Domain, Tuples, Degree, Cardinality, Views, Database Relations, Properties of Relations, Attributes, Keys, Attributes of Relation, Domain Constraints, Integrity Constraints. Relational Algebra: Concepts and Operations: Select, Project, Division, Intersection, Union, Division, Rename, Join etc.

Unit III

SQL: Purpose of SQL, Data Definition Language (DDL) Statements, Data Manipulation Language (DML) Statements Update Statements & Views in SQL, Data Control Language (DCL), Triggers.
Relational Database Design: Purpose of Normalization, Data Redundancy and Update Anomalies, Functional Dependency, Process of Normalization, Various Normal Forms: 1NF, 2NF, 3NF, BCNF, Decomposition, Desirable Properties of Decomposition: Dependency Preservation, Lossless Join, Problems with Null Valued & Dangling Tuple, Multivalued Dependencies.

Unit IV

Transaction Management: Transaction Concept, Transaction State, Concurrent Executions, Serializability: Conflict and View Serializability, Concurrency Control: Lock-Based Protocol, Recovery: Log-Based Recovery.

Unit V

Big Data and Distributed Databases: CAP theorem, eventual consistency, sharding. NoSQL and NewSQL Databases: Document (MongoDB), Key-Value (Redis), Column-family (Cassandra), Graph (Neo4j), Google Spanner, CockroachDB. Real-Time Data Processing and Streaming

Databases: Apache Kafka, Apache Flink.

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RECOMMENDED BOOKS

1. Database System Concepts, Abraham Silberschatz Henry F. Korth S. Sudarshan, McGraw-Hill 6th Edition.
2. Database Management System, Raghu Ramakrishnan Johannes Gehrke, McGraw Hill 3rd Edition.
3. Fundamentals of Database System, Elmasri & Navathe, Addison-Wesley Publishing, 5th Edition.
4. An Introduction to Database Systems, Date C. J, Addison-Wesley Publishing, 8th Edition.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1	Differentiate between traditional file systems and the database approach.
CO2	Construct relational schemas and demonstrate the use of relational algebra operations to query and manipulate relational data.
CO3	Develop SQL queries for data definition, manipulation, and control, and analyze relational schemas for normalization.
CO4	Examine transaction processing concepts and analyze concurrency control and recovery mechanisms in database systems.
CO5	Compare traditional RDBMS with modern distributed and NoSQL databases, and evaluate their suitability for real-time data processing scenarios.

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

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COMPUTER NETWORKS

(31242104/ 24242104/ 27242104/ 28242104)

COURSE OBJECTIVES

- Familiarize the student with the basic taxonomy and terminology of the computer networking.
- Provide detailed knowledge about various layers, protocols and devices that facilitate networking.
- Enable Students to deal with various networking problems such as flow control, error control and congestion control.

Unit I

Network Standardization- OSI Reference Model & TCP/IP Reference Model. Performance Criteria- Bandwidth, Throughput, Propagation Time & Transmission Time.
Physical Layer: Network Topologies- Bus, Ring, Star & Mesh, Switching- Circuit Switching, Message Switching & Packet Switching, Multiplexing: FDM – Frequency Division Multiplexing, WDM – Wavelength Division Multiplexing & TDM – Time Division Multiplexing.

Unit II

Data Link Layer: Introduction, Design Issues, Services, Framing, Error Control, Flow Control, ARQ Strategies, Error Detection and Correction, Parity Bits, Cyclic Redundancy Code (CRC), Hamming Codes, MAC Sub Layer- The Channel Allocation Problem, Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, IEEE 802.3, IEEE 802.4 and IEEE 802.5.

Unit III

Network Layer & Transport Layer: Introduction, Design Issues, Services, Routing- Distance Vector Routing, Hierarchical Routing & Link State Routing, Shortest Path Algorithm- Dijkstra's Algorithm & Floyd–Warshall's Algorithm, Flooding, Congestion Control- Open Loop & Closed Loop Congestion Control, Leaky Bucket & Token Bucket Algorithm. Connection Oriented & Connectionless Service, IP Addressing.

Unit IV

Presentation, Session & Application Layer: Introduction, Design Issues, Presentation Layer- Translation, Encryption- Substitutions and Transposition Ciphers, Compression- Lossy and Lossless. Session Layer – Dialog Control, Synchronization. Application Layer- Remote Login, File Transfer & Electronic Mail.

Unit V

Software-Defined Networking (SDN), Edge and Fog Computing in Networking, Quantum Networking (Introductory Concepts), Zero Trust Architecture (ZTA), Next-Generation Internet Protocols: Segment Routing, Multipath TCP (MPTCP), QUIC.

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RECOMMENDED BOOKS

1. Data Communication and Networking, Behrouz A. Forouzan, McGraw Hill.
2. Computer Networks, Andrew S. Tanenbaum, Pearson Education India.
3. Computer Networks and Internets, Douglas E. Comer, Pearson India.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1	Illustrate network topologies, switching and multiplexing techniques.
CO2	Analyze data link layer protocols for error control and channel access.
CO3	Apply routing algorithms and congestion control mechanisms, and differentiate between connection-oriented and connectionless transport services.
CO4	Describe the functions and services of presentation, session, and application layers.
CO5	Summarize emerging networking technologies and evaluate the advantages of next-generation internet protocols.

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	1	1	1	1	1	1	1	2	2	2
CO2	3	3	2	2	2	1	1	1	1	1	1	2	2	2
CO3	3	3	3	2	2	1	1	1	2	2	2	2	3	3
CO4	2	2	2	1	1	1	1	1	1	1	2	2	3	3
CO5	2	2	2	2	3	2	2	1	2	2	2	3	3	3

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OPERATING SYSTEMS

(31242105/ 24242105/ 27242105/ 28242105)

COURSE OBJECTIVES

- To provide basic knowledge of computer operating system structures and functioning.
- To compare several different approaches to memory management, file management and process management.
- To understand various problems related to concurrent operations and their solutions.

Unit I

Basics of Operating System: Generations, Types, Structure, Services, System Calls, System Boot, System Programs, Protection and Security.

Process Management: Process Concepts, Process States, Process Control Block, Scheduling-Criteria, Scheduling Algorithms and their Evaluation, Threads, Threading Issues.

Unit II

Process Synchronization: Background, Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors.

Deadlock: System Model, Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery from Deadlock.

Unit III

Memory Management: Main Memory, Swapping, Contiguous Memory Allocation, Paging, Structure of Page Table, Segmentation, Virtual Memory, Demand Paging, Page Replacement Algorithms, Allocation of Frames, Thrashing.

Unit IV

Storage Management: Mass-Storage Structure, Overview, Disk Structure, Disk Attachment, Disk Scheduling.

File System Interface: The Concept of a File, Access Methods, Directory Structure, File System Structure, Allocation Methods, Free-Space Management.

Unit V

Containerization and Operating System-Level Virtualization, Kubernetes and Container Orchestration, Secure Boot, Trusted Execution Environments, OS-level sandboxing and isolation, Microkernel and Exokernel Architectures, GPU/TPU scheduling and driver integration, Lightweight OS (KaiOS, Tizen, PostmarketOS).

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RECOMMENDED BOOKS

1. Operating System Concepts, Silberschatz, Ninth Edition, Wiley Publication.
2. Operating Systems, internals and Design Principles, Stallings, Seventh Edition, Pearson Publication.
3. Modern Operating Systems, Tanenbaum, Fourth Edition. Pearson Publication.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1	Describe the fundamental concepts and services of operating systems
CO2	Demonstrate solutions to process synchronization problems and analyze different approaches to deadlock detection, avoidance, and recovery.
CO3	Apply memory management techniques, and evaluate page replacement algorithms.
CO4	Analyze different file systems, storage structures, allocation mechanisms and free-space management methods.
CO5	Evaluate the impact of modern OS-level technologies on performance and security.

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

Centre for Artificial Intelligence
CYBER SECURITY
(31242111/ 24242111/ 27242111/ 28242111)

COURSE OBJECTIVES

- To introduce the basic concepts of cybersecurity.
- To make students aware of various types of cyber threats, vulnerabilities, security policies and cybersecurity tools.
- To build basic skills for protecting information systems.

Unit I

Introduction to Cyber Security: Overview of Cyber Security, Goals of Cyber Security (Confidentiality, Integrity, Availability), Types of cyber attacks: Phishing, Malware, Ransomware, Social Engineering, Malicious Softwares. Hacker and its types. Real-world incidents and their impact, Cyber Ethics and Legal Aspects.

Unit II

Basics of Networking: Internetworking devices, Topologies OSI and TCP/IP models, IP address, DNS, TCP, IP, HTTP, HTTPS, Web Browser, Web Server.

Unit III

Security Mechanisms: Firewalls, Anti-virus, Intrusion Detection Systems (IDS), Intrusion Prevention Systems (IPS), Encryption and Decryption: Symmetric and Asymmetric, Cryptanalysis, Digital Signature, Authentication: Passwords, Biometrics, Multi-Factor Authentication.

Unit IV

System and Application Security: Operating System security basics. Securing mobile devices and apps. Web application vulnerabilities: SQL Injection, XSS, CSRF. Secure coding practices.

Cybercrime, Forensics, and Incident Response: Types of cybercrimes: Identity Theft, Financial Fraud, Cyberbullying. Basics of digital forensics. Cyber law and IT Act (India) overview. Incident response lifecycle and reporting.

Unit V

Cyber Hygiene and Best Practices: Cyber hygiene: Safe browsing, regular updates, backups. Strong password creation and management. Social media safety. Roles of individuals and organizations in ensuring security.

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RECOMMENDED BOOKS

1. "Cybersecurity for Beginners" by Raef Meeuwisse – Wiley
2. "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives" by Nina Godbole and Sunit Belapure – Wiley India
3. "Computer Security: Principles and Practice" by William Stallings and Lawrie Brown – Pearson
4. "Introduction to Cyber Security" by Chwan-Hwa (John) Wu and J. David Irwin – CRC Press
5. "Cybersecurity Essentials" by Charles J. Brooks, Christopher Grow, Philip Craig, Donald Short – Wiley

COURSE OUTCOMES

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

CO1: Describe fundamental concepts of cyber security and identify common cyber threats and legal implications.
CO2: Explain basic networking concepts.
CO3: Demonstrate common security mechanisms used to protect digital data.
CO4 Analyze cybercrime scenarios and vulnerabilities in systems, and outline procedures for incident response and digital forensics.
CO5: Formulate cyber hygiene strategies and practice safe online behavior to minimize cyber risks.

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

Experiment list/ Lab manual for all the Laboratory Courses and Macro Project-I to be offered in B. Tech. III 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)

Recommended in the Board of Studies Meeting of Centre for Artificial Intelligence held on 06 June, 2025

Centre for Artificial Intelligence

PROBLEM SOLVING THROUGH PYTHON PROGRAMMING
(31242106/ 24242106/ 27242106/ 28242106)

List of Programs

1. Display “Hello, World!”
2. Take user input and print it
3. Perform arithmetic operations (add, subtract, multiply, divide)
4. Convert Celsius to Fahrenheit
5. Swap two variables
6. Check if a number is even or odd
7. Find the largest of three numbers
8. Check if a year is a leap year
9. Print multiplication table of a number
10. Compute the factorial of a number (iterative and recursive)
11. Generate Fibonacci series
12. Check if a number is prime
13. Find sum of digits of a number
14. Reverse a number
15. Find the largest and smallest element in a list
16. Count even and odd numbers in a list
17. Remove duplicates from a list
18. Sort a list without using built-in sort
19. Find the frequency of elements in a tuple
20. Convert list to tuple and vice versa
21. Perform set operations: union, intersection, difference
22. Check subset and superset
23. Count the frequency of characters in a string
24. Sort dictionary by key or value
25. Merge two dictionaries
26. Implement a calculator using functions
27. Recursive program for GCD and LCM
28. Recursive function for binary search
29. Lambda function usage examples (sorting, filtering)
30. Remove all punctuation from a string
31. Find the longest word in a sentence
32. read and write to a text file and count the number of lines, words, and characters in a file
33. Copy contents from one file to another using Python
34. Find and replace a word in a file using Python
35. Create a class and object
36. Demonstrate constructor and destructor
37. Implement inheritance
38. Override methods in derived class
39. Handle divide-by-zero error and file-not-found error in Python

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COURSE OUTCOMES

After completion of the course students will be able to:

CO1: Apply control structures and functions to solve computational problems.
CO2: Develop programs using data types such as lists, tuples, sets, and dictionaries.
CO3: Implement file handling, exception handling, and modular programming practices.
CO4: Use object-oriented programming concepts to build modular and reusable Python code.

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

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DESIGN & ANALYSIS OF ALGORITHMS LAB

(31242107/ 24242107/ 27242107/ 28242107)

List of Programs

1. Program to calculate time complexity of different sorting algorithms
2. Implement and compare iterative vs recursive Fibonacci computation
3. Measure execution time of basic operations (e.g., searching in arrays)
4. Implement Merge Sort and Quick Sort
5. Implement Binary Search (recursive and iterative)
6. Find Maximum and Minimum in an array using divide and conquer
7. Design and implement solution of following problems using Greedy Algorithms:
    a. Fractional Knapsack Problem
    b. Activity Selection Problem
    c. Huffman Coding
    d. Job Sequencing with Deadlines
    e. Minimum Spanning Tree: Kruskal's and Prim's algorithms
8. Design and implement solution of following problems using Dynamic Programming Approach:
    a. 0/1 Knapsack Problem
    b. Longest Common Subsequence (LCS)
    c. Matrix Chain Multiplication
9. Traverse a graph using Depth-First Search (DFS) and Breadth-First Search (BFS) algorithms.
10. Find a single source shortest path, in a weighted graph, using Dijkstra's Algorithm.
11. Find all-pair shortest paths, in a weighted graph, using Floyd-Warshall Algorithm.
12. Implement the classic word count problem using the MapReduce framework.
13. Implement gradient descent to minimize MSE for a linear regression problem.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1: Apply algorithmic design techniques to solve computational problems.
CO2: Solve real-world problems using different algorithmic design approaches.
CO3: Evaluate algorithm efficiency and understand computational intractability.

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

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MACRO PROJECT-I

(31242109/ 24242109/ 27242109/ 28242109)

List of Programs

1. Design an ER-diagram for the following:
    a. Library Management System
    b. Online Shopping Database
    c. Examination Result Processing System
2. Design a Student Marksheet System
3. Implement Contact Book using Dictionary
4. Design and implement To-Do List CLI Tool
5. Create a simple Quiz Game
6. Develop a basic ATM Simulator.
7. Develop a Personal Finance Tracker to track income/expenses using Python.
8. Design a Text Analyzer (counts frequency, finds longest word, etc.).
9. Design a Real-Time Chat Application (Console/GUI) using Python sockets or Flask for communication.
10. Create a system which implements route optimizer using Dijkstra algorithm.
11. Create an exam scheduling system using Graph Coloring
12. Develop a File Compressor using Huffman Coding
13. Create an Auto-Correct or Spell Checker using Edit Distance
14. Implement Backup and recovery handling in DBMS.
15. Design a Smart Parking System using algorithmic slot allocation (first-fit, best-fit), user booking via Python interface, and DB to track occupancy.
16. Create an Auction System with Bid Optimization to track users and bids in DB; applies greedy algorithms for winner selection based on utility or price/time factors.
17. Develop a Real-Time Voting App with Conflict Resolution using python and uses Paxos/Raft-inspired algorithm to ensure vote consistency across distributed systems (can simulate using threads).

Note: use SQL at the backend for storing data.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1: Develop database-driven applications using SQL.

CO2: Implement algorithmic solutions using Python for computational and optimization problems.

CO3: Integrate database and algorithmic logic in a cohesive application to solve real-world problems.

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

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ANNEXURE-III

List of Courses for Self-learning/Presentation to be offered from SWAYAM/NPTEL/MOOC based Platforms for B. Tech. III 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)

S.No	Course Name	Duration	link
1	Foundations of Cognitive Robotics	4 weeks	https://onlinecourses.nptel.ac.in/noc25_me126/preview
2	Gender Justice and Workplace Security	4 weeks	https://onlinecourses.nptel.ac.in/noc25_mg131/preview
3	Mobile Virtual Reality and Artificial Intelligence	4 weeks	https://onlinecourses.nptel.ac.in/noc25_cs80/preview
4	Python for Data Science	4 weeks	https://onlinecourses.nptel.ac.in/noc25_cs104/preview

ANNEXURE-IV

List of Professional Certification Platforms and relating Certifications with Specific Domain/Areas of Certification for B. Tech. [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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List of Professional Certification Courses			
S. No.	**Course Name**	**Duration**	**Link**
1	IBM Full Stack Software Developer Professional Certificate	5 month	https://www.coursera.org/professional-certificates/ibm-full-stack-cloud-developer?utm_source=chatgpt.com#courses
2	Meta Android Developer Professional Certificate	7 weeks	https://www.coursera.org/professional-certificates/meta-back-end-developer
3	Certified Ethical Hacker (CEH)	6 month	https://www.eccouncil.org/train-certify/certified-ethical-hacker-ceh/#section_course_info
4	Oracle Cloud Infrastructure and Technology Exams	6 month	https://education.oracle.com/buy-exam
5	Oracle Cloud Applications DELTA Exams & OCI Multi Cloud Architect Associate Exam	6 month	https://education.oracle.com/buy-exam
6	Oracle Cloud Applications Exams	6 month	https://education.oracle.com/buy-exam
7	Oracle Foundations Exams for Students	6 month	https://education.oracle.com/buy-exam
8	Red Hat System Administration - I/II	3 month	https://courses.networknuts.net/redhat-delhi-lp/?utm_source=google&utm_medium=cpc&utm_campaign=&utm_term=e_red%20hat%20certification&device=c&matchtype=e&adposition=&gad_source=1&gad_campaignid=12435426400&gbraid=0AAAAAD6LwPtvLsGetAR-znoaKueJj8CI4&gclid=Cj0KCQjwgIXCBhDBARIsAELC9ZiPiWYPwF3G8UACFKqLS-i5D4OTXdN5flJlYzihpuT5U_gJNlXokk8aAh4cEALw_wcB#
9	AWS Certified DevOps Engineer	6 months	https://aws.amazon.com/certification/certified-devops-engineer-professional/
10	AWS Certified Solutions Architect - Professional	6 months	https://aws.amazon.com/certification/certified-solutions-architect-professional/
11	IBM AI Engineering Professional Certificate	4 month	https://www.coursera.org/professional-certificates/ai-engineer
12	CS50's Introduction to Artificial Intelligence with Python	2 months	https://pll.harvard.edu/course/cs50s-introduction-artificial-intelligence-python

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List of Professional Certification Courses			
13	Microsoft AI & ML Engineering Professional Certificate	6 months	https://www.coursera.org/professional-certificates/microsoft-ai-and-ml-engineering
14	Generative AI Engineering with LLMs Specialization	3 months	https://www.coursera.org/specializations/generative-ai-engineering-with-llms
15	Deep Learning Specialization	6 weeks	https://www.coursera.org/specializations/deep-learning
16	Microsoft AI & ML Engineering Professional Certificate	6 months	https://www.coursera.org/professional-certificates/microsoft-ai-and-ml-engineering
17	Meta Back-End Developer Professional Certificate	7 weeks	https://www.coursera.org/professional-certificates/meta-back-end-developer