



SEVA MANDAL EDUCATION SOCIETY'S
Dr. BHANUBEN MAHENDRA NANAVATI COLLEGE OF HOME SCIENCE
(Empowered Autonomous)
NAAC Re-accredited 'A+' Grade with CGPA 3.69/4 (3rd Cycle)
UGC Status: College with Potential for Excellence
Selected under "Enhancing Quality and Excellence in Select Autonomous College"
by Rashtriya Uchchatar Shiksha Abhiyan (RUSA)

STRUCTURE AND SYLLABUS OF SEMESTER V
(NEP 2020 GUIDELINES)

ACADEMIC YEAR-2025-2026

DEPARTMENT OF COMPUTER APPLICATIONS

STRUCTURE OF SEMESTER V

BACHELOR OF COMPUTER APPLICATIONS (BCA)

SN	Course Code	Courses	Type of Course	Credits	Theory	Practical	Marks
5.1	041UCAMJ051	Artificial Intelligence and Machine Learning	Major (Core)	4	3	1	100
5.2	041UCAMJ052	Computer Networks	Major (Core)	4	3	1	100
5.3	041UCAMJ053	C# Programming	Major (Core)	2	1	1	100
5.4	041UCAME054A / 041UCAME054B	Network Security / Data Science and Cloud Computing	Major Elective	4	4	-	50
5.5	041UCAMI055	Web Technology	Minor Stream	4	3	1	50
5.6	041UCAVS056	R Programming LAB	VSC	2	1	1	50
5.7	041UCACE057	Community Engagement Project	CEP	2	1	1	50
Total				22			550

5.1 Major (Core)

Course Code	Course	TC	Th C	Pr C	Int	Ext	Total
041UCAMJ051	Artificial Intelligence and Machine Learning	4	3	1	50	50	100

Course Title	Artificial Intelligence and Machine Learning
Course Credits	4
Theory Internal – External	4 Credits (Theory) 50 Marks (Internal) + 50 Marks (External)
Course Outcomes	Learners will be able to 1. Understand the characteristics of rational agents, and the environment in which they operate, and gain insights about problem-solving agents. 2. Gain insights about Uninformed and Heuristic search techniques, planning and handling uncertainty through probabilistic reasoning and fuzzy sets 3. Obtain a basic understanding of the AI domains and their applications and examine the legal and ethical issues of AI 4. Define and explain machine learning concepts, types, and basic metrics. 5. Implement and apply supervised learning techniques and unsupervised learning models 6. Develop and evaluate simple machine learning models (e.g., Perceptron, single layer neural networks).
Module 1 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to- 1. Learn the concepts of AI 2. Apply the various characteristics and concepts of Artificial Intelligence.
Content Outline	Introduction to AI: 1.1.Introduction: What is AI? Intelligent Agents: Agents and environment, the concept of Rationality, the nature of environment, the structure of Agents. Knowledge Based Agents: Introduction to Knowledge-Based Agents, The Wumpus World as an Example World. Problem-solving: Problem-solving agents

	1.2. Advanced Search Techniques: Uninformed Search: DFS, BFS, Iterative Deepening Search. Informed Search: Best First Search, A* search, AO* search. Adversarial Search & Games: Two player zero-sum games, Minimax Search, Alpha-Beta pruning. Constraints and Constraint Satisfaction Problems (CSPs), Backtracking search for CSP.
Module 2 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to 1. Study propositional logic and first-order predicate logic and use the technique to solve logical reasoning problems. 2. Develop and use fuzzy arithmetic tools in solving problems.
Content Outline	Logical Reasoning and Uncertainty 2.1.Logic: Propositional logic, First-order predicate logic, Propositional versus first-order inference, Unification and lifting. 2.2.Inference: Forward chaining, Backward chaining, Resolution, Truth maintenance systems. 2.3.Introduction to Planning: Blocks World problem, Strips. 2.4.Handling Uncertainties: Non-monotonic reasoning, Probabilistic reasoning, Introduction to Fuzzy logic.
Module 3 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to- 1. Define and explain machine learning concepts, types, and basic metrics. 2. Develop and evaluate simple machine learning models (e.g., Perceptron, single-layer neural network).
Content Outline	Introduction To Machine Learning 3.1.Introduction: Definition, History and Application of Machine Learning, Types of Machine Learning: Supervised, Unsupervised, Semi Supervised, and Reinforcement Learning. Labeled and Unlabeled Dataset. 3.2.Supervised Learning Tasks: Regression vs. Classification, 3.3.Learning Framework: Training, Validation and Testing of ML models. 3.4.Performance Evaluation Parameters: Confusion matrix, Accuracy, Precision, Recall, F1 Score, and AUC.

Module 4 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to 1. Implement and apply supervised learning techniques (e.g., KNN, Linear Regression, Logistic Regression). 2. Apply unsupervised learning methods (e.g., K-Means, Hierarchical Clustering, Association Rules)
Content Outline	Supervised Learning and Unsupervised Learning, Applications of ML 4.1.Regression: Linear and non-linear Regression, Logistic Regression. 4.2.Classification: Naïve Bayes, K-Nearest Neighbors, Decision Trees. 4.3.Linear model: Introduction to Artificial Neural Networks, Perceptron Learning Algorithm, Single Layer Perceptron, Introduction to Support Vector Machine for linearly separable data. 4.4.Clustering: K-Means, Hierarchical Clustering, DBSCAN, Clustering Validation Measures. 4.5.ML Applications: Ethical Considerations in Machine Learning, Case study and Real-world Applications.

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE)

Evaluation	Details	Marks
Internal	Unit test	25 marks
	Internal Assessments (Class test, Practical Test, Assignment, Presentation)	25 marks
Total		50 marks
External	Final Exam	50 marks
Total		100 marks

LIST OF PROGRAMS:

1. Demonstrate basic problem-solving using Breadth-First Search on a simple grid.
2. Implement Depth-First Search (DFS) on a small graph.
3. Solve the Water Jug Problem using Breadth First Search (BFS).
4. Implement a Hill Climbing search to find the peak in a numeric dataset.

5. Apply the A* Search algorithm to find the shortest path in a 4x4 grid.
6. Implement the Minimax search algorithm for 2-player games. You may use a game tree with 3 plies.
7. Solve the 4 – Queens Problem as a CSP backtracking problem.
8. Use constraint propagation to solve a Magic Square puzzle.
9. Apply optimization techniques to find the maximum value in a list.
10. Represent and evaluate propositional logic expressions.
11. Implement a basic rule-based expert system for weather classification.
12. Implement a basic AI agent with simple decision-making rules.
13. Implement a basic Rule-Based Chatbot.
14. Using Python NLTK, perform the following Natural Language Processing (NLP) tasks for text content.
 - a. Tokenizing
 - b. Filtering Stop Words
 - c. Stemming
15. Using Python NLTK, perform the following Natural Language Processing (NLP) tasks for text content.
16. Part of Speech tagging
17. Chunking
18. Named Entity Recognition (NER)
19. Implement linear regression on a dataset and visualize the regression line.
20. Implement logistic regression on a binary classification data set and plot the decision boundary.
21. Implement and evaluate the performance of Decision tree ID3/ Cart classifier for any given dataset.
22. Implement and evaluate the performance of the Naïve Bayes Classifier on a given dataset.
23. Build and evaluate an ensemble forest classifier using a numerical dataset.
24. Implement a support vector machine for linearly separable classes and visualize the margins and decision boundary.
25. Implement K-Means clustering on a point dataset and visualize and evaluate the clusters.
26. Implement hierarchical clustering on a dataset.
27. Implement DBSCAN clustering on a dataset and visualize and evaluate the clusters.
28. Perform Principal Components Analysis (PCA) and apply any one or more classifiers to show the performance variation with or without feature reduction.
29. Build a single layer perceptron model to classify AND, OR, and XOR problems (may use TensorFlow / Keras) and visualize their decision boundaries. Also evaluate its performance.
30. Demonstrate the concept of boosting using the Ada Boost algorithm.

TEXT BOOKS :

- 1) M.C. Trivedi, *A Classical Approach to Artificial Intelligence*, Khanna Book Publishing Company, 2024 (AICTE Recommended Textbook).
- 2) Nilsson Nils J, *Artificial Intelligence: A new Synthesis*, Morgan Kaufmann Publishers Inc. San Francisco, CA, ISBN: 978-1-55-860467-4.

- 3) Dan W Patterson, *Introduction to Artificial Intelligence & Expert Systems*, PHI Learning 2010.
- 4) Rajiv Chopra, *Data Science with Artificial Intelligence, Machine Learning and Deep Learning*, Khanna Book Publishing Company, 2024.
- 5) Rajiv Chopra (2024), *Machine Learning and Machine Intelligence*, Khanna Publishing House.
- 6) Jeeva Jose (2023), *Introduction to Machine Learning*, Khanna Publishing House.
- 7) Mitchell T. (1997). *Machine Learning*, First Edition, McGraw-Hill.
- 8) Kalita, J. K., Bhattacharyya, D. K. , & Roy, S. (2023). *Fundamentals of Data Science: Theory and Practice*. Elsevier.ISBN9780323917780

REFERENCE BOOKS:

- 1) M.C. Trivedi, *Introduction to AI and Machine Learning*, Khanna Book Publishing Company, 2024.
- 2) Russell, S. and Norvig, P., “Artificial Intelligence - A Modern Approach”, 3rd edition, Prentice Hall
- 3) Van Hirtum, A. & Kolski, C. (2020). *Constraint Satisfaction Problems: Algorithms and Applications*. Springer.
- 4) Flach, P. A. (2012). *Machine Learning: The Art and Science of Algorithms that Make Sense of Data*. Cambridge University Press. ISBN:9781107422223,2012.
- 5) Duda, R.O., Hart, P.E., Stork, D (2007). *Pattern classification* (2Ed), John Wiley & Sons, I SBN-13: 978-8126511167.
- 6) Haykin S. (2009). *Neural Networks and Learning Machines*, Third Edition, PHI Learning.
- 7) Chollet, F. (2018). *Deep Learning with Python*. Manning Publications.
- 8) Bishop, C. M. (2006). *Pattern Recognition and Machine Learning*. Springer.
- 9) Good fellow, I., Bengio, Y., & Courville, A. (2016). *Deep Learning*. MIT Press.
- 10) Géron, A. (2017). *Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems** (1st ed.). O'Reilly Media.

5.2 Major (Core)

Course Code	Course	TC	Th C	Pr C	Int	Ext	Total
041UCAMJ052	Computer Networks	4	3	1	50	50	100

Course Title	Computer Networks
Course Credits	4

Theory Internal – External	3 Credits (Theory) + 1 Credits (Practical) 50 Marks (Internal) + 50 Marks (External)
Course Outcomes	Learners will be able to
	1. Understand and explain Data communication system and its components.
	2. Basic Networking Knowledge: Familiarity with basic networking concepts such as IP addressing and network topologies.
	3. Enumerate the layers of the OSI model and TCP/IP model. Explain the functions of each layer.
	4. Understand the potentials of future networking
	5. Programming Skills: Ability to write basic network programs and scripts in languages such as Python or C
Module 1 (Credit)	
Learning Outcomes	This Module will help to understand the basics of networking, topologies and devices used in networking
Content Outline	Introduction to Computer Networks Overview of Computer Networks: Definition and Objectives, Applications and Examples Network Components and Architecture Network Models: OSI Model: Layers and Functions, TCP/IP Model: Layers and Functions Comparison between OSI and TCP/IP Models Network Topologies: Physical vs. Logical Topologies, Common Topologies: Star, Ring, Bus, Mesh, Hybrid, Advantages and Disadvantages of Each Topology Data Transmission: Analog vs. Digital Signals, Transmission Modes: Simplex, Half-Duplex, Full-Duplex, Bandwidth and Latency Networking Devices: Routers, Switches, Hubs, Bridges, Gateways, Functions and Configurations of Each Device.
Module 2 (Credit	

Learning Outcomes	This module will help to understand the wired and wireless transmission media, types of satellite communication and modulation techniques To understand the main challenges and methods at the network communication's physical layer. They will be able to differentiate between different transmission modes, recognize and evaluate a variety of transmission impairments, and describe how switching techniques work to effectively manage and direct data flow.
Content Outline	Physical Layer Transmission Media Magnetic Media, Twisted Pairs, Coaxial Cable, Power Lines, Fiber Optics, Wireless transmission media The Electromagnetic Spectrum, Radio Transmission, Microwave Transmission, Infrared Transmission, Light Transmission Communication Satellite Geostationary Satellites, Medium-Earth Orbit Satellites, Low-Earth Orbit Satellites, Satellites Versus Fiber Modulation and Multiplexing Baseband Transmission, Passband Transmission, Frequency Division Multiplexing, Time Division Multiplexing, Code Division Multiplexing Type of Data and signals Analog & Digital Data, Analog & Digital signals, Periodic & Non-periodic signals. Transmission Impairments – Attenuation, Delay Distortion & Noise, Channel capacity, Line Coding. Transmission Modes - Parallel & Serial Transmission, Asynchronous & Synchronous and Asynchronous Switching Techniques – Circuit, Message & Packet Switching 4.5 Physical layer devices – Repeaters, hubs – Active hub & Passive hub
Module 3 (Credit 1)	

Learning Outcomes	1. To understand the key design issues of the Data Link Layer, including services to the Network Layer, framing techniques, and mechanisms for error and flow control. 2. To explore and compare various random access protocols along with CSMA/CD and CSMA/CA. 3. To study the concept and working of channelization techniques and understand their practical applications. 4. To analyze the process of data representation, signal encoding/decoding, and generation of chip sequences in communication systems. 5. To understand the principles of congestion control in the Network Layer and explore various policies for its prevention and management. 6. To introduce the concept of routing and its importance in efficient data packet delivery across networks. 7. To study and apply different routing algorithms 8. To explore advanced routing techniques for scalable and efficient network communication. 9. To explore the future trends and advancements in networking with a focus on wireless technologies. 10. To understand the fundamentals of wireless networking, including standards like IEEE 802.11 (Wi-Fi) and Bluetooth. 11. Networks in various environments.
Content Outline	Data Link Layer Design Issues – Services provided to the Network Layer, Framing – Concept, Methods, Error and flow control Random Access Control Protocol ALOHA CSMA- 1- persistent, p-persistent and nonpersistent CSMA/CD, CSMA/CA Channelization FDMA, TDMA and CDMA Analogy, Idea, Chips, Data Representation, Encoding and Decoding, Signal Level, Sequence Generation Network Layer Congestion Control – Principles & Prevention Policies Routing – Introduction, Algorithms – Optimality Principle, Shortest path Algorithm, Flooding, Distance vector routing, Hierarchical routing, Broadcast routing, Multicast routing The future of Networking –

	Wireless Networking Understanding Wireless Networking – Ethernet 802.11 Wireless & Bluetooth, Using WiFi Technology, Implementing a Wireless Network Wireless Networks & Security, Bluetooth
Module 4 (Practical)	
Learning Outcomes	• Understand and configure fundamental network settings including IP addressing, subnetting, and gateways for effective communication. • Gain hands-on experience with core network protocols by implementing DNS resolution and basic HTTP applications using Python. • Develop skills in designing, simulating, and configuring network topologies using tools like Cisco Packet Tracer, while measuring and analyzing performance with diagnostic tools. • Strengthen knowledge of VLAN implementation, web server setup, basic network security practices, and troubleshooting techniques to ensure secure and reliable connectivity.
Content Outline	Configure Basic Network Settings: a) IP Address Configuration b) Subnet Mask and Gateway Settings 2. Implement Network Protocols: a) Write a simple Python script to perform DNS resolution. b) Implement a basic HTTP client-server application. 3. Network Simulation: a) Use network simulation tools (e.g., Cisco Packet Tracer) to design and simulate network topologies. b) Configure routers and switches in a simulated environment. 4. Performance Measurement: a) Measure network performance using tools like `ping`, `traceroute`, and `iperf`. b) Analyze network traffic using Wireshark.

	5. Implement VLANs: a) Configure VLANs on a switch and verify using simulation tools. 6. Set Up a Simple Web Server: a) Deploy a basic web server and configure HTTP/HTTPS access. 7. Network Security Lab: a) Implement basic firewall rules and VPN configurations. b) Perform vulnerability scanning and analyze results. 8. Network Troubleshooting: a) Diagnose and resolve common network issues. b) Use troubleshooting commands and techniques to fix connectivity problems.
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Assignments/Activities towards Comprehensive Continuous Evaluation (CCE)

Evaluation	Details	Marks
Internal	Unit test	25 marks
	Internal assessments (Practical test, class test)	25 marks
Total		50 marks
External	Final Exam	50 marks
Total		100 marks

TEXT BOOKS :

- 1 Andrew S. Tanenbaum, "Computer Networks", 5th Edition, Pearson Education, 2011.
- 2 James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach", 8th Edition, Pearson, 2021

REFERENCE BOOKS:

- 1 Behrouz A. Forouzan, "Data Communications and Networking", 5th Edition, McGraw-Hill Education, 2012.
- 2 Larry L. Peterson and Bruce S. Davie, "Computer Networks: A Systems Approach", 6th Edition, Morgan Kaufmann, 2019
- 3 Networking All In One Dummies Wiley Publication [5thEdition] , 2013

WEB RESOURCES

- Cisco Networking Academy - Online Courses and Resources
- NetworkLessons.com - Tutorials on Various Networking Topics

LAB PROGRAMS:

Configure Basic Network Settings:

a) IP Address Configuration

b) Subnet Mask and Gateway Settings

2. Implement Network Protocols:

a) Write a simple Python script to perform DNS resolution.

b) Implement a basic HTTP client-server application.

3. Network Simulation:

a) Use network simulation tools (e.g., Cisco Packet Tracer) to design and simulate network topologies.

b) Configure routers and switches in a simulated environment.

4. Performance Measurement:

a) Measure network performance using tools like `ping`, `tracert`, and `iperf`.

b) Analyze network traffic using Wireshark.

5. Implement VLANs:

a) Configure VLANs on a switch and verify using simulation tools.

6. Set Up a Simple Web Server:

a) Deploy a basic web server and configure HTTP/HTTPS access.

7. Network Security Lab:

a) Implement basic firewall rules and VPN configurations.

b) Perform vulnerability scanning and analyze results.

8. Network Troubleshooting:

a) Diagnose and resolve common network issues.

b) Use troubleshooting commands and techniques to fix connectivity problems.

5.3 Major (Core)

Course Code	Course	TC	Th C	Pr C	Int	Ext	Total
041UCAMJ053	C# Programming	2	-	2	25	25	50

Course Title	C# PROGRAMMING
Course Credits	2
Theory Internal – External	1 Credits (Theory) + 1 Credits (Practical) 25 Marks (Internal) + 25 Marks (External)
Course Outcomes	Learners will be able to - Understand .NET Framework features & architecture - Understand environment of the C# Programming - Develop small applications in C# programming
Module 1 (Credit 1)	
Learning Outcomes	Learners will be able to - Write various applications using C# Language in the .NET Framework - Debug, compile, and run a simple application
Content Outline	1] .NET Framework Overview Architecture, CIL or MSIL, CLR 2] Overview of C# programming 2.1) Literals, Variables, Data Types 2.2) Flow control 2.3) Operators - checked and unchecked operators 2.4) Casts - implicit and explicit casting 2.5) Expressions, Branching, Looping 3] Data Handling in C# Programming 3.1) Methods 3.2) Constant 3.3) Arrays, Array Class, Array List 3.4) String, StringBuilder 3.5) Structure, 3.6) Enumerations

	3.7) Boxing and unboxing
Module 2 (Credit 1)	
Learning Outcomes	Learners will be able to • Understand the concepts of variable, constants and arrays in C# • Use different object oriented aspects of C# • Develop small applications in C#
Content Outline	1] Object Oriented Aspects of C#: 1.1) Classes and Objects 1.2) Properties 1.3) Constructors and its types 1.4) Inheritance 1.5) Polymorphism 1.6) Overloading 1.7) Sealed class and methods 2] Advance Features 2.1) Interface 2.2) Abstract class, abstract and interface 2.3) Exception Handling 2.4) Delegates, events 2.5) Tuple 2.6) Multithreading 2.7) Collections and Generics 2.8) Indexers, index overloading

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE)

Evaluation	Details	Marks
Internal	Internal assessments (Practical test, class test)	25 marks
Total		
External	Final practical Exam	25 marks
Total		50 marks

TEXT BOOKS :

- 1) Bhasin, H. (2014). Programming in C#. Oxford University Press.
- 2) Christian Nagel et al. (2012). Professional C# 2012 with .NET 4.5. Wiley India.

REFERENCE BOOKS:

- 1) Ian Griffiths, M. A. (2010). Programming C# 4.0 (Sixth ed.). O'Reilly.
- 2) Schildt, H. (2012). The Complete Reference: C# 4.0 . Tata McGraw Hill.
- 3) Troelsen, A. (2010). Pro C# 2010 and the .NET 4 Platform (Fifth ed.). A Press.

WEB RESOURCES

- 1) <https://www.c-sharpcorner.com/article/create-windows-services-in-c-sharp/>
- 2) [C# Tutorial \(tutorialspoint.com\)](http://www.tutorialspoint.com/csharp/)

LAB PROGRAMS:

- 1) Write a program that prints "Hello, World!" to the console.
 - 2) Accept two numbers and an operator (+, -, *, /) and perform the operation.
 - 3) Take an integer and determine if it's even or odd.
 - 4) Swap two numbers without using a third variable.
 - 5) Calculate simple interest using the formula:
$$SI = (P \times R \times T) / 100.$$
 - 6) Employee Management System (Concepts: Class, Object, Encapsulation)
 - 7) Vehicle Inheritance Hierarchy (Concepts: Inheritance, Polymorphism)
 - 8) Library Book Management (Concepts: Encapsulation, Collection of Objects)
 - 9) Banking System (Concepts: Abstraction, Encapsulation)
 - 10) Shape Area Calculator (Concepts: Inheritance, Polymorphism, Abstract Classes)
 - 11) Student Grade Report Generator (Concepts: Class, Constructor Overloading, Method Overloading)
 - 12) Student Marks with Indexer
 - 13) Generic List of Employees
 - 14) Parallel Counting using multithreading
 - 15) Student Result as Tuple
 - 16) Division Calculator using exception handling
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5.4 MAJOR ELECTIVE (ELECTIVE 1)

Course Code	Course	TC	Th C	Pr C	Int	Ext	Total
041UCAME054A	Network Security	4	4	-	50	50	100

Course Title	NETWORK SECURITY
Course Credits	4
Theory Internal – External	4 Credits (Theory) 50 Marks (Internal) + 50 Marks(External)
Course Outcomes	Learners will be able to
	1. Understand the fundamental concepts of Network Security and Its application.
	2. Understand different cryptographic techniques.
	3. Implement basic security mechanism in networks.
Module 1 (1 Credit)	
Learning Outcomes	1. Understand basic concepts of network security, including services, mechanisms, and attack types. 2. Learn classical encryption methods such as substitution and transposition techniques. 3. Introduce symmetric cipher models and their relevance to network security.
Content Outline	1.1 Introduction : • Security Trends, • Security Services, • Security attacks, • Security mechanisms, • A Module for Network security. 1.2 Classical encryption techniques: • Symmetric cipher model, • Substitution techniques and Transposition techniques

Module 2 (1 Credit)	
Learning Outcomes	1. Study mathematical structures like groups, rings, and fields used in cryptography. 2. Explore number theory including prime numbers, Euler's theorem, and primality testing relevant to cryptographic algorithms. 3. Understand the principles and structure of public key cryptography systems. 4. Explore digital signatures and protocols like Kerberos for secure authentication.
Content Outline	2.1 Block ciphers and Data Encryption standard : • Block cipher principles, • Data Encryption standard, • AES Evaluation criteria of AES, • The AES cipher. 2.2 Finite fields: • Groups, Rings and Fields, • Modular Arithmetic, Euclidean Algorithm 2.3 Introduction to number theory – • Prime numbers, • Fermat's & Euler's theorem, • Testing for primality.
Module 3 (1 Credit)	
Learning Outcomes	1. Understand the principles and structure of public key cryptography systems. 2. Learn the RSA algorithm and apply it to encryption and decryption. 3. Study authentication techniques including message authentication codes and hash functions. 4. Explore digital signatures and protocols like Kerberos for secure authentication.
Content Outline	3.1 Public key cryptography & RSA: • Principles of Public key cryptoSystems • RSA algorithm 3.2 Message authentication & Hash functions- • Authentication requirements • Authentication, Functions • Message authentication codes • Hash function 3.3 Digital Signatures & Authentication Applications- • Digital signatures

	Kerberos
Module 4 (1 Credit)	
Learning Outcomes	- Learn about email security protocols such as PGP and S/MIME. - Understand IP and Web security models, architectures, and protocols. - Explore system security including intrusion detection, viruses, firewalls, and layered security models.
Content Outline	4.1 Security: - E-mail Security - Pretty good privacy, S/MIME - IP Security & Web Security - IP security overview - IP Security architecture - Web Security, Considerations - Secure Socket layer & Transport layer Security - System Security - Intruders, Viruses & related Threats, Firewalls

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE)

Evaluation	Details	Marks
Internal	Unit test	25 marks
	Internal assessments (Practical test, class test)	25 marks
Total		50 marks
External	Final Exam	50 marks
Total		100 marks

REFERENCE BOOKS:

- Cryptography and Networking Security Principles & Practice (Fourth edition) – William Stallings
- The Fundamentals of New Security – John F. Chawwan, Arch. House
- The Internet Security Guide Book – Juanaiaata

WEB RESOURCES:

- Geeksforgeeks.com – Tutorials on Various Network Security Topics
- NetworkLessons.com - Tutorials on Various Networking Topics

5.4 MAJOR ELECTIVE (ELECTIVE 2)

Course Code	Course	TC	Th C	Pr C	Int	Ext	Total
041UCAME054B	Data Science & Cloud Computing	4	4	-	50	50	100

Course Title	DATA SCIENCE & CLOUD COMPUTING
Course Credits	4
Theory Internal – External	4 Credits (Theory) 50 Marks (Internal) + 50 Marks (External)
Course Outcomes	Learners will be able to 1. Understand and apply fundamental concepts of data science such as data handling, cleaning, analysis, and visualization using Python-based tools.
Module 1 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to- 1. Explain the fundamental concepts of data science, classify different types and sources of data, and outline the role and skills required of a data scientist. 2. Perform basic data preprocessing, exploratory data analysis (EDA), and data analysis using Python libraries
Content Outline	1.1.Introduction to Data Science: What is Data Science? Data Science Life Cycle, Data Scientist Roles & Skills 1.2.Understanding data: Types of Data: Numeric, Categorical, Graphical, High Dimensional Data, Classification of Data: Structured, Semi-Structured and Unstructured, Example Applications. Sources of Data: Time Series, Transactional Data, Biological Data, Spatial Data, Social Network Data, Data Evolution. 1.3.Data Collection & Preprocessing: Data Cleaning, Handling Missing Values, Data Normalization, Encoding 1.4.Exploratory Data Analysis (EDA): Descriptive Statistics, Data Visualization using Matplotlib / Seaborn (basic). 1.5.Data Analysis using Python: Introduction to Pandas and NumPy, DataFrames, Series, indexing, filtering, and basic operations

	1.6.Data Warehousing: General principles, modeling, design, implementation and optimization, Cloud Computing, OLAP
Module 2 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to 1. Create and interpret various data visualizations and apply basic statistical measures for data understanding. 2. To understand and apply the theory of Data Curation and structuring of data. 3. To learn about Security and ethics behind accessing data.
Content Outline	2.1.Data Visualization: Importance of data visualization, Using Matplotlib and Seaborn for graphs (bar, line, pie, histogram, boxplot), Interpreting visual data. 2.2.Basic Statistics for Data Science & Data Presentation: Mean, median, mode, variance, standard deviation, Correlation and covariance, Frequency distribution, histogram, ogive curves, stem and leaf display. 2.3.Data Curation: Query languages and Operations to specify and transform data, Structured/schema-based systems as users and acquirers of data, Semi-structured systems as users and acquirers of data, Unstructured systems in the acquisition and structuring of data. 2.4.Security and ethical considerations in relation to authenticating and authorizing access to data on remote systems, Software development tools, large scale data systems, Amazon Web Services (AWS)
Module 3 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to- 1. Compare the strengths and limitations of cloud computing. 2. Identify the architecture, infrastructure and delivery models of cloud computing. 3. Apply suitable virtualization concept.
Content Outline	3.1.History and Evolution of Cloud Computing: History of Centralized and Distributed Computing, Overview of Distributed Computing, Cluster computing, Grid computing. Technologies for Network based systems, Software environments for distributed systems and clouds.

	3.2.Introduction to Cloud Computing: What is Cloud Computing? Characteristics & Benefits, Cloud Deployment Models: Public, Private, Hybrid, Community, Cloud Service Models: IaaS (Infrastructure as a Service), PaaS (Platform as a Service), SaaS (Software as a Service). 3.3.Cloud Architecture: Layers and Types of Cloud, Components of Cloud Computing, Cloud Computing Architecture, Infrastructure Components of Cloud Computing. 3.4.Virtualization & Containers: Role in Cloud, Docker Basics, Types of Virtualization, Components of Virtualization, Introduction to Various Hypervisors, High Availability (HA)/Disaster Recovery (DR) using Virtualization, Moving VMs.
Module 4 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to 1. Study how to declare and initialize a pointer and use pointers with Arrays, Functions. 2. Address the core issues of cloud computing such as security, privacy and interoperability
Content Outline	4.1. Cloud Services: Cloud Providers and Services: AWS EC2, S3, Lambda, Google Cloud Services, Cloud Storage & Databases: S3, Google Cloud Storage, Firebase / DynamoDB Basics. 4.2. Cloud Security: Identity and Access Management (IAM): authentication, authorization and accounting, Data Encryption, Compliance, Cloud Provenance and meta-data, Cloud Reliability and fault-tolerance, Cloud Security, privacy, policy and compliance, Cloud federation, interoperability and standards 4.3. Cloud Governance: Organizational Readiness and Change Management in the Cloud Age, Legal Issues in Cloud Computing, Achieving Production Readiness for Cloud Services 4.4. Cloud Trends & Future of Cloud: Cloud in Industry, Migration Challenges, How Cloud Will Change Operating Systems, Future of Cloud TV & Cloud-Based Smart Devices, Cloud and Mobile, Home-Based Cloud Computing.

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE)

Evaluation	Details	Marks
Internal	Unit Test	25 marks
	Internal Assessments (Practical Test, Class test)	25 marks
Total		50 marks
External	Final Exam	50 marks
Total		100 marks

TEXT BOOKS:

1. Doing Data Science, Rachel Schutt and Cathy O'Neil, O'Reilly, 2013 17
2. Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier.

REFERENCE BOOKS:

1. Mastering Machine Learning with R, Cory Laumeister, PACKT Publication, 2015
2. Interactive Data Visualization: Foundations, Techniques, and Applications, Ward, Grinstein Keim A K Peters/CRC Press-2015
3. Handbook of Cloud Computing By Dr.Anand Nayyar (Editor), First Edition 2019, BPB Publication, India
4. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter TATA McGraw- Hill , New Delhi – 2010
5. Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online - Michael Miller - Que 2008
6. Cloud Computing, A Hands on approach, ArshadeepBahga, Vijay Madiseti, University Press
7. Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christenvecctiola, S Tammaraiselvi, TMH

5.5 MINOR STREAM

Course Code	Course	TC	Th C	Pr C	Int	Ext	Total
041UCAMI055	Web Technology	3	3	1	50	50	100

Course Title	Web Technology
Course Credits	4
Theory Internal – External	2 Credits (Theory) + 2 Credits (Practical) 50 Marks (Internal) + 50 Marks (External)
Course Outcomes	Learners will be able to
	1. Apply scripting and server-side technologies such as PERL, CGI, Java Servlets, and JSP to build dynamic and interactive web applications.
	2. Develop ASP.NET-based web applications utilizing server controls, validation, master pages, themes, and AJAX for a responsive user experience
	3. Design and deploy full-stack applications using the MEAN stack (MongoDB, Express.js, Angular, and Node.js), implementing RESTful services and data binding
	4. Demonstrate proficiency in developing end-to-end web projects, showcasing front-end, back-end, and deployment skills in a production-like environment.
Module 1 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to- 1. Demonstrate proficiency in programming with PERL including Core syntax and features, String and array manipulation, File handling techniques, Pattern matching and text formatting and Creation and use of subroutines 2. Develop CGI scripts using PERL to process form data and create interactive web applications. 3. Apply Java-based server-side technologies including Java Servlets and JSP (JavaServer Pages), and demonstrate understanding of: Handling HTTP requests and responses, Managing application sessions and cookies, Accessing and manipulating data from data stores and Designing and deploying web applications using Java technologies
Content Outline	PERL & CGI Unit I: CGI Architecture and Introduction to PERL • Overview of CGI architecture • Introduction to PERL and its features

	- Working with strings and arrays in PERL Unit II: PERL Programming Concepts - File handling in PERL - Pattern matching and text formatting - Creating and using subroutines - Using PERL for CGI scripting Unit III: Java Servlets and JSP - Introduction to Java Servlets and JavaServer Pages (JSP) - Handling requests and responses - Application contexts, session management, and cookies Unit IV: Data Handling in Web Applications - Data store access using Servlets and JSP - Developing web applications using Java-based technologies Unit V: Server Side Includes (SSI) - Introduction to Server Side Includes - SSI directives and environment variables - Formats and usage of SSI in web development
Module 2 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to Understand and apply ASP.NET server-side web development concepts, including: User controls and graphic elements, Server controls, validation controls and navigation controls for building interactive and user-friendly web pages. - Design consistent and maintainable web applications using Styles, Themes, and Master Pages, demonstrating separation of content and presentation. - Perform data binding operations with various ASP.NET data controls such as: GridView, DetailsView and FormView. - Utilize LINQ (Language Integrated Query) to query and manipulate data collections and integrate them with ASP.NET applications.

	5 Integrate AJAX and AJAX Toolkit controls to develop responsive and interactive web applications by minimizing full page reloads and improving user experience.
Content Outline	ASP.NET Unit I: Web Controls in ASP.NET • Introduction to User Controls and Graphics • Server Controls • Validation Controls • Rich Controls • Navigation Controls in Web Pages Unit II: Page Styling and Structure • Styles and Themes • Master Pages Unit III: Configuration and Application-Level Settings • Introduction to web.config • Overview of global.asax • State Management techniques Unit IV: Data Handling and Controls • Data Binding • Introduction to Data Controls: GridView, DetailsView, FormView Unit V: Advanced Features and Security • Introduction to LINQ • AJAX and AJAX Toolkit • Security Fundamentals: Authentication and Authorization • Windows and Forms Authentication
Module 3 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to- 1. Understand the components and architecture of the MEAN stack. 2. Set up a complete MEAN development environment (Node.js, MongoDB, Angular CLI, VS Code). 3. Create basic servers and handle HTTP requests using Node.js and Express.js. 4. Build and deploy MEAN stack applications for production.

Content Outline	MEAN STACK WEB DESIGNING	
	• Introduction to MEAN Stack	What is MEAN? Use cases, architecture, data flow
	• Setting Up the Development Environment	Install Node.js, MongoDB, Angular CLI, VS Code
	• Node.js Basics	Creating simple server, using modules, npm basics
	• Express.js Introduction	Create Express app, routes, sending responses
	• REST API with Express	Route handling, params, query strings
	• MongoDB Basics	Create DB, insert, find, update, delete records
	• Mongoose Integration	Define schema, connect MongoDB, CRUD operations
	• Angular Project Setup	Angular CLI, components, folder structure
	• Angular Components & Binding	Data binding, interpolation, event binding
	• Angular Forms	Template-driven forms, validation
	• Angular Services	Creating and using services
	• Connecting Angular to API	Consume Express API from Angular
	• Full-stack CRUD Integration	Add/Delete product from Angular to DB

	<table border="1"> <tr> <td data-bbox="608 192 1007 322"> • Deployment Basics </td><td data-bbox="1007 192 1453 322">Angular build, serve backend, static hosting</td></tr> <tr> <td data-bbox="608 322 1007 452"> • Project Demo & Recap </td><td data-bbox="1007 322 1453 452">Recap all topics, Q&A, good practices</td></tr> </table>	• Deployment Basics	Angular build, serve backend, static hosting	• Project Demo & Recap	Recap all topics, Q&A, good practices
• Deployment Basics	Angular build, serve backend, static hosting				
• Project Demo & Recap	Recap all topics, Q&A, good practices				
Module 4 (Credit 1)					
Learning Outcomes	After learning the module, learners will be able to 12. Download, install, and configure Apache Tomcat on a local or server environment. 13. Understand the Tomcat directory structure 14. Deploy static (HTML) and dynamic (JSP) web applications on the Tomcat server. 15. Access and use the Tomcat Manager web interface for deploying, undeploying, starting, and stopping web applications				
Content Outline	APACHE TOMCAT Unit I: Introduction to Apache Tomcat • Obtaining and installing Apache Tomcat • Overview of Tomcat directory structure: ◦ bin, conf, logs, server, work, temp, webapps • Understanding web application directory structure Unit II: Deployment of Web Applications • Deploying HTML and JSP pages • Editing server.xml for configuration • Introduction to deployment descriptors • Configuring web.xml file Unit III: Tomcat Manager and Deployment • Using Tomcat Manager for deploying and managing web applications • Creating a WAR (Web Application Archive) file Unit IV: Database Configuration • Configuring Tomcat to connect to a database Unit V: Security Configuration • Configuring security in Tomcat				

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE)

Evaluation	Details	Marks
Internal	Unit test	25 marks
	Internal assessments (Practical test, class test)	25 marks
Total		50 marks
External	Final Exam	50 marks
Total		100 marks

TEXT BOOKS:

- Scott Guelich , Shishir Gundavaram, Gunther Birznies, “CGI Programming with Perl”, O'Reilly Media, 2000
- Chris Hart, John Kauffman, David Sussman, and Chris Ullman, “Beginning ASP.NET 2.0 with C#”, Wiley Publishing, Inc.,2006
- Jason Brittain, Ian F. Darwin, “Tomcat: The Definitive Guide, 2nd Edition”, O'Reilly Media, Inc., 2007
- Pinakin Ashok Chaubal, “Mastering MEAN Stack”, BPB Publications, 2023

REFERENCE BOOKS:

- Randal L. Schwartz, brian d foy, Tom Phoenix, Learning Perl, 8th Edition, O'Reilly Media, Inc.,2021
- Bill Evjen Scott Hanselman Devin Rader, “Professional ASP.NET 4 In C# and VB”, Wiley Publishing, Inc., 2010
- Aleksa Vukotic, James Goodwill, “Apache Tomcat 7 1st ed. Edition, Apress, 2011
- Brad Dayley, Brendan Dayley, Caleb Dayley, “Node.js, MongoDB and Angular Web Development: The Definitive Guide to Using the Mean Stack to Build Web Applications”, Addison-Wesley, 2018
- Nabendu Biswas, “Ultimate Full-Stack Web Development with MERN: Design, Build, Test and Deploy Production-Grade Web Applications with MongoDB, Express, React and NodeJS”, Orange Education Pvt Ltd 2023

WEB RESOURCES

- <https://www.youtube.com/watch?v=nelyq4LD-KY> (ASP.NET)
- <https://www.youtube.com/watch?v=IoLVCEr207w> (PERL & CGI)
- https://youtu.be/48SUuk8e55c?si=S6JWMz2u_0xKSn3m (MEAN STACK WEB DESIGNING)
- <https://www.youtube.com/watch?app=desktop&v=rElJIPRw5iM> (APACHE TOMCAT)

LAB PROGRAMS:

- 1 Write a Perl script to print "Hello, World!" and display server environment variables using CGI
 - 2 Write a Perl script to:
 - Concatenate and manipulate strings.
 - Declare and print array values.
 - Perform array operations like push, pop, shift, unshift.
 - 3 Create a Perl program with multiple subroutines to calculate Average, factorial, check for prime, and reverse a string.
 - 4 **Creating Your First ASP.NET Web Form** : Set up ASP.NET Web Forms Project in Visual Studio, Design a simple webpage using basic controls (Label, TextBox, Button) and Handle a button click event
 - 5 **Validation Controls** : Use RequiredFieldValidator, CompareValidator, RangeValidator
 - 6 **Validation Controls** : Perform client-side and server-side validations
 - 7 Use Calendar, FileUpload
 - 8 **State Management - Cookies and Application State** : Create persistent and session cookies
 - 9 **Master Pages** : Create a Master Page layout, Link content pages to the Master Page, Modify content placeholders
 - 10 **Data Binding** : Bind a GridView with data, Enable paging and sorting in GridView
 - 11 **Data Control** : Use FormView for insert/edit/display operations,
 - 12 **Data Control** : Bind DetailView with SQL database
 - 13 **Introduction to LINQ** : Create a simple LINQ query on a List
 - 14 **AJAX and AJAX Toolkit** : Add UpdatePanel to avoid full-page postbacks
 - 15 **Security - Authentication & Authorization** : Implement Forms Authentication
 - 16 Explore MEAN app examples; install Node.js & MongoDB
 - 17 Set up project folders, initialize Node & Angular app
 - 18 Create a "Hello World" server with Node.js
 - 19 Build basic server with GET/POST endpoints
 - 20 Build a simple product API with in-memory data
 - 21 Install MongoDB Compass, create sample DB
 - 22 Build backend to store products using Mongoose
 - 23 Create Angular app with sample component
 - 24 Create form to collect and display user data
 - 25 Design product entry form with validation
 - 26 Create service to fetch mock data using HttpClient
 - 27 Display product list from backend API in Angular
- Dr. B.M.N. College of Home Science

- 28 Implement add/delete functionality with live DB
 - 29 Build and serve MEAN app locally for deployment
 - 30 Demo mini-project: Product Catalog App
-

5.6 VSC

Course Code	Course	TC	Th C	Pr C	Int	Ext	Total
041UCAVS056	R Programming LAB	2	1	1	25	25	50

Course Title	R Programming Lab
Course Credits	2
Theory Internal – External	2 Credits (Practical) 50 Marks (Internal)
Course Outcomes	Learners will be able to 1. Understand various data types and their statistical characteristics using R programming. 2. Apply statistical techniques including central tendencies, dispersion, correlation, regression, and hypothesis testing. 3. Visualize, interpret, and present data insights through graphical and tabular representations using R.
Module 1 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to- 1. Identify and handle different types of data variables in R. 2. Create frequency distribution tables and descriptive visualizations. 3. Use R programming to generate various charts, diagrams, and plots to summarize data.
Content Outline	Introduction to R: • Basic syntax, variables, and data types • Working with vectors, data frames, and lists

	Data Handling and Visualization in R: • Handling different types of data variables • Creating frequency distribution tables • Graphical Representation: ○ Bar Charts, Pie Charts ○ Histograms, Line Graphs, Boxplots ○ Polygons and Scatter Plots • Tabular summaries and cross-tabulations
Module 2 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to 1. Calculate and interpret measures of central tendency and dispersion. 2. Perform correlation and regression analysis. 3. Conduct hypothesis testing using R and interpret statistical results.
Content Outline	Descriptive Statistics: • Mean, Median, Mode • Standard Deviation, Variance Inferential Statistics using R: • Correlation and Regression • Hypothesis Testing (Z-test, T-test) • Chi-Square Test for Goodness of Fit

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE)

Evaluation	Details	Marks
Internal	Internal assessments (Practical test (25 marks and class test for 25 marks)	25 marks
Total		50 marks

TEXT BOOKS

- S. C. Gupta (2018), *Fundamentals of Statistics*, Himalaya Publishing House

REFERENCE BOOKS:

- Efraim Turban et al. (2013), *Business Intelligence*, Pearson
- Swain Scheps (2008), *Business Intelligence for Dummies*, Wiley
- N.G. Das (2009), *Statistical Methods*, McGraw-Hill Education
- A. Gaur & S. Gaur (2009), *Statistical Methods for Practice and Research*, Sage Publications

LAB PROGRAMS:

1. Write a program to demonstrate creation and manipulation of vectors, lists, matrices, data frames, and factors.
2. Import a .csv file and display its structure, summary statistics, and the first few rows.
3. Create frequency and relative frequency tables for categorical and numerical variables.
4. Visualize categorical data using bar charts and pie charts.
5. Generate histograms and boxplots to visualize the distribution of continuous variables and detect outliers.
6. Plot line graphs for time series data and scatter plots to observe relationships between two variables.
7. Calculate and compare mean, median, and mode for a dataset using R.
8. Compute range, variance, standard deviation, and coefficient of variation for a numerical variable.
9. Calculate Pearson and Spearman correlation coefficients and plot a correlation matrix.
10. Fit a simple linear regression model and visualize the regression line with interpretation.
11. Conduct a one-sample Z-test for population mean with known standard deviation.
12. Compare means of two independent samples (e.g., male vs. female scores) using t-test.
13. Conduct a chi-square test to determine if observed frequencies match expected frequencies.

5.7 CEP

Course Code	Course	TC	Th C	Pr C	Int	Ext	Total
041UCACE057	Community Engagement Project	2	1	1	25	25	50

Course Title	Community Engagement Program
Course Credits	2 (1 Theory (15 Hours)+1 Practical (30 Hours))

Internal – External	25 Marks + 25 Marks
Course Outcomes	After going through the course, learners will be able to
	1 Develop a comprehensive understanding of social responsibility in the digital age.
	2 Design, plan, and implement community engagement programs that address social issues and empower communities.
	3 Educate the community about electronic waste and its environmental impact.
	4 Promote responsible disposal and recycling of e-waste.
Module 1 Awareness and Education (15 hours)	
Learning Outcomes	1. Define e-waste and identify its sources in households, institutions, and businesses.
	2. Explain the environmental and health hazards associated with improper disposal of electronic waste.
	3. Demonstrate effective communication skills by creating informative content such as posters, flyers, and social media posts.
	4. Plan and execute community awareness activities , including presentations, campaigns, and interactive events.
Content Outline	1. Orientation & Training (08 hours) · Introduction to e-waste: Types, sources, hazards · Impact on environment and health · Methods of disposal and recycling · Legal and ethical responsibilities (e-waste management rules in India or relevant country)
	2. Campaign Planning (02 hours) · Group formation · Planning community outreach activities (posters, social media, door-to-door awareness, etc.)
	3. Planning & Coordination (05 hours) · Identifying collection points (schools, RWAs, offices) · Coordination with local e-waste recyclers or NGOs
Module 2 E-Waste Collection and Impact Assessment (30 hours)	
Learning Outcomes	1. Plan and organize e-waste collection drives effectively in coordination with local communities and stakeholders.
	2. Safely handle and categorize collected e-waste , ensuring it is stored and prepared for proper recycling or disposal.

	3. Record, analyze, and interpret data on the types and quantity of e-waste collected during the program.
Content Outline	1. Community Awareness Activities (15 hours) Designing flyers, presentations, or short plays/skits · Conducting awareness sessions in schools, residential societies, or local markets Street plays or short presentations Distributing flyers and posters · Social media awareness campaign (Instagram reels, YouTube shorts etc.)
	2. E-Waste Collection Drive (10 hours) Collection of e-waste from local community. Sorting and storing collected items safely
	3. Reflection & Reporting (05 hours) Group presentation on learning outcomes Report on collected e-waste (weight, type, source) Reflection journal: What did you learn, challenges, and future scope

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE)

Evaluation	Details	Marks
Internal	Report	25 marks
	Internal assessments (weekly report assessment)	
Total		25 marks
External	Report Presentation	25 marks
Total		50 marks

1. Continues Internal Assessment (25 Marks): Students are required to maintain a Field Diary/Journal to document their activities, readings, and reflections throughout the course. The Field Diary/Journal should include detailed records of 30 hours field visits, planning, and monthly engagement activities related to the course. The subject teacher will review and assess the Field Diary/Journal on a monthly basis and assign marks accordingly.
2. Final Exam (25 Marks) : The final assessment will comprise an Project Report,

Presentation, and Viva, with evaluation conducted by external experts to ensure a thorough and objective assessment of the student's performance and understanding. The experts will review supporting evidence such as official letters from relevant authorities, photographs, video clips, and other pertinent documentation to verify the student's engagement and participation in community activities. Additionally, the experts will assess pre- and post-test results to evaluate the impact of the project on the community, as well as the impact on the student, reflecting on their personal growth, learning, and skill development throughout the project. This comprehensive evaluation will ensure that both the societal impact of the project and the student's development are effectively measured.

REFERENCE BOOKS:

1. Fostering Social Responsibility & Community Engagement in Higher Educational Institutions in India 2.0, National Curriculum Framework and Guidelines, UGC, January 2022.
2. Principles of Community Engagement, 2nd Edition, NIH Publication, 2011.

