



MUSLIM ARTS COLLEGE

(Accredited by NAAC with B+ grade & Affiliated to Manonmaniam Sundaranar University,
Tirunelveli; Recognized US 2(f) 12 (B) of UGC Act.)

Thiruvithancode, Kanyakumari District, Tamil Nadu - 629174.

DEPARTMENT OF ARTIFICIAL INTELLIGENCE

CBCS SYLLABUS

Learning Outcome-based Curriculum Framework for

ARTIFICIAL INTELLIGENCE (M.Sc.)

*Applicable for students admitted from June 2026 as per the Resolutions of the Academic Council Meeting held
on 01.06.2026*

Vision

- To achieve excellence in quality education and innovation by using advanced technologies, fostering collaboration, and contributing to academia, industry, and society.

Mission

- To develop skilled professionals in Artificial Intelligence and Data Science
- To provide quality and value-based education
- To promote innovation in computing, expert systems, and data-driven technologies
- To apply advancements in high-performance computing and modern technologies
- To enhance the learning experience and meet the expectations of stakeholders

Academic and Professional Attributes of the Graduates

1. **Advanced Knowledge in Artificial Intelligence and Data Science**
Demonstrate advanced knowledge of Artificial Intelligence, Machine Learning, Deep Learning, Data Science, Computer Vision, Natural Language Processing, and related computing disciplines.
2. **Analytical and Computational Problem-Solving Skills**
Analyze complex computational problems using logical reasoning, mathematical foundations, algorithms, and intelligent techniques to develop effective AI-based solutions.
3. **Programming and Technical Competence**
Exhibit proficiency in advanced programming languages, software development methodologies, AI frameworks, cloud computing platforms, databases, and modern development tools.
4. **Research, Innovation, and Critical Thinking**
Apply research methodologies, critical thinking, and innovative approaches to design, implement, and evaluate intelligent systems that address real-world challenges.
5. **Ethical and Responsible Artificial Intelligence Practice**
Demonstrate professional ethics, integrity, transparency, fairness, accountability, and awareness of legal, privacy, and societal implications in the development and deployment of AI technologies.
6. **Communication and Collaborative Skills**
Communicate technical concepts, research findings, and project outcomes effectively through oral, written, and digital media while working efficiently in multidisciplinary and multicultural teams.
7. **Leadership and Professional Competence**
Display leadership qualities, project management abilities, entrepreneurial mindset, and professional competence to contribute effectively in academia, research organizations, industry, and society.
8. **Digital Literacy and Technological Adaptability**
Adapt to rapidly evolving technologies by utilizing advanced AI tools, cloud computing, big data technologies, intelligent automation, and emerging computational paradigms.
9. **Global Perspective and Societal Responsibility**
Understand the global, environmental, ethical, and socio-economic impact of

Artificial Intelligence and develop sustainable, inclusive, and socially responsible AI solutions.

10. Lifelong Learning and Career Advancement

Engage in continuous learning, advanced research, professional certifications, higher studies, innovation, and entrepreneurship to remain competent in the rapidly evolving field of Artificial Intelligence.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEOs	Upon completion of the M.Sc. Artificial Intelligence Degree Programme, graduates are expected to	Mapping with Mission
PEO1	Demonstrate advanced knowledge in Artificial Intelligence, Machine Learning, Data Science, and related computing disciplines to develop intelligent solutions for complex real-world problems.	M1 & M2
PEO2	Design, develop, and implement innovative Artificial Intelligence models and intelligent systems using modern computational techniques, programming tools, and research methodologies.	M3 & M4
PEO3	Exhibit professional ethics, leadership, teamwork, effective communication, and social responsibility while addressing industrial, societal, and global challenges through Artificial Intelligence.	M2 & M5
PEO4	Pursue lifelong learning, advanced research, innovation, entrepreneurship, and continuous professional development to adapt to emerging Artificial Intelligence technologies and global industry needs.	M4 & M5

Programme Outcomes (POs)

POs	Upon completion of the M.Sc. Artificial Intelligence Degree Programme, students will be able to:	Mapping with PEOs
PO1: Advanced Disciplinary Knowledge	Demonstrate advanced knowledge of Artificial Intelligence, Machine Learning, Deep Learning, Data Science, Computer Vision, Natural Language Processing, and related computing disciplines to solve complex real-world problems.	PEO1
PO2: Critical Thinking and Problem Solving	Analyze complex computational problems, evaluate alternative AI techniques, and design intelligent, innovative, and evidence-based solutions using analytical reasoning.	PEO1, PEO2
PO3: Research and Innovation	Apply research methodologies, critical thinking, experimentation, and innovation to develop, evaluate, and optimize intelligent systems and AI-based applications.	PEO2, PEO4
PO4: Programming and Modern Tool Usage	Design, develop, and deploy AI applications using advanced programming languages, AI frameworks, cloud computing platforms, databases, and modern software development tools.	PEO1, PEO2

PO5: Data Analytics and Intelligent Decision Making	Apply statistical analysis, machine learning algorithms, data mining, and intelligent decision-support techniques for solving multidisciplinary problems.	PEO1,PEO2
PO6: Communication and Teamwork	Communicate technical concepts, research outcomes, and project findings effectively through oral, written, and digital media while working collaboratively in multidisciplinary teams.	PEO3
PO7: Ethics and Professional Responsibility	Demonstrate professional ethics, integrity, fairness, legal compliance, privacy awareness, and responsible Artificial Intelligence practices in research and industrial applications.	PEO3
PO8: Leadership and Entrepreneurship	Exhibit leadership, project management, innovation, and entrepreneurial skills for developing AI-enabled products, services, and technology-driven enterprises.	PEO3, PEO4
PO9: Societal and Global Perspective	Evaluate the societal, environmental, cultural, and global impact of Artificial Intelligence and develop sustainable, inclusive, and socially responsible AI solutions.	PEO3
PO10: Lifelong Learning	Engage in lifelong learning, higher education, professional certifications, research, and continuous skill enhancement to adapt to rapidly evolving Artificial Intelligence technologies.	PEO4

Programme Specific Outcomes (PSOs)

PSOs	Upon completion of the M.Sc. Artificial Intelligence Degree Programme, students will be able to:	Mapping with POs
PSO1	Advanced AI Solution Development: Apply advanced concepts of Artificial Intelligence, Machine Learning, Deep Learning, Data Science, and intelligent computing to design, develop, and deploy AI-based solutions for complex real-world problems.	PO1, PO2, PO4, PO5
PSO2	Intelligent System Design and Implementation: Design, implement, and evaluate intelligent systems using advanced programming languages, AI frameworks, cloud computing platforms, big data technologies, and modern software development tools.	PO1, PO2, PO3, PO5, PO8
PSO3	Research and Innovation in Artificial Intelligence: Conduct independent research, develop innovative AI models, publish scholarly work, and contribute to advancements in Artificial Intelligence, Data Science, Computer Vision, Natural Language Processing, and related domains.	PO2, PO3, PO5, PO10
PSO4	Professional Practice and Ethical AI: Develop secure, reliable, ethical, and socially responsible AI applications by integrating professional ethics, legal standards, teamwork, communication, and project management practices.	PO4, PO6, PO7, PO8, PO9
PSO5	Lifelong Learning and Emerging Technologies: Adapt to emerging technologies through lifelong learning, professional certifications, entrepreneurship, and continuous skill development to contribute effectively to academia, research, industry, and society.	PO3, PO8, PO9, PO10

Mapping of Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

POs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
PO1: Advanced Disciplinary Knowledge	3	3	1	3	3
PO2: Critical Thinking and Problem Solving	3	3	3	3	3
PO3: Research and Innovation	2	3	2	3	2
PO4: Programming and Modern Tool Usage	3	3	3	3	3
PO5: Data Analytics and Intelligent Decision Making	1	3	3	3	3
PO6: Communication and Teamwork	3	3	2	2	3
PO7: Ethics and Professional Responsibility	3	3	3	3	3
PO8: Leadership and Entrepreneurship	3	3	3	3	3
PO9: Societal and Global Perspective	2	3	2	3	3
PO10: Lifelong Learning	3	3	3	3	3

•3 – High Correlation

•2 – Moderate Correlation

•1 – Low Correlation

COURSES OFFERED

SEMESTER I

Course status	Course Code	Title of the Course	Credits	Hours / Week
Core 1	NMAI11	Artificial Intelligence & Expert Systems	4	5
Core 2	NMAI12	Design & Analysis of Algorithms	4	5
Core 3	NMAI13	Python Programming	4	4
Elective I	NEAI11	Fundamentals of cloud computing	4	4
Elective II	NEAI12	Fundamentals of cyber Security	4	4
Core Practical I	NMAIP1	Algorithm Lab using C++	2	4
Core Practical II	NMAIP2	Python Programming Lab	2	4
Total			24	30

SEMESTER I

CORE COURSE I: ARTIFICIAL INTELLIGENCE & EXPERT SYSTEMS

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
NMAI11	Core	Y	Y	-	Y	4	5	25	75	100

Pre-requisite

Basic idea and the concepts of Artificial Intelligence.

Learning Objectives

The course aims to:

1. To understand the basic concepts and principles of Artificial Intelligence
2. To learn various applications domains of AI
3. To study the concepts of Expert Systems

Course Outcomes (COs)

Upon successful completion of the course, students will be able to:

CO No.	Course Outcomes	BT Level
CO1	Delineate Artificial intelligence.	K1
CO2	Build knowledge about Expert systems.	K2
CO3	Understand the basics of knowledge representations	K2
CO4	Develop Expert Systems	K3,K4
CO5	Design a Fuzzy set for a given application	K5,K6

Bloom's Taxonomy Levels

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyse, K5 – Evaluate, K6 – Create

Course Content

Units	Contents	No. of Hours
I	Fundamentals of Artificial Intelligence : Introduction, A. I. Representation, Non-AI & AI Techniques, Representation of Knowledge, Knowledge Base Systems, State Space Search, Production Systems, Problem Characteristics, types of production systems, Intelligent Agents and Environments, concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation	15
II	Search Strategies : Uninformed Search: Formulation of real world problems, Breadth First Search, Depth First Search, Depth Limited	15

	Search, Iterative Deepening Depth First Search, Bidirectional Search, Comparison of Uninformed search Strategies Informed Search: Generate & test, Hill Climbing, Best First Search, A* and AO* Algorithm, Constraint satisfaction, Game playing: Minimax Search, Alpha-Beta Cutoffs, Waiting for Quiescence	
III	Knowledge Representation: Knowledge based agents, Wumpus world. Propositional Logic: Representation, Inference, Reasoning Patterns, Resolution, Forward and Backward Chaining. First order Logic: Representation, Inference, Reasoning Patterns, Resolution, Forward and Backward Chaining. Basics of PROLOG: Representation, Structure, Backtracking.	15
IV	Non Monotonic Reasoning Logics for Non Monotonic Reasoning, Semantic Nets, Statistical Reasoning, Fuzzy logic: fuzzy set definition and types, membership function, designing a fuzzy set for a given application. Probability and Bayes' theorem - Bayesian Networks.	15
V	Expert systems: Architecture of expert systems, Role of expert systems – Knowledge Acquisition – Meta knowledge, Heuristics. Typical expert systems – MYCIN, PROSPECTOR	15
	Total	75

S. No.	Text Book
1	Elaine Rich, Kevin Knight, Shivashankar B. Nair, "Artificial Intelligence." Tata McGraw Hill, 3 rd Edition
2	Stuart Russell & Peter Norvig: "Artificial Intelligence: A Modern Approach", Pearson Education, 2 nd Edition.
3	Donald A. Waterman: "A Guide to Expert Systems", Addison Wesley Publishing Company

S. No.	Reference Books
1	Ivan Bratko, "Prolog Programming For Artificial Intelligence", 2 nd Edition Addison Wesley
2	Eugene Charniak, Drew McDermott, "Introduction to Artificial Intelligence", Addison Wesley
3	Patterson, "Introduction to AI and Expert Systems", PHI
4	Nilsson, "Principles of Artificial Intelligence", Morgan Kaufmann
5	Carl Townsend, "Introduction to Turbo Prolog"

Mapping with Programme Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	2	3	2	3	2	3	3	3
CO2	2	3	3	3	3	3	3	1	2	3
CO3	3	3	3	3	3	3	3	3	1	3
CO4	3	3	3	3	3	3	3	3	2	3
CO5	3	3	3	3	3	3	3	3	3	3

3 – Strong, 2 – Medium , 1 - Low

Mapping with Programme Specific Outcomes

CO /PO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Core 2: DESIGN AND ANALYSIS OF ALGORITHMS

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
NMAI12	Core	Y	Y	-	Y	4	5	25	75	100

Learning Objectives

The course aims to:

1. To understand fundamental concepts of Algorithm
2. To impart knowledge about Basic Traversal And Search Techniques and Problematic Design

3. To implement the linear and non-linear data structures

Course Outcomes

Upon successful completion of the course, students will be able to:

CO No.	Course Outcomes	BT Level
CO1	Understand and solve complex problems	K2
CO2	Select an appropriate algorithm for the problem	K2
CO3	Evolve as a competent programmer capable of designing and analyzing algorithms and data structures for different kinds of problems	K5
CO4	Classify problems in to complexity classes like P and NP.	K5,K6
CO5	Analyze graphs and determine shortest path	K4

Bloom's Taxonomy Levels

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyse, K5 – Evaluate, K6 – Create

Course Content

Units	Contents	No. of Hours
I	Introduction: Algorithm-Specification - Performance Analysis. Divide And Conquer - General Method - Binary Search - Find the Maximum and Minimum - Quick sort - Strassen's Matrix Multiplication	15
II	Representing rooted trees –Hash Tables: Direct-address tables, Hashtables,Hash functions - Open addressing, Perfect hashing – Binary Search Trees: Querying a binary search tree, Insertion and deletion, Randomly built binary search trees – Red-Black Trees: Properties of red-black trees, Rotations, Insertion, Deletion – B- Trees: Definition of B-trees, Basic operations, Deleting a key from a B-tree.	15
III	The Greedy Method: General Method - Knapsack Problem - Job Sequencing with Deadlines- Minimum Cost Spanning Tree - Single Source Shortest Path.Dynamic Programming: General Method-Multistage Graph-All Pairs Shortest Path -Optimal Binary Search Tree - 0/1 Knapsack- Travelling Sales person Problem	15
IV	Basic Traversal And Search Techniques: Techniques for Binary Trees – Techniques for Graphs-Connected Components and Spanning Trees-Bi-connected Components and DFS.Backtracking: General Method-8-Queen Problem, Sum of Subsets Graph Coloring: Hamiltonian Cycle.	15
V	Graph Algorithms: Representation of Graphs, Breadth first search, Depth first search, Topological sort.Minimum Spanning Trees: Algorithms of Kruskal and Prim – Single Source Shortest Path: The Bellman-Ford Algorithm, Single source shortestpathindirectedacyclicgraphs,Dijkstra'salgorithmAllpairsShortest Path: Shortest path and Matrix Multiplication, The Floyd-Warshall algorithm – Johnson's algorithm for sparse graphs	15
	Total	75

S. No.	Text Books
1	Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", 2nd Edition, Universities Press(India) Private Ltd.,2018.
2	Aho, Hopcroft and Ullman, "The Design and Analysis of Computer Algorithm", Pearson Education, Delhi, 2001.
3	Basu S.K., "Design Methods and Analysis of Algorithms", PHI, 2006.

S. No.	Reference Books
1	M. A. Weiss, "Data Structures and Algorithm Analysis in C++", Pearson Education, Asia, 2013.
2	Sandeep Sen and Amit Kumar, "Design and Analysis of Algorithms: A contemporary perspective", Cambridge University Press, 2019.
3	Thomas S. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Third Edition, The MIT Press, Cambridge, Massachusetts, London, England.
4	Eric Bach and Jeffrey Shallit, "Algorithmic Number Theory: Efficient Algorithms", Vol.1: The MIT Press, Cambridge, Massachusetts, London, England

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
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Mapping with Programme Outcomes

C01	3	3	3	3	3	3	2	3	3	2
C02	2	3	3	3	2	2	3	3	3	3
C03	3	3	3	2	3	3	3	3	3	3
C04	3	3	3	3	3	3	3	3	3	3
C05	3	2	3	3	3	3	3	3	2	3

3 – Strong, 2 – Medium , 1 – Low

Mapping with Programme Specific Outcomes

CO /PO	PSO 1	PSO 2	PS O3	PSO 4	PSO 5
CO1	3	2	2	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	14	14	15	15
Weighted percentage of Course Contribution to POs	3.0	2.8.	2.8	3.0	3.0

Core 3 : PYTHON PROGRAMMING

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
NMAI13	Core	Y	-	-	Y	4	4	25	75	100

Learning Objectives

The course aims to:

1. To understand different data types in Python
2. To learn the different concepts in Python
3. To analyze Database Connectivity and Data Visualization

Course Outcomes

Upon successful completion of the course, students will be able to:

CO No.	Course Outcomes	BT Level
CO1	Create Arrays, Strings, Lists and Tuples	K6
CO2	Examine Dictionaries & Object Oriented Programming concepts in Python	K4
CO3	Understand Database Connectivity and Data Visualization	K2
CO4	Access Database with Python	K5
CO5	Use MySQL from Python	K3

Bloom's Taxonomy Levels

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyse, K5 – Evaluate, K6 – Create

Course Content

Unit	Contents	No. of Hours
I	INTRODUCTION: Introduction to Python: Features of Python – Writing the First Python Program – Executing a Python Program – Datatypes in Python – Literals – Operators – Input and Output – Control Statements.	12
II	ARRAYS,STRINGS,FUNCTIONS AND TUPLES : Creating an Array – Indexing and Slicing on Arrays – Types of Arrays – Working with arrays using numpy- Slicing and Indexing in numpy Arrays – Working with Multi-dimensional Arrays – Indexing and Slicing the Multi-dimensional Arrays – Creating Strings – Indexing, Slicing and Comparing Strings – Finding and Counting Substrings – Splitting and Joining Strings – Defining and Calling a Function–Passby ObjectReference –AnonymousFunctionsorLambdas–Lists – Creating and Updating the Elements of a List – Methods to Process Lists –Creating Tuples – Functions to process Tuples – Inserting, Modifying and Deleting Elements from a Tuple.	12
III	DICTIONARIESANDINTRODUCTIONTOOOPS : Operations on Dictionaries – Dictionary Methods – Creating a Class – Types of Variables – Types of Methods – Constructors in Inheritance – Types of Inheritance – Operator Overloading – Method Overloading and Overriding – Interfaces in Python – Regular Expressions in Python.	12
IV	DATASTRUCTURES&GUI : Linked Lists – Stacks – Queues – Graphical User Interface: The Root Window – Working with Containers – Canvas – Frame – Widgets – Button Widget – Label Widget – Message Widget – Text Widget – Scrollbar Widget – Checkbutton Widget – Radiobutton Widget – Entry Widget – Listbox Widget – Menu Widget – Creating Tables – Sending a Simple Mail.	12
V	DATABASECONNECTIVITY& DATA SCIENCE : Database	12

	Connectivity: Types of Databases used with Python – Using MySQL from Python – Retrieving all rows from a Table – Inserting, Deleting and Updating rows in a Table – Creating Database Tables using Python Data Science using Python: Data Frame and Data Visualization	
	Total	60

S. No.	Text Books
1	Dr.R.Nageswara Rao, “Core Python Programming”, Second Edition, Dreamtech Press, 2019.

S. No.	Reference Books
1	Martin C. Brown, “The Complete Reference Python”, Indian Edition, Mc Graw Hill Education, 2018.
2	Yashavant Kanetkar, Aditya Kanetkar, “Letus Python”, Second Edition, BPB Publications, 2019

Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO1	3	3	3	3	3	3	3	3	2	3
CO2	2	3	3	3	2	3	3	3	3	2
CO3	3	3	3	2	3	3	3	3	3	3
CO4	3	3	3	3	3	2	3	3	3	3
CO5	3	2	3	3	3	3	3	3	3	3

3 – Strong, 2 – Medium, 1 - Low

Mapping with Programme Specific Outcomes

CO /PO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	3
CO2	3	3	3	2	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	14	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	2.8	3.0

Elective – I: Fundamentals of Cloud Computing

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
NEAI11	Elective - I	Y	-	-	Y	4	4	25	75	100

Learning Objectives

The course aims to:

- 1.To introduce the basic concepts and architecture of cloud computing.
- 2.To understand different cloud service and deployment models.
- 3.To familiarize students with cloud storage and virtualization.
- 4.To explore popular cloud platforms and their applications.
- 5.To understand cloud security and emerging trends.

Course Outcomes

Upon successful completion of the course, students will be able to:

CO No.	Course Outcomes	BT Level
CO1	Explain the fundamental concepts and benefits of cloud computing	K1& K2
CO2	Differentiate between cloud service models and deployment models.	K4
CO3	Describe virtualization, cloud storage, and cloud infrastructure.	K2
CO4	Identify the features of major cloud platforms and cloud-based applications.	K5
CO5	Discuss cloud security issues, data protection, and emerging trends in cloud computing	K6

Bloom's Taxonomy Levels

K1 – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyse, **K5** – Evaluate, **K6** – Create

Course Content

Unit	Contents	No. of Hours
I	Introduction to Cloud Computing : Basics of Cloud Computing, Evolution of Cloud Computing, Characteristics and Benefits of Cloud Computing ,Cloud Computing vs Traditional Computing ,Applications of Cloud Computing.	12
II	Cloud Service Models : Infrastructure as a Service (IaaS) ,Platform as a Service (PaaS), Software as a Service (SaaS), Cloud Deployment Models ,Public Cloud, Private Cloud ,Hybrid Cloud ,Community Cloud	12
III	Cloud Infrastructure : Introduction to Virtualization, Virtual Machines, Cloud Storage Concepts, Data Centers,Cloud Networking Basics.	12
IV	Cloud Platforms and Applications : Introduction to Amazon Web Services (AWS) ,Introduction to Microsoft Azure ,Introduction to Google Cloud Platform (GCP), Cloud-Based Applications, Cloud Collaboration Tools	12
V	Cloud Security and Future Trends : Basics of Cloud Security,Data Privacy and Protection, Backup and Disaster Recovery,Challenges in Cloud Computing Future Trends in Cloud Computing	12
	Total	60

S. No.	Text Books
1	RajkumarBuyya, Christian Vecchiola and S. ThamaraiSelvi, Mastering Cloud Computing, McGraw-Hill Education.

2	Barrie Sosinsky, Cloud Computing Bible, Wiley India
S. No.	Reference Books
1	Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Pearson.
2	Thomas Erl, Ricardo Puttini, Zaigham Mahmood, Cloud Computing: Concepts, Technology & Architecture, Pearson.
3	Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, Cloud Computing: A Practical Approach, McGraw-Hill.

Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO1	3	3	3	3	3	3	3	2	3	2
CO2	2	3	3	3	2	3	3	3	3	3
CO3	3	3	3	2	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	2	3	3
CO5	3	2	3	3	3	2	3	3	3	2

3 – Strong, 2 – Medium, 1 - Low

Mapping with Programme Specific Outcomes

CO /PO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	3
CO2	3	3	3	2	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	14	15

Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	2.8	3.0
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Elective – II: Fundamentals of Cyber Security

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
NEAI12	Elective - II	Y	-	-	Y	4	4	25	75	100

Learning Objectives

The course aims to:

1. Introduce the fundamental concepts and principles of cyber security.
2. Familiarize students with common cyber threats, attacks, and vulnerabilities.
3. Develop an understanding of network security, authentication, and access control mechanisms.
4. Explore data protection techniques, cyber laws, and ethical issues in cyber security.
5. Understand emerging cyber security technologies and best practices for securing digital systems.

Course Outcomes

Upon successful completion of the course, students will be able to:

CO No.	Course Outcomes	BT Level
CO1	Explain the basic concepts, principles, and importance of cyber security.	K1
CO2	Identify common cyber threats, vulnerabilities, and security mechanisms	K2
CO3	Apply authentication methods, encryption techniques, and data protection practices.	K3
CO4	Identify the features of major cloud platforms and cloud-based applications Understand cyber laws, ethical issues, and safe computing practices.	K5
CO5	Analyze emerging cyber security technologies and recommend appropriate security measures for modern digital systems.	K4

Bloom's Taxonomy Levels

K1 – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyse, **K5** – Evaluate, **K6** – Create

Course Content

Unit	Contents	No. of Hours
I	Introduction to Cyber Security: Introduction to Cyber Security, Need and Importance of Cyber Security, Information Security Concepts, Cyber Threats and Vulnerabilities, Types of Cyber Attacks, Cyber Security Challenges.	12
II	Network and System Security: Basics of Network Security, Firewalls and Intrusion Detection Systems, Malware: Viruses, Worms, Trojans, and Ransomware, Phishing and Social Engineering, Secure Communication, Network Security Best Practices.	12
III	Authentication and Data Protection: User Authentication Methods, Password Management, Multi-Factor Authentication (MFA), Encryption Fundamentals, Data Privacy and Protection, Backup and Recovery Techniques	12
IV	Cyber Laws and Ethical Practices: Introduction to Cyber Laws, Digital Signatures, Intellectual Property Rights, Cyber Ethics, Privacy Issues, Safe Internet Practices.	12
V	Emerging Trends in Cyber Security: Cloud Security, Artificial Intelligence in Cyber Security, Internet of Things (IoT) Security, Block chain and Cyber Security, Cyber Security Frameworks, Future Trends and Career Opportunities	12
	Total	60

S. No.	Text Book
1	Charles P. Pfleeger and Shari Lawrence Pfleeger, <i>Security in Computing</i> , 6th Edition, Pearson.
2	Nina Godbole and Sunit Belapure, <i>Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives</i> , Wiley India.

S. No.	Reference Books
1	William Stallings, <i>Network Security Essentials: Applications and Standards</i> , Pearson.
2	Michael E. Whitman and Herbert J. Mattord, <i>Principles of Information Security</i> ,

	Cengage Learning
3	Joseph MiggaKizza, <i>Guide to Computer Network Security</i> , Springer
4	Eric Maiwald, <i>Fundamentals of Network Security</i> , McGraw-Hill Education

MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES (POs)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	2	1	1	1	2	1	1	2	1
CO2	2	2	3	2	1	2	1	2	2	1
CO3	1	2	3	2	1	2	1	1	3	2
CO4	2	2	3	2	1	2	1	3	2	1
CO5	1	2	2	1	1	2	2	2	3	3

3 – Strong Correlation, 2 – Moderate Correlation, 1 – Low Correlation.

MAPPING OF COURSE OUTCOMES WITH PROGRAMME SPECIFIC OUTCOMES (PSOs)

CO / PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	1	1	1
CO2	2	2	3	2	1
CO3	1	2	3	2	1
CO4	2	2	3	2	1
CO5	1	2	2	1	1
Weightage	8	10	12	8	5
Weighted Percentage of Course Contribution to POs	1.6	2.0	2.4	1.6	1.0

3 – Strong Correlation, 2 – Moderate Correlation, 1 – Low Correlation

CORE PRACTICAL I: ALGORITHM LAB USING C++

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	CIA	External	Total
NMAIP1	Practical-I	-	-	Y	Y	2	4	50	50	100

Learning Objectives

The course aims to:

1. To develop programming skills by implementing fundamental algorithms using C++.
2. To understand and apply algorithm design techniques such as Divide and Conquer, Greedy Method, Dynamic Programming, Backtracking, and Graph Algorithms.
3. To implement and analyze searching, sorting, tree, graph, hashing, and shortest path algorithms for solving computational problems.
4. To enhance logical thinking, algorithm analysis, and problem-solving skills through practical programming exercises.

Course Outcomes

Upon successful completion of the course, students will be able to:

CO No.	Course Outcomes	BT Level
CO1	Demonstrate the implementation of fundamental algorithms and data structures using C++ to solve computational problems.	K2
CO2	Select and implement appropriate algorithm design techniques such as Divide and Conquer, Greedy, Dynamic Programming, and Backtracking for different problem domains.	K3
CO3	Analyze the efficiency and correctness of algorithms using appropriate data structures and complexity measures.	K4
CO4	Evaluate computational problems by implementing graph algorithms, tree traversals, hashing, postfix evaluation, and shortest path algorithms.	K5
CO5	Design and develop optimized algorithmic solutions for real-world problems using advanced programming and problem-solving techniques.	K6

Bloom's Taxonomy Levels

K1 – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyse, **K5** – Evaluate, **K6** – Create

Course Content

Contents

1. Implement Merge Sort, Heap Sort and Quick Sort algorithms.
2. Implement the knapsack problem (0/1).
3. Obtain the topological ordering of vertices in a given digraph
4. Greedy algorithm to find minimum number of coins to make change for a given value of Indian currency. Assume that we have infinite supply of denominations in Indian currency.
5. Implement Breadth First Search and Depth First search
6. Use Prim's Algorithm to find a minimum spanning tree.
7. Find shortest path using Dijkstra's algorithm.
8. Multiply two matrices recursively.
9. Find whether a string is a permutation of another given string.
10. Postfix evaluation
11. Binary tree traversal
12. Binary Search Tree
13. N queen problem
14. Hash table
15. Divide and conquer algorithm for binary search

MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES (POs)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	2	1	1	3	2	3	1	2
CO2	3	2	2	2	1	3	3	2	1	2
CO3	2	2	3	2	1	3	3	1	1	3
CO4	2	2	3	2	1	3	3	3	1	1
CO5	2	2	2	2	1	3	3	2	1	3

Mapping Scale

3 – Strong Correlation, 2 – Moderate Correlation, 1 – Low Correlation

MAPPING OF COURSE OUTCOMES WITH PROGRAMME SPECIFIC OUTCOMES (PSOs)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	1	2
CO2	3	2	1	1	2
CO3	2	3	2	1	3
CO4	2	3	3	1	3
CO5	2	3	2	2	3
Weightage	12	13	9	6	13
Weighted Percentage of Course Contribution to PSOs	2.4	2.6	1.8	1.2	2.6

Mapping Scale

3 – Strong Correlation, 2 – Moderate Correlation, 1 – Low Correlation

PYTHON PROGRAMMING LAB

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	CIA	External	Total
NMAIP2	Practical -II	-	-	Y	Y	2	4	50	50	100

Learning Objectives

The course aims to:

1. To develop programming skills using Python for solving computational and real-world problems.
2. To implement Python data structures, object-oriented programming concepts, and graphical user interface (GUI) applications.
3. To design and develop database-driven applications using Python and MySQL.
4. To perform data analysis and visualization using Python libraries for intelligent decision-making and AI applications.

Course Outcomes

Upon successful completion of the course, students will be able to:

CO No.	Course Outcomes	BT Level
CO1	Demonstrate proficiency in Python programming by implementing programs using fundamental data types, control structures, functions, arrays, strings, lists, tuples, and dictionaries.	K3
CO2	Develop Python applications using object-oriented programming concepts, graphical user interface (GUI) widgets, and regular expressions.	K4
CO3	Design and implement database-driven applications by performing Create, Read, Update, and Delete (CRUD) operations using Python and MySQL.	K5
CO4	Develop and manipulate data using Python DataFrames to perform data processing and analysis.	K6
CO5	Create meaningful data visualizations using Python libraries to analyze and communicate data effectively for intelligent decision-making.	K6

Bloom's Taxonomy Levels

K1 – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyse, **K5** – Evaluate, **K6** – Create

Course Content

Contents
1. Program to generate the FibonacciSeries. 2. Program to check whether the given number is prime or not. 3. Program to find the factorial of a given number using function. 4. Program using Arrays -Python program to sort the elements of an array in ascending order 5. Program using Strings-Program to Sort Words in Alphabetic Order 6. Program to perform various list operations, such as: • Append an element • Insert an element • Append a list to the given list • Modify an existing element • Delete an existing element from its position • Delete an existing element with a given value • Sort the list • Display the list. 7. Program using Tuples- Write a program to swap two numbers without using a temporary variable. 8. Program using Dictionaries - Write a program to count the number of times a character appears in a given string

9. Write a function to convert number in to corresponding number in words For eg, if the input is 876 then the output should be 'Eight Seven Six'.
10. Program using Inheritance.
11. Program using Interfaces.
12. Program using Regular Expressions.
13. Program to perform Stack Operations.
14. Program to perform Queue Operations.
15. Working with Widgets.
16. Program to Insert, Delete and Update in Database.
17. Program to create and perform operations using Data Frames.
18. Program to implement Data Visualization.

MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES (POs)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	2	1	3	3	2	3	2	3
CO2	3	2	2	2	3	3	2	3	3	2
CO3	2	2	3	2	3	3	3	3	3	3
CO4	2	2	3	2	3	3	3	3	3	3
CO5	2	2	2	2	3	3	3	3	3	3

3 – Strong Correlation, 2 – Moderate Correlation, 1 – Low Correlation

**MAPPING OF COURSE OUTCOMES WITH PROGRAMME SPECIFIC
OUTCOMES (PSOs)**

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	1	2
CO2	3	2	1	1	2
CO3	2	3	2	1	3
CO4	2	3	3	1	3
CO5	2	3	2	2	3
Weightage	12	13	9	6	13
Weighted Percentage of Course Contribution to PSOs	2.4	2.6	1.8	1.2	2.6

Mapping Scale

3 – Strong Correlation, **2** – Moderate Correlation, **1** – Low Correlation