



**PSGR
Krishnammal College for Women**



**College of Excellence,  2024-7th Rank
Autonomous and Affiliated to Bharathiar University
Reaccredited with A++ grade by NAAC, An ISO 9001: 2015 Certified Institution
Peelamedu, Coimbatore-641004**

DEPARTMENT OF COMPUTER SCIENCE (PG)

**CHOICE BASED CREDIT SYSTEM (CBCS) &
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)**

**MASTER OF SCIENCE IN COMPUTER SCIENCE
2025 - 2027 BATCH
SEMESTER I,II**



M.Sc Computer Science

Programme Outcomes

After completion of the Programme, the student will be able to

- PLO1:** Demonstrate broad knowledge in core areas of computer science, current and emerging technologies in IT
- PLO2:** Apply higher degree of technical skills in problem solving and application development
- PLO3:** Gain analytical and managerial skills to enhance employment potential
- PLO4:** Acquire holistic development with strong emphasis on values and ethics

Programme Specific Outcomes

The students at the time of graduation will

- PSO1:** Identify and formulate complex problems to achieve solutions using concepts of algorithms, advanced networks, database management systems, artificial intelligence and machine learning
- PSO2:** Design solutions for complex problems and design processes that meet the specific needs of the society.
- PSO3:** Create and apply appropriate techniques, resources and tools including prediction and modeling to multifaceted activities
- PSO4:** Apply programming and technical skills to solve real-life complex problems and hence enhance employability
- PSO5:** Analyse research methods including interpretation of data and synthesis of the information to provide valid conclusions.
- PSO6:** Demonstrate skills as an individual and as a member or leader in diverse teams
- PSO7:** Recognize the need for life-long learning and pursue a career as a researcher or software engineer.
- PSO8:** Apply ethical principles and contribute effectively to the welfare of the society



MASTER OF SCIENCE IN COMPUTER SCIENCE
CHOICE BASED CREDIT SYSTEM (CBCS) &
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)
SYLLABUS & SCHEME OF EXAMINATION
2025 - 2027 BATCH – SEMESTER I

Semester	Course Code	Title of the Course	Course Type	Instruction Hours/week	Contact Hours	Tutorial Hours	Duration of Examination	Examination Marks			Credits
								CA	ESE	Total	
I	MCS2501	Advanced Design and Analysis of Algorithms	CC	4	58	2	3	25	75	100	4
I	MCS2502	Advanced Network Security	CC	4	58	2	3	25	75	100	4
I	MCS2503	Modern Operating Systems	CC	4	58	2	3	25	75	100	4
I	MCS2404	Data Mining Techniques and Tools	CC	4	58	2	3	25	75	100	4
I	MCS2505	Digital Image Processing	CC	4	58	2	3	25	75	100	4
I	MCS24P1	Data Mining Techniques and Tools Lab	CC	5	75	-	3	25	75	100	3
I	MCS23P2	Full Stack Development Lab	CC	5	75	-	3	25	75	100	3
I-III	17MONL1	Online Course	ACC	-	-	-	-	-	-	-	-

Course Type	Abbreviation	Courses
Core Courses	CC	All core courses
Additional Credit Courses	ACC	Online Courses

EXAMINATION SYSTEM

Pattern

Semester system will be followed. A semester consists of a minimum of 90 working days excluding the days of conduct of ESE. There will be Continuous Internal Assessment (CA) to evaluate the performance of students in each course and the End Semester Examination will be held at the end of every semester.

Weightage assigned to various components of Continuous Internal Assessment

Theory

CIA Test	: 5 marks (conducted for 45 marks after 50 days)
Model Exam	: 7 marks (conducted for 75 marks after 85 days)
Seminar/ Assignment /Quiz	: 5 marks
Class Participation	: 5 marks
Attendance	: 3 marks
Total	: 25 Marks

Practical Lab

Performance	: 7 marks
Regularity	: 5 marks
Model Exam	: 10 marks
Attendance	: 3 marks
Total	: 25 marks

CA Question Paper Pattern and distribution of marks - (First 3 Units)

Core and Elective Courses

CA Question from each unit comprising of

One question with a weightage of 2 Marks : $2 \times 3 = 6$

One question with a weightage of 5 Marks (Internal Choice at the same CLO level) : $5 \times 3 = 15$

One question with a weightage of 8 Marks (Internal Choice at the same CLO level) : $8 \times 3 = 24$
Total : 45 Marks

End Semester Examination - Question Paper Pattern and Distribution of Marks

Core and Elective Courses

ESE Question Paper Pattern : $5 \times 15 = 75$ Marks

Question from each unit comprising of

One question with a weightage of 2 Marks: $2 \times 5 = 10$

One question with a weightage of 5 Marks (Internal Choice at the same CLO level): $5 \times 5 = 25$

One question with a weightage of 8 Marks (Internal Choice at the same CLO level): $8 \times 5 = 40$

ESE Practical Pattern

The End Semester Examination will be conducted for a maximum of 75 marks respectively with a maximum 15 marks for the record and other submissions if any.

Criteria for Attendance

3 Marks (Attendance 75%- 80% - 1 Mark, 81%-90% - 2 Marks, 91%- 100% - 3 Marks)

Course Code	Course Title	Category	L	T	P	Credits
MCS2501	ADVANCED DESIGN AND ANALYSIS OF ALGORITHMS	Theory	58	2	-	4

Preamble

This course covers the fundamental techniques for designing and analyzing algorithms, including asymptotic analysis, Trees, graphs, divide and conquer algorithms and recurrences. It also presents effective search methods, graph algorithms and randomized algorithms.

Prerequisite

Data structures and algorithms

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand fundamental algorithmic concepts and performance analysis including time-space trade-offs and recurrence relations.	K2
CLO2	Apply appropriate algorithm design strategies to solve computational problems.	K3
CLO3	Analyze the complexity and efficiency of algorithms, including sorting, hashing, graph, and tree-based algorithms using worst-case and average-case analysis.	K4
CLO4	Evaluate algorithmic efficiency using asymptotic notations and apply amortized analysis, parallel processing techniques, and performance optimizations.	K5
CLO5	Design and implement optimal algorithmic solutions for real-world applications such as scheduling, string processing, and graph-based problems.	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4
CLO1	S	M	S	S
CLO2	S	S	S	M
CLO3	S	S	M	S
CLO4	M	L	S	L
CLO5	S	S	M	S

S- Strong; M-Medium; L-Low

UNIT I

(11 Hrs)

Introduction: Algorithms - Analyzing Algorithms - Complexity of Algorithms - Classification of Algorithms - Time-space Trade-offs: Counting Sort - Bucket Sort - Radix Sort - Shell Sort - Topological Sort - Hashing and Hash Tables: Introduction to Hash tables - Hash Functions Construction- Hash Table Operations - Collision Resolution Techniques. **Introduction to M-array Trees: B Trees - B+ Trees.** Recursive Algorithm – Techniques for solving Recurrence Equations. **Amortized Analysis.**

UNIT II

(12 Hrs)

Divide and Conquer Approach - Recurrence Equation for Divide and Conquer - Advantages and Disadvantages of Divide-and-Conquer Paradigm - **Merge Sort - Quick Sort: Partitioning Algorithms - Variants of Quick Sort.** External Sorting: Sorting with Disk - Sorting with Tapes - Strassen's Matrix

Multiplication - Closest-pair Problem - Convex Hull: Quick hull – Merge hull. **Fourier Transform for Polynomial Multiplication.**

UNIT III

(12 Hrs)

Greedy Algorithms: Introduction - Components of Greedy Approach - Coin Change Problem - Scheduling Problems: **Shortest Job First Scheduling - Knapsack Problem**, Minimum Cost Spanning Trees – Tree Vertex Splitting Problem - Single-Source Shortest-Path Problem - Dijkstra's Algorithm - Heuristic Approach for Travelling Salesperson Problem - **Job sequencing with deadlines - Optimal merge pattern.**

UNIT IV

(12 Hrs)

Dynamic Programming: Introduction - Components of Dynamic Programming - Fibonacci Problem: Bottom-Up Approach - Top-Down Approach - Matrix Chain Multiplication - **Floyd-Warshall Algorithm - Longest Common Subsequence (LCS)** - Parallel Algorithm: Classification of Parallel System - Flynn Classification - Address-Space-Memory Classification - Classification based on Interconnection Networks. **Parallel Searching and Parallel Sorting.**

UNIT V

(11 Hrs)

Backtracking: Concept and General Approach - Generation of State Space Trees - Searching state Space Trees - Vertex Colouring Problem - N-Queens Problem - Sum of Subset Problem - Hamiltonian Cycle. **Randomized Algorithms: Generation of Random Numbers - Hiring Problem -Comparing Two Strings using Randomization Algorithms - Randomized QuickSort.**

CASE STUDY: Word Frequency Analysis, Plagiarism detection using string search algorithms, Travel planner using graph, Cash flow minimizer, Real-time analysis, Email Spam Filter.

Text Books

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR & EDITION
1.	Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran	Computer Algorithms	University Press Publications	2019, 4 th Edn
2.	S. Sridhar	Design and Analysis of Algorithms	Oxford University Press	November 2023, 2 nd Edn
3	M. H. Alsuwaiyel	Algorithms Design Techniques and Analysis	World Scientific Publishing Co. Pvt. Ltd	2016, 2 nd Edn

Reference Books

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR & EDITION
1.	Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran	Fundamentals of Computer Algorithms	University Press Publications	2019, 2 nd Edn
2.	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein	Introduction to Algorithms	MIT Press	2022, 4 th Edn

Pedagogy: Lectures, Group Discussions, Case studies

Course Code	Course Title	Category	L	T	P	Credits
MCS2502	ADVANCED NETWORK SECURITY	Theory	58	2	-	4

Preamble

This course covers network security techniques, cryptographic protocols, and attack detection mechanisms. It focuses on analyzing security threats and implementing cryptographic solutions for secure communication.

Prerequisite

- Number Theory
- Computer Networks

Course Learning Outcomes

On successful completion of the course, the students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand network protection, monitoring, and detection techniques.	K2
CLO2	Apply security protocols and standards to ensure secure communication.	K3
CLO3	Analyze network attacks and vulnerabilities in cryptographic systems.	K4
CLO4	Evaluate authentication protocols and key exchange mechanisms.	K5
CLO5	Develop secure key agreement protocols and cryptographic solutions.	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4
CLO1	S	S	M	L
CLO2	S	S	M	S
CLO3	S	S	L	S
CLO4	S	S	S	S
CLO5	S	S	S	S

S- Strong; M-Medium; L-Low

UNIT I

(11 Hrs)

Techniques for Network Protection, Monitoring and Detection: Firewalls, packet filter and stateful firewalls, application aware firewalls, personal firewalls-IPtables, Proxies, NAT, Intrusion Detection System-Snort, Signature and Anomaly based detection, Honeypots and Honeynets, **Network Log management-syslog or SPLUNK; RBAC: Role mining; DNS-Dig tool: DNSSEC-DS and NSEC records.**

UNIT II

(12 Hrs)

Protocols and Standards: SCP, SSH, SSL3.0, TLS 1.2, STARTTLS, IPsec, VPN and Secure HTTP; Encrypting and Signing Emails: PGP- GPG/open PGP, **DKIM and SPF; Single Sign On (SSO)-OAUTH and OPENID.**

UNIT III

(12 Hrs)

Attack Techniques: Network reconnaissance-Nmap and vulnerability audits-openVAS; DNS based attacks, Phishing-DNS Twist; Network based malware attacks: Remote access TrojanPoison Ivy and Domain name

generation algorithm based Botnets; LAN attacks: ARP Cache poisoning- Ettercap/arp spoof, MAC flooding, Man in the middle attacks, Port Stealing, DHCP attacks, VLAN hopping; **Network Sniffing - Wireshark and Password Cracking-John the Ripper; Attacks on SSL/TLS: SSL stripping, Drown and Poodle attack; Network packet creation and Manipulation using scapy and dpkt libraries.**

UNIT IV

(12 Hrs)

Protocols for identification and login: Interactive protocols, ID protocols, Password protocols, Challenge-response protocols, Schnorr's identification protocol, Proving properties in zero knowledge. Authenticated Key Exchange: Goals for authentication and Key Establishment, encryption based protocol and its attacks, Perfect forward secrecy, Protocol based on ephemeral encryption, **Attacks on Insecure variations, Identity protection, One-sided authenticated key exchange, Security of protocol AKE1, Password authenticated key exchange - Phishing attacks, Protocol PAKE0, Protocol PAKE1, Protocol PAKE2, Explicit key confirmation.**

UNIT V

(11 Hrs)

Classes of Key Agreement protocols: Diffie Hellman Key Agreement, MTI Protocols, Diffie Hellman- Based Protocols. Protocols not based on Diffie Hellman. Pairing based cryptographic protocol: ID based encryption schemes, Boneh and Franklin's Scheme, Shamir's encryption and signature schemes. **Conference Key protocols: Security goals, Static and dynamic groups, Generalizing Diffie- Hellman key agreement.**

Text Books

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR & EDITION
1	William Stallings	Cryptography and Network Security: Principles and Practice	Pearson	2020, 8 th Edn
2	Behrouz A. Forouzan	Cryptography & Network Security	McGraw-Hill	2015, 3 rd Edn
3	Colin Boyd, Anish Mathuria, Douglas Stebila	Protocols for Authentication and Key Establishment	Springer	2020, 6 th Edn
4	Dan Boneh, Victor Shoup	A Graduate Course in Applied Cryptography	-	2020, 3 rd Edn

Reference Books

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR & EDITION
1	W. Stallings	Network Security Essentials: Applications and Standards	Pearson Prentice Hall	2016, 6 th Edn
2	Bryan Sullivan, Vincent Liu	Web Application Security, A Beginner's Guide	McGraw-Hill Education	2012, 2 nd Edn
3	C. Kaufman, R. Perlman, M. Speciner	Network Security: Private Communication in a Public World	Prentice Hall PTR	2002, 2 nd Edn

4	J. Menezes, P. C. V. Oorschot, S. A. Vanstone	Handbook of Applied Cryptography	CRC Press	1996, 1 st Edn
5	J. Pieprzyk, T. Hardjono, J. Seberry	Fundamentals of Computer Security	Springer	2003, 2 nd Edn
6	Abhijit Das, Veni Madhavan C. E.	Public-Key Cryptography: Theory and Practice	Pearson Education	2009, 3 rd Edn
7	L. Dong, K. Chen	Cryptographic Protocol: Security Analysis Based on Trusted Freshness	Springer	2012, 4 th Edn

Pedagogy: Lectures, Group Discussions, Case studies

Course Code	Course Title	Category	L	T	P	Credits
MCS2503	MODERN OPERATING SYSTEMS	Theory	58	2	-	4

Preamble

This course introduces the architecture of various modern operating systems. It also includes techniques such as processes and threads, security threats, RTOS, Linux and various types of OS.

Prerequisite

- Operating System
- Distributed OS

Course Learning Outcomes

On successful completion of the course, the students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the architecture and communication mechanisms in distributed operating systems.	K2
CLO2	Apply concepts of process and thread management, inter-process communication, and scheduling in various operating system environments.	K3
CLO3	Analyze security threats and vulnerabilities specific to operating systems	K4
CLO4	Evaluate the role and functionality of Real-Time Operating Systems (RTOS) including task scheduling, memory management, and inter-task communication.	K5
CLO5	Design and examine innovations such as virtualization, cloud, IoT, and mobile operating systems.	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4
CLO1	S	M	M	S
CLO2	S	S	M	L
CLO3	S	M	M	S
CLO4	L	S	L	S
CLO5	S	S	M	S

S- Strong; M-Medium; L-Low

UNIT I

(12 Hrs)

Distributed OS Systems – Network Hardware - Network Services and Protocols - Document Based Middleware – File system based middleware - Object based middleware - Co-ordination based middleware – **Multi computers: User level Communication software** – Remote Procedure call - Distributed shared memory – Multicomputer scheduling – Load Balancing. Trends in OS Design: Virtualization and the cloud – Manycore Chip – Large address space OS – Seamless data access – Battery – Powered Computing Embedded systems – **OS Structure: Monolithic Structure - Layered System - Virtual Machine - Exo Kernel – Client-Server Model.**

UNIT II

(10 Hrs)

Processes and Threads: Process model - Process Creation - Process Termination - Process Hierarchies - Process State. **Threads: Thread usage - Classical Thread Model - Implementing Threads in userspace**

and kernel. Interprocess Communication - Semaphores- Message Passing-**Scheduling - Scheduling in Batch systems - Interactive Systems - Real Time Systems - Thread Scheduling.**

UNIT III

(12 Hrs)

Security Environment: Threats – Attackers - Controlling Access to Resources - Protection Domains - Access Control lists – Capabilities - Formal Models of Secure Systems - **Multilevel security – Covert Channels** - Authentication using a Physical object - Authentication using Biometrics – **Defenses – Code Signing – Jailing – Model based intrusion detection – Encapsulating Mobile Code.**

UNIT IV

(12 Hrs)

Introduction to RTOS: Purpose of Real Time Operating Systems - Process Management - Memory Management - Interrupts Management – **Multitasking** - File System Management - I/O Management - Characteristics of RTOS Kernels - Priority Scheduling - **Inter task Communication and Resource Sharing** - Real Time Signals – Shared Memory -Asynchronous I/O - Memory Locking. **Real-Time Embedded Systems** - Real-Time Embedded System Characteristics-System Structure-Real-Time Response - Concurrency – Predictability - safety and Reliability - Hard and Soft Real-Time Embedded Systems.

UNIT V

(12 Hrs)

Linux Overview – Linux Goals - **Linux Architecture** - Scheduling – Synchronization - Memory Management System calls - Paging – **Input – output system calls - File system calls in Linux** Introduction to Android - History of Android - Design Goals - Android Architecture -Types of OS– Mobile OS-IOS, Web OS- Smart OS. **Embedded OS - Memory Management** - Services Layer - Core OS Layer - File System. Practical Issues - Software Reliability - Software Faults – Reliability Measurement – Security - Challenges.

Case Study: Virtualization and Cloud OS – Windows 8 – Windows 11 - Security Enhancements - IoT and Embedded OS. Challenges and Future Trends in Modern Operating System.

Text Books

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR & EDITION
1.	Andrew S.Tanenbaum Herbert Bos	Modern Operating Systems	Pearson Education	2023, 5 th Edn
2.	Jiacun Wang	Real- Time Embedded Systems	John Wiley & Sons, Inc.	2017,1 st Edn

Reference Books

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR & EDITION
1.	Shubra Garg	Fundamentals of Distributed Operating Systems	S.K. Kataria & Sons	2022, 1 st Edn
2.	Andrew S.Tanenbaum	Distributed Operating System	Pearson Education	2017,10 th Edn

Course Code	Course Title	Category	L	T	P	Credits
MCS2404	DATA MINING TECHNIQUES AND TOOLS	Theory	58	2	-	4

Preamble

This course presents the basic concepts of data mining and various data mining techniques like classification, clustering, and association rule mining. The course also introduces various applications of data mining such as text mining, web mining, multimedia mining, and spatial mining.

Prerequisite

- Database Management Systems
- Probability and Statistics

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand data mining techniques, algorithms and data Visualization	K2
CLO2	Apply data mining techniques to carry out simple data mining tasks	K3
CLO3	Analyze data mining algorithms appropriate for different data mining Applications	K4
CLO4	Evaluate data mining models for solving real world problems	K5
CLO5	Develop predictive models using advanced data mining techniques for various application domains	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4
CLO1	S	S	M	L
CLO2	S	S	M	L
CLO3	S	S	M	L
CLO4	S	S	M	L
CLO5	S	S	M	L

S- Strong; M-Medium; L-Low

UNIT I

(12 Hrs)

Introduction: Need for data mining - **Kinds of data** - Patterns for mining: Characterization and Discrimination Associations - Classification and Regression - Cluster Analysis - Outlier Analysis – **Technologies** - **Applications** - **Major issues in Data Mining**. Data Pre-processing: Overview – Data cleaning - Data integration - Data reduction – Data Transformation and Discretization.

UNIT II

(11 Hrs)

Association rule mining: Apriori algorithm, Mining Frequent Patterns–Associations and correlations – Mining Methods– Mining Various kinds of Association Rules– **Correlation Analysis**– Advanced

methods: **Constraint-based Pattern mining**, Mining Sequential pattern

UNIT III

(12 Hrs)

Classification: Basic Concepts – Decision tree induction - Bayes Classification Methods – **Rule-based classifier(classification)**- Classification with weak supervision- **Techniques to improve classification accuracy, Model evaluation and selection**. Classification: Advanced Methods: Lazy learners: KNN, Case-based reasoning, Support Vector Machines.

UNIT IV

(12 Hrs)

Cluster Analysis-Partitioning Methods: K-Means, K-Medoids - Hierarchical Methods: **Agglomerative versus Divisive**, BIRCH, Probabilistic Hierarchical clustering - **Density-based methods: DBSCAN, OPTICS** – Probabilistic model-based clustering: Fuzzy clusters, Probabilistic model-based clusters

UNIT V

(11 Hrs)

Data Mining Trends and Research Frontiers: Mining Sequence data: Time-series, Symbolic sequences and Biological sequences Mining graphs and networks Visual and audio data mining. Mining sequence patterns in Transactional databases - Spatial Data mining - Text Mining – Mining the World Wide Web. **Case Study: Financial data analysis, Retail and Telecommunication -Science and Engineering, Intrusion Detection and Prevention, Recommender systems.**

Text Books

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR & EDITION
1.	Jiawei Han Jian Pei Hanghang Tong	Data Mining- concepts and techniques	Morgan Kaufmann Publishers, San Francisco.	2023, 4 th Edn

Reference Books

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR & EDITION
1.	Mark A. Hall, Ian H. Witten, Eibe Frank	Data Mining: Practical Machine Learning Tools and Techniques	Morgan Kaufmann Publishers, San Francisco.	2022, 4 th Edn
2.	Pang-Ning Tan, Michael Steinbach, Anuj Karpatne, Vipin Kumar	Introduction to Data Mining	Pearson Education	2021, 2 nd Edn

Pedagogy : Lectures, Group Discussions, Case studies

Course Code	Course Title	Category	L	T	P	Credits
MCS2505	DIGITAL IMAGE PROCESSING	Theory	58	2	-	4

Preamble

This course covers the fundamental techniques to expose simple image enhancement techniques, image segmentation and representation techniques with image compression and recognition methods.

Prerequisite

- Basic Mathematics, Programming Skills

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.	K2
CLO2	Apply image processing techniques in both the spatial and frequency (Fourier) domains.	K3
CLO3	Analyze the restoration concepts and filtering techniques.	K4
CLO4	Evaluate the basics of segmentation, features extraction, compression and recognition methods for color models	K5
CLO5	Design and evaluate image analysis techniques	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4
CLO1	M	S	S	S
CLO2	L	S	S	L
CLO3	S	M	S	S
CLO4	S	L	S	S
CLO5	S	S	M	S

S- Strong; M-Medium; L-Low

UNIT I

(11 Hrs)

Digital Image Fundamentals: Fundamental steps in Digital Image Processing – **Components of an image processing system** – **Elements of Visual Perception** – Image Sensing and Acquisition – Image Sampling and Quantization – **Relationships between pixels.**

UNIT II

(11 Hrs)

Image Enhancement in Spatial Domain: Histogram processing – Fundamentals of Spatial Filtering – **Smoothing and Sharpening Spatial Filtering.** Image enhancement in Frequency Domain: Basics – Smoothing using low pass frequency domain filters, Sharpening using high pass filters.

UNIT III

(12 Hrs)

Image segmentation and Feature extraction: Fundamentals- Point, Line and Edge detection-

Thresholding- Segmentation using region growing and by region splitting and Merging.- Region segmentation using clustering and super pixels - Region segmentation using Graph cuts - segmentation using Morphological Watersheds – The use of motion in segmentation - Feature extraction: Boundary preprocessing- **Boundary Feature descriptors - Region features descriptors – Principal Component as Feature descriptors.**

UNIT IV

(12 Hrs)

Image Compression: Fundamentals-Huffman Coding-Golomb coding - Arithmetic Coding – LZW coding - DCT implementation using FFT Sub-image size selection Coding-Run- length Coding-Symbol-based Coding-Bit-plane Coding-**Block Transform Coding-Predictive Coding -Wavelet coding.**

UNIT V

(12 Hrs)

Image Restoration: Degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering.

Case study: Medical Imaging Analysis, Facial Recognition Technology, Agricultural Applications, Historical Document Restoration and Analysis, Entertainment and Media, Autonomous vehicles AR/VR in image processing.

Text Books

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR & EDITION
1.	Rafael C. Gonzalez, Richard E.Woods	Digital Image Processing	Pearson Publication	2018, 4 th Edn
2.	S.Jayaraman,S.Esakki rajan,T.Veerakumar	Digital Image Processing	Tata Mc Graw Hill	2020,2 nd Edn

Reference Books

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR & EDITION
1.	Sandipan Dey	Hands-On Image Processing with Python	O'Reilly Publications	2018, 2 nd Edn
2.	Wilhelm Burger , Mark J. Burge	Digital Image Processing An Algorithmic Introduction	Springer	2022,3 rd Edn

Pedagogy: Lectures, Group Discussions, Case studies

Course Code	Course Title	Category	L	T	P	Credits
MCS24P1	DATA MINING TECHNIQUES AND TOOLS LAB	Practical	-	-	75	3

Preamble

This course provides exercises to implement data mining techniques such as classification, clustering, association rule mining, and regression using data mining tools like R, Python, Knime and Tableau.

Prerequisite

- SQL, Oracle

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Implement the association rule mining, classification, clustering, prediction algorithm.	K3
CLO2	Apply data mining techniques to real world problem	K3
CLO3	Analyze the performance of various classifications, clustering and prediction algorithm.	K4
CLO4	Evaluate the features of data mining tools.	K5
CLO5	Build models using classification, clustering and prediction to solve real world problems using Python, R and Knime.	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4
CLO1	S	S	S	L
CLO2	S	S	S	M
CLO3	S	S	S	M
CLO4	S	S	S	L
CLO5	S	S	S	M

S- Strong; M-Medium; L-Low

Syllabus

- Exercises to implement data exploration and visualization techniques in R, Tableau.
- Exercises to perform preprocessing tasks in Python
- Exercises to implement linear regression & logistic regression
- Exercises to perform classification & clustering
- Exercises to perform association rules & text mining

Pedagogy: Demonstrations

List of Exercises

1. Demonstrate the following data preprocessing tasks using Python libraries.
 - a) Loading the dataset
 - b) Identifying the dependent and independent variables
 - c) Dealing with missing data
2. Demonstrate the following data preprocessing tasks using Python library
 - a) Dealing with categorical data
 - b) Scaling the features
 - c) Splitting dataset into Training and Testing Sets
3. Demonstrate the following similarity measures using python
 - a) Pearson's Correlation
 - b) Euclidean Distance
 - c) Manhattan Distance
4. Experiment on hierarchal Data Clustering algorithms on weather data set.
5. Write a Python code to perform Clustering using the Birch algorithm.
6. Write a Python code to implement Text Mining for the corpus data.
7. Perform data exploration and visualization of the iris dataset and implement various statistical operations in R.
8. Perform classification of the iris dataset using support vector machine (SVM) in R.
9. Build a logistic regression model to a dataset using R.
10. Apply the DBSCAN clustering algorithm to a dataset using R.
11. Perform data exploration and visualization of the stock dataset and implement various statistical operations in Tableau.
12. Perform decision tree classification using Knime.
13. Perform Apriori Algorithm (Frequent Itemset Mining) using Knime.

Applications

1. Customer buying patterns using classification methods
2. Credit card Fraud Detection using Supervised algorithm
3. Breast Cancer Prediction using Supervised Algorithm
4. Customer Segmentation using Clustering
5. Loan defaulters Prediction
6. Classification of Iris Dataset

Course Code	Course Title	Category	L	T	P	Credits
MCS23P2	FULL STACK DEVELOPMENT LAB	Practical	-	-	75	3

Preamble

This course provides exercises to create dynamic web application in both client and server side using CSS3, AJAX, Javascript, jQuery, PHP/ MySQL, Angular and React. It enables students to equip themselves as a full stack developer.

Prerequisite

- HTML

Course Learning Outcomes

On successful completion of the course, the students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the concepts of Client-side /Server-side web programming	K2
CLO2	Apply the form validation using jQuery	K3
CLO3	Analyze validation concepts using JavaScript	K4
CLO4	Design applications using connectivity with MySQL database	K5
CLO5	Develop dynamic web pages using PHP, MYSQL, CSS, jQuery, JavaScript, Angular and React	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4
CLO1	S	S	S	L
CLO2	M	S	S	M
CLO3	M	S	S	M
CLO4	M	S	S	M
CLO5	L	S	S	L

S- Strong; M-Medium; L-Low

Syllabus

- Exercise to pass information between web pages.
- Exercise to apply string functions to manipulate strings
- Exercise to implement file operations.
- Exercise to implement the date and time functions.
- Exercise to create menus, styles, and animation using CSS and AJAX.
- Exercise to validate the HTML form fields using Javascript.
- Exercise to handle events and special effects using jQuery and jQuery traversing.

- Exercise to implement explode and implode functions
- Exercise to create database connectivity using PHP and MySQL
- Exercise using Angular
- Exercise using ReactJS

Pedagogy: Demonstrations

List of Exercises

1. Build a responsive web application for shopping cart with registration, login, catalog and cart pages using CSS3 features, flex and grid
2. Using AJAX Create visual search feature to search using name for practical number 15 which list name, mobile number and email id of matching users.
3. Design a project focusing on implementing jQuery special effects, such as fading, sliding, or animating elements on a web page.
4. Develop a JavaScript program to count the number of elements in a registration form.
5. Write a program to create and Build a Password Strength Check using JQuery.
6. Create a jQuery program to manage various mouse events on elements within a web page.
7. Create a password validation program using ReactJS
8. Create a voting application using ReactJS
9. Write a program to create a simple calculator Application using React JS

Applications

1. Create a PHP script that connects to a MySQL database and provides functionalities to manage employee records, including adding, retrieving, updating, and deleting employee information.
2. Create a dynamic web application using AJAX to modify content on-the-fly based on user interactions, providing seamless and efficient content updates without page reloads.
3. Develop a web form utilizing AJAX to dynamically suggest options based on user input, enhancing user experience by providing real-time suggestions as they type.
4. Develop a project AngularJS application that displays a list of shopping items. Allow users to add and remove items from the list using directives and controllers.
5. Create Angular JS application that allows users to maintain a collection of items. The application should display the current total number of items, and this count should automatically update as items are added or removed. Users should be able to add items to the collection and remove the mas needed. Note: The default values for items may be included in the program.

6. Develop Angular JS application that displays a detail of students and their CGPA. Allow users to read the number of students and display the count. Note: Student details maybe included in the program.
7. Develop an Angular JS program to create a simple to-do list application. Allow users to add, edit, and delete tasks.
8. Write an Angular JS program to create simple CRUD application (Create, Read, Update, and Delete) for managing users
9. Create a blog using React JS Using the CMS
10. Create a project on Grocery delivery application
11. Develop a project to schedule doctor appointments using ReactJS



MASTER OF SCIENCE IN COMPUTER SCIENCE
CHOICE BASED CREDIT SYSTEM (CBCS) &
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)
SYLLABUS & SCHEME OF EXAMINATION
2025-2027 BATCH – SEMESTER II

Semester	Course Code	Title of Course	Course Type	Instruction hours / week	Contact hours	Tutorial hours	Duration of Examination	Examination Marks			Credits
								CA	ESE	Total	
II	MCS23CE	Python Programming	CC	3	45	-	-	100	-	100	3
II	MCS2307	Internet of Things	CC	5	73	2	3	25	75	100	5
II	MCS2408	Pervasive Computing	CC	4	58	2	3	25	75	100	4
II	MCS23E1/ MCS23E2/ MCS25E3/ MCS25E4/ MCS25E5	Machine Learning/ Internet Protocol / Information Retrieval/ Soft Computing Bioinformatics	DSE	4	58	2	3	25	75	100	4
II	MCS24P3	ADBMS Lab	CC	5	75	-	3	25	75	100	3
II	MCS23P4	Big Data Analytics Lab	CC	5	75	-	3	25	75	100	3
II	MTH19A5	Statistical Techniques in Practice	GC	4	60	-	3	-	100	100	4
I-III	17MONL1	Online Course	ACC	-	-	-	-	-	-	-	-

CC - Core Courses

DSE - Discipline Specific Elective

GC - General Courses

ACC - Additional Credit Courses

CA - Continuous Assessment

ESE - End Semester Examination

QUESTION PAPER PATTERN

Core Paper Pattern:

CA Question from each unit comprising of

One question with a weightage of 2 Marks : $2 \times 3 = 6$

One question with a weightage of 5 Marks (Internal Choice at the same CLO level) : $5 \times 3 = 15$

One question with a weightage of 8 Marks (Internal Choice at the same CLO level) : $8 \times 3 = 24$

Total : 45 Marks

ESE Question Paper Pattern:

Question from each unit comprising of

One question with a weightage of 2 Marks: $2 \times 5 = 10$

One question with a weightage of 5 Marks (Internal Choice at the same CLO level): $5 \times 5 = 25$

One question with a weightage of 8 Marks (Internal Choice at the same CLO level): $8 \times 5 = 40$

Continuous Internal Assessment Pattern

Theory

- CIA Test: 5 marks (conducted for 45 marks after 50 days)
- Model Exam: 7 marks (Conducted for 75 marks after 85 days (Each Unit 15 Marks))
- Seminar/Assignment/Quiz: 5 marks
- Class Participation: 5 marks
- Attendance: 3 marks

Total: 25 Marks

Practical Lab

- Performance: 7 marks
- Regularity: 5 marks
- Model Exam: 10 marks
- Attendance: 3 marks

Total: 25 marks

ESE Practical Pattern

The End Semester Examination will be conducted for a maximum of 75 marks respectively with a maximum 15 marks for the record and other submissions if any.

PG-IDC and Special Course:

Section A: 5 questions (Internal choice): 25 marks

Section B: 5 questions (Internal choice): 75 marks

Total: 100 marks

From the academic year 2024-25 and onwards marks allotted for attendance component in CA is modified as

91-100% attendance : 3 Marks

81-90% attendance : 2 Marks

75-80% attendance : 1 Marks

Course Code	Course Title	Category	L	T	P	Credits
MCS23CE	PYTHON PROGRAMMING	Theory	45	-	-	3

Preamble

This course introduces the core concepts of programming in Python. It also provides knowledge in concepts like regular expressions, text processing, multithreading, internet programming, GUI programming and database programming. It also explores Web Development using Python.

Prerequisite

- Basic concepts of Programming Language
- Database concepts

Course Learning Outcomes

On successful completion of the course, the students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the programming constructs of Python	K2
CLO2	Apply the concepts of Python in simple tasks	K3
CLO3	Analyze python packages suitable to develop solutions for real time problems	K4
CLO4	Evaluate the complex problems and solve using python modules	K5
CLO5	Create python projects for real time applications	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4
CLO1	S	S	M	L
CLO2	S	S	S	M
CLO3	S	S	M	M
CLO4	S	S	S	M
CLO5	S	S	S	M

S-Strong; M-Medium; L-Low

Sl. No.	Coursera Courses	Coursera Link	No. of Hours
1	Crash Course on Python	https://www.coursera.org/programs/psgr-faculty-learning-program-1luew/skills/python-programming-language?collectionId=skill~python-programming-language&productId=8D3R5HiaEeioIg7r4jw_PA&productType=course&showMiniModal=true	22
2	Capstone: Retrieving Processing, and Visualizing Data with Python	https://www.coursera.org/programs/psgr-faculty-learning-program-1luew/learn/python-data-visualization?specialization=python	9
3	Using Python to Access Web Data	https://www.coursera.org/programs/psgr-faculty-learning-program-1luew/learn/python-network-data?specialization=python	14

Course Code	Course Title	Category	L	T	P	Credits
MCS2307	INTERNET OF THINGS	Theory	73	2	-	5

Preamble

This course aims to cover the basics of Internet of Things and protocols, Internet evolving to connect people to physical things and physical things to other physical things all in real. It helps us to learn about the middleware for Internet of Things

Prerequisite

Basic knowledge of hardware and networking technology for IoT projects.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the basics of Internet of Things and protocols	K2
CLO2	Implementing IoT architecture and IoT design constraints	K3
CLO3	Analyze the basics of IOT protocols and M2M	K4
CLO4	Evaluate the low-cost embedded system using IoT	K5
CLO5	Designing IoT solutions using sensors, actuators and devices in Arduino Raspberry Pi	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4
CLO1	M	S	M	L
CLO2	S	M	M	L
CLO3	S	S	S	M
CLO4	S	M	M	S
CLO5	M	S	S	S

S-Strong; M-Medium; L-Low

Syllabus

UNIT I

(15 Hrs.)

Introduction to Internet of Things: Elements of an IoT - Technology drivers, Business drivers, Trends and implications, Machine-to-Machine Communications. Characteristics IoT-Physical Design of IoT-Logical Design of IoT- Functional Blocks - IoT Communication Models and APIs - IoT enabled Technologies - M2M and WSN – Cloud Computing. IoT and M2M.M2M - Difference between IoT and M2M - Software defined networks- Network functions virtualization. Communication Protocols– Issues with IoT Standardization – Unified Data Standards. IoT system Management and its protocol: Needs for IoT Management –Simple Network Management Protocol (SNMP) – Limitations of SNMP – Network operation Requirements – IoT system with NET CONF-YANG. Application Protocols for IoT: UPnP, CoAP, MQTT, XMPP, DDS, AMQPSCADA, Web Socket; IP-based protocols: 6LoWPAN, RPL, mAuthentication Protocols.

UNIT II

(15 Hrs.)

Architecture for IoT: Domain model specification, Information Model Specification, Service specification, IoT Level specification, Functional view specification, Operational view specification, Device and

Component Integration, User centered design, Open-source development, End user programming, Tools for IoT. IoT Platform Design Methodology: Design Methods - Connectivity Technologies (6L) 6LoWPAN-RFID - Zigbee Bluetooth- NFC- Piconets.M2M value chains - IoT value chains – Emerging Industrial structure of IoT. Network & Communication aspects in IoT: Wireless Medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.

UNIT III

(15 Hrs.)

Devices a Gateway: Device types – Deployment scenarios for devices-Gateways – Data management – Local Application – Device Management – Need of Networks (LAN / WAN) - Advanced Devices-IoT analytics – Analytical architecture –Methodology– Knowledge management – Reference model of IoT and architecture – IoT reference model – IoT domain model – Information model - Functional model – Communication model – Security and Privacy. Introduction to Arduino Structuring an Arduino Program - Simple Primitive Types- Floating-Point Numbers –Working with groups of values- Arduino String Functionality – C character Strings- Converting Number to String – Structuring the Code into FunctionBlock- Serial communication - Input from Sensor - Input from visual output- Audio Output.

UNIT IV

(14 Hrs.)

Introduction on Raspberry Pi: About the Board – Linux on Raspberry Pi – Raspberry Pi Interfaces – Programming Raspberry Pi with Python. IoT Design using Raspberry Pi: IoT Applications based on Pi, LAMP Web-server- GPIO Control over Web Browser - Creating Custom Web Page for LAMP - Communicating data using on-board module- Home automation using Pi -Node-RED-MQTT Protocol, Using Node-RED Visual Editor on R pi Configuring- Wi-Fi on Raspberry Pi-MQTT (Message Queuing Telemetry Transport) protocol-Establishing communication between IoT devices- Analyzing and processing IoT data on Raspberry Pi-Implementing security measures for IoT devices.

UNIT V

(14 Hrs.)

Introduction to Cloud Storage Models: Overview of cloud-based IoT platforms- Cloud Deployment Models-Cloud service Models: PaaS, SaaS, IaaS- IoT Platform- Cloud IoT Architecture-IoT cloud services- Comparison of Google, AWS and Azure IoT Core Services – AWS IoT Core – Connecting a web application to AWS IoT using MQTT-. Security Concerns, Risk Issues, and Legal Aspects of Cloud Computing – Cloud Data Security. Data analytics for IoT: MapReduce Programming model, Ozie Workflow for IoT data analysis, Setting up a Strong, Cluster, REST – based approach, Web Socket-based approach. Broad categories of IoT applications: Consumer IoT, Commercial IoT, Industrial IoT, Infrastructure IoT, Military Things (IoMT). Case Study: Automotive Applications, home automation, smart cards

Text Books

S.No.	AUTHORS	TITLE	PUBLISHERS	YEAR & EDITION
1	Dr. Ashok Kumar	The Internet of Things	Vayu education of India	2025, 1 st Edn
2	Shriram K Vasudevan RMD Sundaram , Abhishek S Nagarajan	Internet of Things	Wiley	2024, 3 rd Edn
3	Raj Kamal	Internet of Things (IOT): Architecture And Design Principles	McGraw- Hill	2022, 2 nd Edn

Reference Books

S.No.	AUTHORS	TITLE	PUBLISHERS	YEAR & EDITION
1.	Jeeva Jose	Internet of Things	Khanna Book Publishing	2018, 1 st Edn
2.	Prof. Satish Jain, Shashi Singh	Internet of Things (IOT) & Its Applications	BPB Publications	2020, 1 st Edn

Pedagogy: Lectures, Group Discussions, Case studies.

Course Code	Course Title	Category	L	T	P	Credits
MCS2408	PERVASIVE COMPUTING	Theory	58	2	-	4

Preamble

This course covers the fundamentals of pervasive computing, focusing on its structure, challenges, resource management, human-computer interaction, mobile transactions, and green computing. It also includes case studies which explore real-world applications like smart homes, autonomous vehicles, and cloud infrastructure.

Prerequisites

Computer Networks

Operating Systems

Course Learning Outcomes

On successful completion of the course, the students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the principles, challenges, and technologies of pervasive computing.	K2
CLO2	Apply pervasive computing techniques to solve basic problems in resource management and HCI.	K3
CLO3	Analyze mobile transactions and evaluate context-aware computing models.	K4
CLO4	Evaluate pervasive computing frameworks and their suitability for real-world applications.	K5
CLO5	Develop and implement pervasive computing solutions for emerging domains like smart homes and green computing.	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4
CLO1	S	S	M	L
CLO2	S	S	M	L
CLO3	S	S	S	L
CLO4	S	S	S	M
CLO5	S	S	S	M

S- Strong; M-Medium; L-Low

Syllabus

UNIT I

(11 Hrs)

Introduction: Perceptive of pervasive computing - Challenges - Research trends in pervasive computing and networking - Technology. Structure and elements of pervasive computing: Infrastructure and devices - Middleware for Computing Systems- Environment. Context Collection, User tracking and context reasoning.

UNIT II

(12 Hrs)

Resource management in Pervasive computing: Efficient Resource allocation in pervasive environment - Transparent Task Migration. Human- Computer Interface in pervasive computing: HCI service - Context driven HCI Service Selection - Web service Based HCI - Migration.

UNIT III

(12 Hrs)

Pervasive Mobile Transaction : Mobile Transaction Framework - Context - Aware Pervasive Transactional

Model - Dynamic Transaction Management - Formal Transaction Verification - Evaluation. Content based Recommendation in RSS Reader- Preference - based Top K- Recommendation in Social Networks.

UNIT IV

(12 Hrs)

Tools and Techniques for dynamic reconfiguration Interoperability of Pervasive Computing - Service management in Pervasive Computing- Security and Services in Pervasive Computing - Autonomic and Pervasive Networking - Implementation for the framework Mobile and Pervasive Computing.

UNIT V

(11 Hrs)

Green Computing : A dual Technology for HPC and Cloud Computing. Case Studies : icampus prototype - IPSPace - Computer Based Navigation Systems, Autonomous Vehicle - Smart Homes- Vitaever cloud infrastructure. Sustainable practices inspired by traditional Indian systems along with IKS: Energy-efficient water harvesting techniques and environmentally adaptive designs with vibhavas, anubhavas, vyabichari bhavas and rusa.

Text Books

S.No.	AUTHORS	TITLE	PUBLISHERS	YEAR & EDITION
1	Minyi guo, Jingyu Zhou, Feilong Tang, Yao Shen	Pervasive computing: Concepts, Technologies and Applications	CRC Press	2016, 1 st Edn
2	Mohammad S. Obidat, Mieso Denko, Issac Woungang	Pervasive computing and Networking	Wiley Publication	2011, 1 st Edn

Reference Books

S.No.	AUTHORS	TITLE	PUBLISHERS	YEAR & EDITION
1	Swarnalatha C., Ashok Kumar K., Dinesh Samuel S. (Editors)	Pervasive Computing Technologies for Healthcare (2 Vols.)	Springer (LNICST)	2024, 1 st Edn
2	Uwe Hansmann, Lothar Merk, Martin S. Nicklous, Thomas Stober	Pervasive Computing: Next Generation Platforms for Intelligent Data Collection	Elsevier/Academic Press	2022, 1 st Edn

Pedagogy

Lectures, Group Discussions, Case studies

Course Code	Course Title	Category	L	T	P	Credits
MCS24P3	ADBMS LAB	Practical	-	-	75	3

Preamble

This course provides implementation of object oriented, parallel and partitioning concepts in RDBMS packages. This course also covers various queries in advanced databases like Neo4j and MongoDB

Prerequisite

- RDBMS

Course Learning Outcomes

On successful completion of the course, the students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the fundamental differences between NOSQL and graph database	K2
CLO2	Apply object oriented, parallel and partitioning technique to optimize the execution of complex queries	K3
CLO3	Analyze the structure and performance of graph data models in Ne04j	K4
CLO4	Design and implement partitioned queries to efficiently manage and access distributed data	K5
CLO5	Develop and execute parallel queries to improve query performance and speed by utilizing multiple processing units	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4
CLO1	S	M	M	M
CLO2	S	M	M	M
CLO3	S	S	M	M
CLO4	S	S	S	M
CLO5	S	S	S	M

S- Strong; M-Medium; L-Low

Syllabus

- Exercises to implement DDL and DML Commands.
- Exercises to implement the concepts of null constraint, unique constraint, integrity constraints, check constraints.
- Exercises to implement parallel queries.
- Exercises to implement the concepts of partitioning queries.
- Exercises to implement object-oriented concepts.
- Exercises to implement the various queries for CRUD operations in MongoDB.
- Exercises to implement Replication, Backup and Restore of database in MongoDB.
- Exercises to implement aggregate functions in MongoDB.
- Exercises to implement the various queries for CRUD operations in Neo4j.
- Exercises to implement various clauses like order by, read, write and where clause in neo4j.
- Exercises to implement string functions in neo4j.

- Exercises to implement aggregate functions in neo4j.
- Develop a simple application using VB.NET as front with database connectivity
- Develop a simple application using python as front with database connectivity

Pedagogy: Demonstrations

List of Exercises

1. Create an employee table and perform Insertion, updation, deletion and set the following constraints.
 - a) Primary
 - b) Foreign Key
 - c) Check
 - d) Unique
 - e) Null
2. Create an employee table and perform following join operation.
 - a) Self join
 - b) Inner join
 - c) Outer join
 - d) Left join
 - e) Right join
3. a) Create sales table with (sid, sname, sale_amount, sale_date) perform range partition with sales_date for (January February, March).
b) list and hash partitioning.
4. a) Create table employee (empno, dept, salary) and another table emp2 using the parallel query concepts.
5. Create a type address (street, city, state) as object and create table employee using the same type. Insert values and update the address of an employee.
6. Write queries in MongoDB to create student collection with id ,name, course, percentage. Create another collection student2 with id, age, gender, address
 - a) Display all students coming from Coimbatore.
 - b) Display all students getting above 50 percent.
 - c) Display all female students coming from Erode.
 - d) Display all bsc students in descending order of their percentage.
7. Write queries in MongoDB to perform CRUD Operations:
 - a) Insert a sample of 5 users into the database with various profile details. Then, retrieve users with usernames starting with 'A'.
 - b) Update the email address of a specific user. Ensure that the change is reflected in the database.
 - c) Identify and delete users who have not logged in for more than six months.
8. Write queries in MongoDB to perform Querying and Filtering:
 - a) Retrieve products with a price between \$50 and \$100 in the "Electronics" category.
 - b) Retrieve posts created within the last 30 days and sort them by the creation date.
9. Write queries in MongoDB to perform Aggregation:
 - a) Calculate the average rating of products based on customer reviews using the aggregation framework.
 - b) Find the top 5 posts with the highest number of comments using the aggregation framework.
10. Write queries in MongoDB to create a student database
 - a) Create a backup of student database
 - b) Restore student database from the backup.
11. Write basic Cypher queries in Neo4j for creating Node and Relationship:
 - a) Create two nodes representing users with properties like name and email.
 - b) Establish a friendship relationship between two users. Create a relationship type like FRIEND_OF.
 - c) Create nodes representing different cities with properties like name and population. Connect the

users to the cities with a relationship type indicating their current residence.

12. Write basic Cypher queries in Neo4j for Retrieving Data Using MATCH, WHERE, and RETURN clauses.

- a) To retrieve all nodes of a specific label (e.g., User). Return the names and email addresses of these users.
- b) Retrieve the friendship relationships (FRIEND_OF) between users. Return the names of the users who are friends.
- c) To find users who live in a specific city. Use the MATCH and WHERE clauses.

Applications

1. Develop an application for Banking Management system.
2. Design and implement an application of inventory for Super Market
3. Develop an application for student information system.
4. Design and develop an application for doctor's appointment.
5. Design and develop an application for Employee payroll.

Course Code	Course Title	Category	L	T	P	Credits
MCS23P4	BIG DATA ANALYTICS LAB	Practical	-	-	75	3

Preamble

This course provides hands-on to the introduction of Hadoop framework and its components like pig, spark, hive and scala with distributed environment through map reduce programming.

Prerequisite

SQL, DBMS

Course Learning Outcomes

On successful completion of the course, the students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand Hadoop components for big data processing and building a Hadoop cluster.	K2
CLO2	Apply Pig on executing Map reduce program .	K3
CLO3	Analyze the large sets of data representing them as Data flow.	K4
CLO4	Design a self-optimizing data transformation.	K5
CLO5	Develop Spark, Hive, Cassandra and Zepplin for data processing	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4
CLO1	S	S	M	L
CLO2	S	S	M	L
CLO3	S	S	M	M
CLO4	S	S	S	M
CLO5	S	S	S	M

S- Strong, M-Medium, L-Low

Syllabus

1. Setting up a Hadoop environment
2. Exercises to implement file management tasks using Hadoop
3. Exercises to implement Map Reduce program that mines patient data
4. Exercises to implement Pig Latin scripts to sort, group, join, project, and filter data.
5. Exercises to implement simple processing tasks in Spark & Scala.
6. Exercises to implement basic operations in Spark SQL.
7. Exercise to implement Spark RDD actions.
8. Exercise to implement Hive, Cassandra and Zepplin.

List of Exercises:

1. Implement the following file management tasks in Hadoop: Adding files and directories, retrieving files, Deleting Files.
2. Develop a Map Reduce to find the maximum electrical consumption in each year given electrical

consumption for each month in each year.

3. Develop a Map Reduce to analyze weather data set and print whether the day is shiny or cool day.
4. Write a Pig script to find the Count of Gender and Hobbies.
5. Write a program to find the number of words using Pig Script.
6. Write a Program to Creation, Alter, and Dropping Internal and External tables in Hive
7. Write a Program to implement Tables, Partitions, and Buckets in Hive.
8. Implement Built-in Functions in Hive for employee and student details.
9. Write a Hive Program to perform four types of join operations for customer table.
10. Write a Scala program that creates a class Employee with properties like name, age, and designation. Implement a method to display employee details.
11. Write a Scala program to test if a given string contains the specified sequence of char values.
12. Write a Scala program to create a map and find the minimum and maximum values in the map.
13. Write a Scala program to create Data frame and perform group by Operations with Summer Olympic data.
14. Write a program to create and use a key space in Cassandra using Java API.
15. Write a program to add a column to an existing table in Cassandra using Java API.
16. Write a Scala program to find the count of words in a document using Spark RDD.

Applications

17. Write a simple YARN client Application. Develop a Map Reduce program to calculate the frequency of a given word in given file.
18. Analyze the Cyber Crime Data set and display the results in charts using Zeppelin.
19. Develop an online using Interactive Queries and prepare Charts using Zeppelin.
20. Develop a Scala Application to generate the Student Grade Analysis.

Pedagogy: Demonstrations

ELECTIVES

Course Code	Course Title	Category	L	T	P	Credits
MCS23E1	MACHINE LEARNING	Theory	58	2	-	4

Preamble

This course introduces the fundamentals of Machine Learning and its algorithms. It also covers various supervised and unsupervised learning algorithms for classification, prediction and clustering.

Prerequisite

- Linear Algebra
- Data Mining

Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand supervised, unsupervised and semi-supervised learning	K2
CLO2	Apply supervised and unsupervised learning algorithms for classification, prediction and clustering	K3
CLO3	Analyze the efficiency of machine learning algorithms suitable for applications.	K4
CLO4	Evaluate various machine learning models.	K5
CLO5	Design an appropriate model for any given application	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4
CLO1	M	S	M	L
CLO2	S	M	M	L
CLO3	S	M	S	M
CLO4	S	S	M	M
CLO5	S	M	S	S

S- Strong; M-Medium; L-Low

Syllabus

UNIT I

(11 Hrs.)

Introduction: Machine learning Basics – Examples of machine Learning Applications. Supervised Learning: Learning a class from Examples - Vapnik- Chervonenkis Dimension - Probably Approximately Correct Learning – Noise - Learning Multiple Classes – Regression - Model Selection and Generalization - Dimensions of a Supervised Machine Learning Algorithm.

UNIT II

(12 Hrs.)

Bayesian Decision Theory: Classification - Losses and Risks - Discriminant Functions - Association Rules. Parametric Methods: Maximum Likelihood Estimation - Evaluating an Estimator: Bias and Variance - The Bayes' Estimator - Parametric Classification – Regression - Tuning Model Complexity: Bias/Variance Dilemma - Model Selection Procedures.

UNIT III

(12 Hrs.)

Multivariate Methods: Multivariate Data - Parameter Estimation - Estimation of Missing Values - Multivariate Normal Distribution - Multivariate Classification - Tuning Complexity - Discrete Features - Multivariate Regression. Nonparametric Methods: Nonparametric Density Estimation - Generalization to Multivariate Data - Nonparametric Classification - Condensed Nearest Neighbor - Distance-Based Classification - Outlier Detection - Nonparametric Regression: Smoothing Models.

UNIT IV

(12 Hrs.)

Decision Trees: Univariate Trees – Pruning - Rule Extraction from Trees - Learning Rules from Data - Multivariate Trees. Clustering: Mixture Densities - k-Means Clustering - Expectation-Maximization Algorithm - Mixtures of Latent Variable Models - Supervised Learning after Clustering - Spectral Clustering - Hierarchical Clustering - Choosing the Number of Clusters.

UNIT V

(11 Hrs.)

Multilayer Perceptrons: Introduction – Perceptron - Training a Perceptron - Learning Boolean Functions Multilayer Perceptrons - MLP as a Universal Approximator - Back propagation Algorithm - Training Procedures - Tuning the Network Size - Bayesian View of Learning - Dimensionality Reduction -Learning Time. WEKA Implementations.

Text Book

S.No.	AUTHORS	TITLE	PUBLISHERS	YEAR & EDITION
1.	Ethem Alpaydm	Introduction to Machine Learning	The MIT Press	2020, 4th Edn

Reference Bookss

S.No.	AUTHORS	TITLE	PUBLISHERS	YEAR & EDITION
1.	Ian Witten	Data mining: Practical Machine Learning Tools and Techniques	Morgan Kaufmann Publishers	2016, 4 th Edn
2.	Tom M. Mitchell	Machine Learning	Tata McGraw-Hill, New Delhi	2017, 1 st Edn
3.	Jitendra Kumar, Prof. Tahseen A. Mulla, Mohammad Haider Syed, Charanjeet Singh	Machine Learning For Absolute Beginners	Book Rivers	2023, 1 st Edn

Pedagogy

Lectures, Group Discussions, Demonstrations.

Course Code	Course Title	Category	L	T	P	Credits
MCS23E2	INTERNET PROTOCOLS	Theory	58	2	-	4

Preamble

This course presents the concept of protocols in the TCP/IP suite (IP, UDP & TCP), Layering Concepts, and Routing Architectures. It also includes Internet Addressing, Mobile IP Addressing, Network Virtualization and Client Server model of interaction.

Prerequisite

- Computer Networks
- Basic Concept of Networking

Course Learning Outcomes

On successful completion of the course, the students will be able to,

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the concept of protocols in the TCP/IP suite, Protocol Layering, Routing Architecture.	K2
CLO2	Apply TCP/IP in the Mobiles.	K3
CLO3	Analyze the relation between the various internet protocols.	K4
CLO4	Evaluate the suitability of an internet protocol for Supporting a given application type.	K5
CLO5	Deploy the overlay networks.	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4
CLO1	S	M	M	S
CLO2	S	M	M	S
CLO3	S	S	S	L
CLO4	S	S	M	L
CLO5	S	S	S	S

S – Strong; M –Medium; L -Low

Syllabus

UNIT I

(11 Hrs)

Introduction and Overview: The TCP/IP Internet – Internet services – History and Scope of the Internet – Internet Architecture Board-Transition to IPv6 - Relationship between IPv4 and IPv6-IPv6 Migration, Overview of Underlying Network Technologies: Two Approaches to Network Communication – WAN and LAN–Ethernet –Wi-Fi - ZigBee – OC and POS-Bridging–Congestion and Packet Loss, Internetworking Concept and Architectural Model: Application-Level Interconnection – Network Level Interconnection – Internet Architecture – Interconnection of Multiple Networks with IP Routers, Protocol Layering: Reference Model - ISO 7 Layer - TCP/IP 5 Layer.

UNIT II

(11 Hrs)

Internet Addressing: IPv4 - Classful Addressing Scheme - Subnet Addressing - Classless Addressing Scheme- Classless Addressing Example- IPv6 Addressing Scheme- Embedding IPv4 Addresses IPv6 for Transition- Special Addresses- Weaknesses in Internet Addressing, Mapping Internet Addresses of Physical Addresses (ARP), Internet Protocol: Connectionless Datagram Delivery: Connectionless Delivery System Characteristics

– IP Datagram – Datagram Encapsulation – Fragmentation – Reassembly.

UNIT III

(12 Hrs)

Internet protocol: Forwarding IP Datagrams, Error and Control Messages: Internet Control Message Protocol - Error Reporting Vs. Error Correction - ICMP Message Delivery - ICMP Message Format – Example ICMP Message Types Used with IPv4 & IPv6, User Datagram Protocol, Reliable Stream Transport Service (TCP): Properties of the Reliable Delivery Service – Sliding Window Paradigm - Transmission Control Protocol - Layering, Ports, Connections and Endpoints -Segment Format - Checksum Computation.

UNIT IV

(12 Hrs)

Routing Architecture: Origin of Forwarding Tables - Forwarding With Partial Information - Internet Architecture and Cores –Distance Vector(Bellman-Ford) Routing – Link State(SPF)Routing, Routing Among Autonomous Systems : Scope Of A Routing Update Protocol - Autonomous System Concept - Exterior Gateway Protocols And Reachability – BGP, Routing Within an Autonomous System : Static Vs. Dynamic Interior Routes – Routing Information Protocol(RIP) – Open SPF Protocol(OSPF) - IS-IS Route Propagation Protocol.

UNIT V

(12 Hrs)

Mobility And Mobile IP : Mobility, Addressing, and Routing - Mobility Via Host Address Change – Mobility Via Changes In Datagram Forwarding – Mobile IP Technology- Mobile IP Operation- Mobile IPv4 Addressing - IPv6 Mobility Support - Datagram Transmission, Reception, and Tunnelling - Assessment Of IP Mobility And Unsolved Problems , Network Virtualization: Virtual Private Networks (VPNs) - VPN tunnelling and IP- in-IP Encapsulation- VPN Addressing And Forwarding - Network Address Translation (NAT) - Example Of NAT Translation - Overlay Networks - Multiple Simultaneous Overlays, Client-Server Model of Interaction.

Text Books

S.No.	AUTHORS	TITLE	PUBLISHERS	YEAR & EDITION
1	DouglasE. Comer	Internet working with TCP/IP Principles, Protocols and Architecture	Pearson Publications	2014, 6 th Edn
2	Behrouz A. Forouzan	TCP/IP protocol Suite1	Tata McGraw-Hill	2016, 1 st Edn
3	James Wemette	TCP/IP Model: Network Protocol Fundamentals	Prentice Hall of India	2024, 1 st Edn
4	Olivier Bonaventure	Computer Networking: Principles, Protocols and Practice	Open Textbook	2023, 1 st Edn

Reference Books

S.No.	AUTHORS	TITLE	PUBLISHERS	YEAR & EDITION
1	Richard Stevens	TCP/IP Illustrated	Prentice Hall of India	2011, 2 nd Edn
2	Julie C. Gaffin	Internet Protocol6	Nova Science	2007, 1 st Edn

Pedagogy

Lectures, Case Studies, Group Discussions.

Course Code	Course Title	Category	L	T	P	Credits
MCS25E3	INFORMATION RETRIEVAL	Theory	58	2	-	4

Preamble

This course presents the concepts of document representation, document indexing, digital information storage, retrieval and distribution. It also introduces effective search strategies for IR systems, vector space model, text classification and evaluation methods of IR systems.

Prerequisite

- Database Management systems
- Data Mining

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the concepts of document representation, document indexing, digital information storage, retrieval and distribution	K2
CLO2	Apply the concepts of vector spaces and classifiers to perform document classification.	K3
CLO3	Analyze the strengths and weaknesses of various Information Retrieval models.	K4
CLO4	Evaluate the effectiveness of different search strategies used in Information Retrieval systems.	K5
CLO5	Assess and design an information retrieval system tailored for specific use cases.	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4
CLO1	S	M	M	L
CLO2	S	M	M	L
CLO3	S	S	M	M
CLO4	S	M	S	M
CLO5	S	S	S	M

S-Strong; M-Medium; L-Low

Syllabus

UNIT I

(11 Hrs)

Boolean retrieval: Information retrieval problem - Processing Boolean queries - Boolean model versus ranked retrieval. The term vocabulary and postings lists: Document delineation and character sequence decoding - Determining the vocabulary of terms - Faster postings list intersection via skip pointers - Positional postings and phrase queries

UNIT II

(12 Hrs)

Dictionaries and tolerant retrieval: Search structures for dictionaries - Wildcard queries - Spelling correction - Phonetic correction. Index construction: Hardware basics - Blocked sort-based indexing - Single-pass in-memory indexing - Distributed indexing - Dynamic indexing - Other types of indexes

UNIT III

(12 Hrs)

Scoring, term weighting and the vector space model: Parametric and zone indexes-Term frequency and weighting - The vector space model for scoring. Evaluation in information retrieval: Information Retrieval

system – Standard test Collection – Evaluation of unranked retrieval sets – Evaluation of ranked retrieval results – Assessing relevance

UNIT IV

(12 Hrs)

XML retrieval: Basic XML concepts – A vector space model for XML retrieval – Evaluation of XML retrieval - Text-centric vs. data-centric XML retrieval. Text classification and Naive Bayes: The text classification problem- Naive Bayes text classification - Properties of Naive Bayes – Feature selection - Evaluation of text classification

UNIT V

(11Hrs)

Vector space classification: Document representations and measures of relatedness in vector spaces – Rocchio classification - Flat clustering: Clustering in information retrieval - Evaluation of clustering - K-means –Web search basics – Web characteristics - Advertising as the economic model– Search user experience – Basic Page Rank

Text Book

S.No.	AUTHORS	TITLE	PUBLISHERS	YEAR & EDITION
1	Christopher D.Manning, Prabhakar Raghavan, Henrich Schutze	Introduction to Information Retrieval	Cambridge University Press	2018, 1 st Edn
2	Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack	Information Retrieval	MIT Press	2025, 1 st Edn

Reference Books

S.No.	AUTHORS	TITLE	PUBLISHERS	YEAR & EDITION
1	K. S. Jones, S. D. Dumais (Editors)	Modern Information Retrieval: Guide Books	ACM Press	2024, 1 st Edn
2	Dr Ricardo Baeza-Yates et.al	Modern Information Retrieval: The Concepts and Technology	Addison Wesley	2012, 1 st Edn
3	David A.Grossman andopfir Frieder	Information Retrieval	Universities Press	2010, 1 st Edn

Pedagogy: Lectures, Demonstrations, Guest Lectures, Video Lectures

Course Code	Course Title	Category	L	T	P	Credits
MCS25E4	SOFT COMPUTING	Theory	58	2	-	4

Preamble

This course aims to explain importance of optimization techniques and genetic programming and to gather knowledge about various hybrid soft computing techniques and apply in real time problems.

Prerequisite

Basic knowledge of problem solving and networking.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the concepts of soft computing and their applications	K2
CLO2	Apply supervised and unsupervised learning in neural networks	K3
CLO3	Analyze soft computing techniques for small applications	K4
CLO4	Evaluate the results of knowledge base system	K5
CLO5	Designs of computing techniques suitable for real time applications	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4
CLO1	S	S	M	L
CLO2	S	M	S	L
CLO3	S	M	M	M
CLO4	S	M	S	M
CLO5	S	S	M	S

S-Strong; M-Medium; L-Low

Syllabus

UNIT I

(11 Hrs)

Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic Algorithm and Evolutionary Programming-Swarm Intelligent Systems-Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta- Perceptron Network-Adaline Network-Madaline Network.

UNIT II

(11 Hrs)

Neural Networks Back Propagation Neural Networks - Kohonen Neural Network -Learning Vector Quantization- Hamming Neural Network- Hopfield Neural Network-Bi-directional Associative Memory - Adaptive Resonance Theory Neural Networks- Support Vector Machines-Spike Neuron Models

UNIT III

(12 Hrs)

Fuzzy system Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets – Classical Relations and Fuzzy Relations – Membership Functions- Defuzzification – Fuzzy Arithmetic and Fuzzy Measures – Fuzzy Rule Base and Approximate Reasoning - Introduction to Fuzzy Decision Making

UNIT IV

(12

Hrs)

Genetic Algorithm Basic Concepts- Working Principles -Encoding- Fitness Function - Reproduction - Inheritance Operators- Cross Over – Inversion and Deletion –Mutation Operator - Bit-wise Operators - Convergence of Genetic Algorithm

UNIT V

(12

Hrs)

Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic -GA Based Weight Determination - LR-Type Fuzzy Numbers - Fuzzy Neuron - Fuzzy BP Architecture - Learning in Fuzzy BP- Inference by Fuzzy BP- Fuzzy Art Map: A Brief Introduction-Soft Computing Tools- GA in Fuzzy Logic Controller Design - Fuzzy Logic Controller.

Text Books

S.No.	AUTHORS	TITLE	PUBLISHERS	YEAR & EDITION
1	Jin Xiong	Essential Bioinformatics	Cambridge University Press	2016, 1 st Edn
2	T K Attwood & D J Parry Smith	Introduction to Bioinformatics	Pearson Education	2007, 1 st Edn
3	Gautam B. Singh	Fundamentals of Bioinformatics and Computational Biology	Springer International Publishing	2025, 1 st Edn

Reference Books

S.No.	AUTHORS	TITLE	PUBLISHERS	YEAR & EDITION
1	Sudan Jha, Shubhabrata Datta (Editors)	Soft Computing in Smart Manufacturing and Materials	Elsevier	2025, 1 st Edn
2	S. Gupta, A. Kumar Saini, T. Zia (Editors)	Soft Computing Principles and Integration for Real-Time Service-Oriented Computing	Routledge	2025, 1 st Edn

Pedagogy: Lectures, Group Discussions, Case studies

Course Code	Course Title	Category	L	T	P	Credits
MCS25E5	BIOINFORMATICS	Theory	58	2	-	4

Preamble

This course presents the basic concepts of Bioinformatics integrates biology, computer science, and statistics to analyze, interpret, and manage biological data. It explores Sequencing, DNA and Protein Structure.

Prerequisite

- Basic knowledge of molecular biology (DNA, RNA, proteins) and genetics.
- Fundamental understanding of computer science concepts, algorithms, and programming

Course Learning Outcomes

On the successful completion of the course, student will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the fundamental concepts, scope and applications of Bioinformatics.	K2
CLO2	Apply various biological databases for data retrieval and analysis	K3
CLO3	Analyze sequence similarity using appropriate bioinformatics tools and techniques	K4
CLO4	Evaluate sequence alignment methods and interpret alignment results effectively	K5
CLO5	Design and visualize the structural models of proteins and DNA using computational tools	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4
CLO1	M	S	S	S
CLO2	M	S	M	S
CLO3	M	M	M	S
CLO4	S	S	M	M
CLO5	S	M	S	M

S – Strong; M – Medium

Syllabus

UNIT I

(12 Hrs)

Introduction to Bioinformatics – Goal – Scope – Applications – Limitations. Biological Databases: Introduction to Database – Types of Database – Biological Database – Pitfalls of Biological Database – Information retrieval from Biological databases.

UNIT II

(11 Hrs)

Database Similarity Searching: Unique Requirements of database searching – Heuristic database searching – Basic local alignment search tool (BLAST) – FASTA – Comparison of FASTA & BLAST – Database searching with smith – waterman method.

UNIT III

(12 Hrs)

Sequence Alignment: Pairwise Sequence Alignment: Evolutionary basis – Sequence Homology versus sequence Similarity- Sequence Similarity versus Sequence Identity – Methods. Multiple Sequence Alignment: Scoring Function, Exhaustive Algorithms.

UNIT IV

(12 Hrs)

Protein Structure Basics: Amino Acids- Peptide Formation-Secondary Structure - Tertiary Structure. Protein Secondary Structure Prediction: Secondary structure prediction for Globular Proteins. Tertiary Structure Prediction: Methods-Homology modeling. Protein Structure Visualization, Comparison and classification.

UNIT V

(11 Hrs)

Bioinformatics in pharmacy: Drug Discovery Process, Structure based and Ligand based drug design (CADD). Bioinformatics in agriculture: Meta Genomics: Crops, Insect Resistance, Nutritional Quality and Abiotic Stress Tolerance. Microarray Expression Data Analysis using Bayesian MethodologiesTools: Multi Alignment (T-Coffee, Muscle) Phylogenetic Analysis Tools (ODEN, Tree View).

Text Books

S.No.	AUTHORS	TITLE	PUBLISHERS	YEAR & EDITION
1	Jin Xiong	Essential Bioinformatics	Cambridge University Press	2016, 1 st Edn
2	T K Attwood & D J Parry Smith	Introduction to Bioinformatics	Pearson Education	2007, 1 st Edn
3	Gautam B. Singh	Fundamentals of Bioinformatics and Computational Biology	Springer International Publishing	2025, 1 st Edn

Reference Books

S.No.	AUTHORS	TITLE	PUBLISHERS	YEAR & EDITION
1	Jean-Michel Claverie , Cedric Notredame	Bioinformatics – A Beginner's Guide	Wiley Computer Publishing	2009, 1st Edn
2	Shuba Gopal, Rhys Price Jones, Paul Tymann, Anne Haake	Bioinformatics with fundamentals of Genomics and Proteomics	Tata McGraw Hill	2010, 1st Edn

Pedagogy Chalk and talk, PPT, Discussion, Assignment, Demo, Quiz



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DEPARTMENT OF COMPUTER SCIENCE (PG)

**CHOICE BASED CREDIT SYSTEM (CBCS) &
LEARNING OUTCOMES - BASED CURRICULUM FRAMEWORK (LOCF)**

**MASTER OF SCIENCE IN COMPUTER SCIENCE
2024 -2026 BATCH
Semester III,IV**



M.Sc. Computer Science

Programme Outcomes

After completion of the Programme, the student will be able to

PLO1: Demonstrate broad knowledge in core areas of computer science, current and emerging technologies in IT

PLO2: Apply higher degree of technical skills in problem solving and application development

PLO3: Gain analytical and managerial skills to enhance employment potential

PLO4: Acquire holistic development with strong emphasis on values and ethics

Programme Specific Outcomes

The students at the time of graduation will

PSO1: Identify and formulate complex problems to achieve solutions using concepts of algorithms, advanced networks, database management systems, artificial intelligence and machine learning.

PSO2: Design solutions for complex problems and design processes that meet the specific needs of the society.

PSO3: Create and apply appropriate techniques, resources and tools including prediction and modeling to multifaceted activities.

PSO4: Apply programming and technical skills to solve real life complex problems and hence enhance employability.

PSO5: Analyze research methods including interpretation of data and synthesis of the information to provide valid conclusions.

PSO6: Demonstrate skills as an individual and as a member or leader in diverse teams

PSO7: Recognize the need for life-long learning and pursue career as a researcher or software engineer.

PSO8: Apply ethical principles and contribute effectively to the welfare of the society.

MASTER OF SCIENCE IN COMPUTER SCIENCE
CHOICE BASED CREDIT SYSTEM(CBCS)
LEARNING OUTCOMES - BASED CURRICULUM FRAMEWORK(LOCF)
SYLLABUS & SCHEME OF EXAMINATION
2024 - 2026 Batch -Semester- III

Semester	Course Code	Title of the Course	Course Type	Instruction hours / week	Contact hours	Tutorial hours	Duration of Examination	Examination Marks			Credits
								CA	ESE	Total	
III	MCS2306	Artificial Intelligence	CC	3	43	2	3	25	75	100	3
III	MCS2409	Advanced Java Programming	CC	5	73	2	3	25	75	100	5
III	MCS2410	Cloud Computing Tools and Techniques	CC	4	58	2	3	25	75	100	4
III	MCS24E3/ MCS23E4/ MCS23E6/ MCS23E7/ MCS23E9/ MCS23E10	Deep Learning / Cyber Security and Forensics / Natural Language Processing / Social Media Analytics/ Virtual Reality/ Quantum Computing	DSE	4	58	2	3	25	75	100	4
III	MCS22S1	Research Methodology	CC	4	60	-	3	-	100	100	4
III	MCS23P5	Advanced Java Programming Lab	CC	5	75	-	3	25	75	100	3
III	MCS23P6	Robotic Process Automation Lab	CC	5	75	-	3	25	75	100	3
IV	MCS24COM	Comprehensive Exam – Online	GC	-	-	-	-	100	-	100	Gr.
III	MCS23IST	Summer Internship	DSE	-	-	-	-	100	-	100	Gr.
III	MNM22CS2	Cyber Security II	AECC	-	-	-	-	100	-	100	Gr.
I-III	17MONL1	Online Course	ACC	-	-	-	-	-	-	-	-

*Open Book-MCS2306-Artificial Intelligence

CC - Core Course

DSE - Discipline Specific Elective

AECC - Ability Enhancement Compulsory Course

ACC – Additional Credit Course

GC - General Course

Examination System

Pattern:

Semester system will be followed. A semester consists of a minimum of 90 working days Excluding the days of conduct of ESE. There will be Continuous Internal Assessment (CA) to evaluate the performance of students in each course and the End Semester Examination will be held at the end of every semester.

Weightage assigned to various components of Continuous Internal Assessment

Theory

CIA Test	: 5 marks (conducted for 45 marks after 50 days)
Model Exam	: 7 marks (Conducted for 75 marks after 85 days (Each Unit 15 Marks))
Seminar/Assignment/Quiz	: 5 marks
Class Participation	: 5 marks
Attendance	: 3 marks
Total	: 25 Marks

Practical Lab

Performance	: 7 marks
Regularity	: 5 marks
Model Exam	: 10 marks
Attendance	: 3 marks
Total	: 25 marks

CA Question Paper Pattern and distribution of marks –(First 3 Unit)

Core and Elective Courses

CA question from each unit comprising of

One question with a weightage of 2 Marks : $2 \times 3 = 6$

One question with a weightage of 5 Marks (Internal Choice at the same CLO level) : $5 \times 3 = 15$

One question with a weightage of 8 Marks (Internal Choice at the same CLO level) : $8 \times 3 = 24$

Total : 45 Marks

Cyber Security II

Quiz	: 60 marks
Case study	: 20 marks
Poster	: 20 marks
Total	: 100 marks

End Semester Examination- Question Paper Pattern and Distribution of Marks

Core and Elective Courses

ESE Question Paper Pattern: $5 \times 15 = 75$ Marks

Question from each unit comprising of

One question with a weightage of 2 Marks: $2 \times 5 = 10$

One question with a weightage of 5 Marks (Internal Choice at the same CLO level): $5 \times 5 = 25$

One question with a weightage of 8 Marks (Internal Choice at the same CLO level): $8 \times 5 = 40$

Research Methodology

Section A - 5 questions (Internal choice): 25 marks

Section B - 5 questions (Internal choice): 75 marks

Total : 100 Marks

ESE Practical Pattern

The End Semester Examination will be conducted for a maximum of 75 marks respectively with a maximum 15 marks for the record and other submissions if any.

Open book exam

CIA Test Pattern: $4 (4 \text{ out of } 6) \times 15 \text{ Marks} = 60 \text{ Marks}$

Criteria for Attendance:

3 Marks (Attendance 75% - 80% - 1 Marks, 81% - 90% - 2 Marks, 91% - 100% - 3 Marks)

Course code	Course Title	Category	L	T	P	Credit
MCS2306	ARTIFICIAL INTELLIGENCE	Theory	43	2	-	3

Preamble

This course introduces the concepts of Artificial Intelligence and the various methods of solving problems using Artificial Intelligence. It also provides insights on machine learning techniques and its applications.

Prerequisite

- Probability and Statistics
- Discrete Structures

Course Learning Outcomes

On successful completion of the course, the students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the techniques of knowledge representation and problem solving in the field of artificial intelligence	K2
CLO2	Apply appropriate AI techniques for real time scenarios	K3
CLO3	Analyze suitable Artificial Intelligence principles to solve a given problem	K4
CLO4	Evaluate different AI algorithms appropriate for solving a given problem	K5
CLO5	Design and develop models for predictive tasks in various domains	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4
CLO1	S	S	M	M
CLO2	M	M	M	M
CLO3	M	M	M	L
CLO4	S	M	L	M
CLO5	S	S	M	M

S- Strong; M-Medium; L-Low

UNIT I

(9 hrs)

Introduction: AI problems, Agents and Environments, Structure of Agents, Problem Solving Agents
Basic Search Strategies: Problem Spaces, Uninformed Search (Breadth- First, DepthFirst Search, Depth-first with Iterative Deepening), **Heuristic Search (Hill Climbing, Generic Best-First, A*), Constraint Satisfaction (Backtracking, Local Search)**

UNIT II

(9 hrs)

Advanced Search: Constructing Search Trees, Stochastic Search, A* Search Implementation, Minimax Search, Alpha-Beta Pruning. Randomized Search: Genetic Algorithm - Ant Colony Optimization. **Basic Knowledge Representation and Reasoning:** Propositional Logic, First-Order Logic, **Forward Chaining and Backward Chaining**, Introduction to Probabilistic Reasoning, Bayes Theorem.

UNIT III**(9 hrs)**

Knowledge representation issues: Representations and mappings – Approaches to Knowledge representations – Issues in Knowledge representations – Frame Problem. **Using Predicate Logic:** Representing simple facts in logic – Representing Instance and Is a relationship – **Computable functions and predicates – Resolution**

UNIT IV**(8 hrs)**

Representing knowledge using rules: Procedural Vs Declarative knowledge – Logic programming – Forward Vs Backward reasoning – **Matching – Control knowledge**

UNIT V**(8 hrs)**

Expert Systems: Representing and Using Domain Knowledge- Expert Knowledge Shell- Knowledge Acquisition- Perception. **Case Studies:** AI in Environmental Management (Smart Pollution Control, Water Management, Farming) - AI in Retail (Alibaba, Walmart) - **AI in Medical Imaging (MRI, US, Mammography)**

Text Books

S.NO	AUTHOR	TITLE	PUBLISHERS	YEAR & EDITION
1.	Stuart Russell, Peter Norvig,	Artificial Intelligence: A Modern Approach	Pearson Publishing	2020,4 th Edn
2.	Lavika Goel	Artificial intelligence: Concepts and applications	Wiley Publications	2021,1 st Edn

Reference Books

S.NO	AUTHOR	TITLE	PUBLISHERS	YEAR & EDITION
1.	G. Luger	Artificial Intelligence: Structures and Strategies for complex problem solving	Pearson Publishing	2021,4 th Edn

Pedagogy: Lectures, Demonstrations, Case Studies

Course Code	Course Title	Category	L	T	P	Credit
MCS2409	ADVANCED JAVA PROGRAMMING	III	73	2	-	5

Preamble

This course presents concepts to design and develop web-based applications using Servlets and Web Sockets. It also covers concepts such as Java Persistence API, EJB, JSF, Hibernate, Spring and Struts framework.

Prerequisite

- Java
- HTML

Course Learning Outcomes

On completion of the course, the students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1.	Understand the basic concepts of web designing	K2
CLO2.	Determine the importance of scripting language in making a web page interactive	K3
CLO3.	Examine the utilization of Servlets, EJB, JSF and Hibernate in the development of dynamic web applications	K4
CLO4.	Design web-based applications using Spring, Struts and Java Persistence API	K5
CLO5.	Develop modern Web Applications using the client and server-side technologies	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4
CLO1	S	S	S	M
CLO2	S	S	M	L
CLO3	S	M	M	M
CLO4	S	M	L	M
CLO5	S	M	M	L

S- Strong; M-Medium; L-Low

UNIT I

(15 Hrs)

Java Servlets: Java Servlets and Common Gateway Interface Programming – A Simple Java Servlet – Anatomy of a Java Servlet – Reading data from a client – Reading HTTP Request Headers – Sending Data to a Client and Writing the HTTP Response Header – **Working with Cookies – Tracking Sessions.**

Java Server Pages (JSP): Introduction to JSP- JSP architecture and lifecycle - JSP scripting elements and directives - **JSP standard actions and custom tags-Expression Language.**

Model-View-Controller (MVC): Fundamental Concepts and Components - Integration with Servlets and JSP for Web Application Development.

UNIT II

(15 Hrs)

Java Server Faces (JSF): JSF Request Processing Lifecycle - JSF Expression Language (EL) - PrimeFaces

Library Usage in JSF Applications -JSF Libraries- **JSF Event Handling- Standard Component Tags and Facelets.**

Enterprise Java Beans (EJB): Introduction to EJB: Benefits and Types - Lifecycle of Stateful and Stateless Session Beans - Message-Driven Beans: Configuration, Features, and Applications - **Client Access Interfaces: Remote and Local Access - Container-Managed Relationships.**

Java Database Connectivity (JDBC): Establishing Connections, Executing SQL Queries - Transaction Management - **ResultSet and Metadata Processing.**

UNIT III

(15 Hrs)

Spring Core: IoC Container and Dependency Injection (DI) - Spring Configuration and Spring Boot Setup - **Bean Lifecycle and Configuration.**

Spring MVC: Dispatcher Servlet Architecture - Annotations and Controllers - Views and Input Validation - **File Upload Handling.**

Spring REST API: Building and Consuming RESTful Web Services - HTTP Methods (GET, POST, PUT, DELETE) - **Exception Handling in REST API.**

UNIT IV

(14 Hrs)

Spring ORM with Hibernate: Entity Relationships (One-to-One, One-to-Many, Many-to-Many) - Embeddable Collection Types – Inheritance – Persistence Context & Entity Manager – JPQL and Criteria API – Spring Data JPA – **Spring Data JPA Specification & Projection** - Integrating Spring ORM with Hibernate.

Spring AOP: Aspect-Oriented Programming Concepts - **Implementing Cross-Cutting Concerns like Logging and Security** - Join Points and Pointcuts.

Spring Cloud: Microservices Architecture - Service Discovery (Eureka) - Centralized Configuration (Config Server) - **Fault Tolerance and Load Balancing with Hystrix and Ribbon.**

UNIT V

(14 Hrs)

STRUTS FRAMEWORK: Introduction to Struts – Two Development Models – Model View Architecture – Enter struts – Basic Components of Struts – Building Simple Struts Application – Model Layer: Struts and the model - **View Layer: Struts and view layer -The Controller Layer: Struts and controller layer.**

TEXT BOOKS

S.No	AUTHOR	TITLE	PUBLISHERS	YEAR & EDITION
1	David Flanagan	JavaScript: The Definitive Guide	O'Reilly Media	2020 / 7th Edn
2	Matt Frisbie	Professional JavaScript for Web Developers	Wiley Publishing	2019 / 4th Edn
3	David R. Heffelfinger	Java EE 8 Application Development	Packt Publishing	2017 / 1st Edn

REFERENCE BOOKS

REFERENCE BOOKS									
S.NO	AUTHOR		TITLE		PUBLISHERS		YEAR & EDITION		
1	Iuliana Cosmina et al.		Pro Spring 5		Apress		2017 / 5th Edn		
2	Jim Keogh		The Complete Reference J2EE		McGraw Hill Education		2017 / 1st Edn		
3	Giulio Zambon		Beginning JSP, JSF and Tomcat		Apress		2022 / 1st Edn		
4	Santosh Kumar K		JDBC 4.2, Servlet 3.1, and JSP 2.3 Includes JSF 2.2 and Design Patterns		Dream Tech		2016 / 2nd Edn		
Course Code		Course Title			Category	L	T	P	Credit

MCS2410	CLOUD COMPUTING TOOLS AND TECHNIQUES	Theory	58	2	-	4
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Preamble

This course begins with an introduction to cloud computing, covering service and deployment models, virtualization technologies, and the benefits of cloud-based solutions. It further explores scalability strategies, autoscaling mechanisms, and collaborative development in cloud-native environments.

Prerequisite

- Computer Network
- Fundamentals of Operating Systems

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Explain the fundamental concepts of cloud computing, including service and deployment models, characteristics, benefits, and cloud-native principles.	K2
CLO2	Demonstrate the ability to use virtualization techniques, autoscaling strategies, and collaborative development in cloud-native environments.	K3
CLO3	Analyze resource management issues and security challenges in cloud computing and propose effective solutions.	K4
CLO4	Evaluate open-source cloud-native DevOps tools, infrastructure as code (IaC) management, and the impact of AI and security compliance in cloud environments.	K5
CLO5	Design and develop cloud-based solutions using cloud computing development tools, cloud simulators, and modern cloud-native frameworks.	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4
CLO1	S	S	S	S
CLO2	S	S	S	S
CLO3	S	S	S	M
CLO4	S	S	M	M
CLO5	S	S	M	L

S-Strong; M-Medium; L-Low

UNIT I

(11 hrs)

Introduction: Cloud Computing – Service Delivery Models-Deployment Models - Characteristics and Benefits of Cloud Computing - Cloud Computing Platforms and Technologies. Cloud Native: Continuous Integration and Delivery - **Serverless Computing** - **Advantages of Serverless Cloud Computing**-Popular Serverless Computing Platforms-Disadvantages of Serverless Cloud Computing

Virtualization: Virtualization **Technology**- Virtualization Platforms – Virtualization Techniques-Pros and Cons of Virtualization.

UNIT II

(12 hrs)

Scalability and Autoscaling Strategies: Scaling Principles in Cloud-Native Applications-Multi-Cloud Strategies-Autoscaling Implementation in AWS-**Future Trends in Scalability and Autoscaling.**

Collaborative Development in the Cloud Native: Optimizing Cloud-Based Data Flow-ETL Processes and Supply Chain Management.

UNIT III

(11 hrs)

Resource Management in Cloud: Significant Resource in Cloud-Issues in Resource Management-**Solutions to Resource Management Issues.****Cloud Security:** Data Security-Encryption Techniques in Cloud-Infrastructure Security-PaaS Application Security-SaaS Application Security- **Securing Virtual Servers-**Cloud Security Controls

UNIT IV

(12 hrs)

Open-Source Tools for Cloud-Native Devops: Overview of Open-Source Tools in Cloud Native-Argo Streamlining Workflows-Kubeflow Pipelines-Future Trends in Cloud-Native Devops Tools-Adoption of Cloud-Native Technologies-**Infrastructure as Code (IaC) Management**-Artificial Intelligence Evolution-Security and Compliance-Collaboration between DevOps Teams-Fresh Dimension in Quantum Computing-Adapting to Change-Artificial Intelligence for IT Operations (AIOps)

UNIT V

(12 hrs)

Cloud Computing Development Tools: Kernel Virtual Machine (KVM)-DeltaCloud-Eucalyptus-OpenStack-SaltStack-Apache CloudStack-AWS **Cloud Development Kit (AWS CDK)**-Windows Azure SDK **Cloud Simulators-** CloudSim and GreenCloud Introduction to Simulator, understanding CloudSim simulator, CloudSim Architecture (User code, CloudSim, GridSim, SimJava) Understanding Working platform for CloudSim, **Introduction to Green Cloud**

TEXT BOOKS

S.NO	AUTHOR	TITLE	PUBLISHERS	YEAR & EDITION
1.	Dr.Sunilkumar Manvi, Dr.Gopal K.Shyam	Cloud Computing Concepts and Technologies	CRC Press, Taylor and Francis Group, New York	2025 / 1 st Edn
2.	Mohammed Iiyas Ahmed	Cloud-Native DevOps	Apress	2025 / 1 st Edn
3.	K.Chandrasekaran	Essentials of Cloud Computing	CRC Press, Taylor and Francis Group, New York	2023 / 1 st Edn

REFERENCE BOOKS

S.NO	AUTHOR	TITLE	PUBLISHERS	YEAR & EDITION
1.	Anthony T.Velte , Toby J. Velte Robert Elsenpeter	Cloud computing a practical approach	TATA McGraw-Hill, New Delhi	2017 / 2 nd Edn
2.	Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski	Cloud Computing (Principles and Paradigms)	John Wiley & Sons, Inc.	2013 / 3 rd Edn

Pedagogy: Lectures, Group Discussions, Case studies

Course Code	Course Title	Category	L	T	P	Credits
MCS22S1	RESEARCH METHODOLOGY	Theory	60	-	-	4

Preamble

This course presents the concepts of research, types of research, research design, literature review and writing reports. It also covers various areas of computer science.

Prerequisite

This course is most appropriate for postgraduate students who are interested in research but do not have prior research experience.

Course Learning Outcomes

On successful completion of the course, the students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the concepts of research design, research process and various types of research	K2
CLO2	Apply the research methodologies in different research areas	K3
CLO3	Analyze the ethical issues in research	K4
CLO4	Evaluate the methods and techniques for various experimental study	K5
CLO5	Develop solutions for research problems in a responsible and ethical manner	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4
CLO1	S	M	M	M
CLO2	S	L	M	M
CLO3	S	S	S	L
CLO4	S	M	S	S
CLO5	S	S	S	S

S- Strong; M-Medium; L-Low

UNIT I

(12 Hrs)

Research Methodology: An Introduction: Meaning of research - Objective of research -Types of research - Significance of research -Research methods versus Methodology - Research and scientific method - Research process - Criteria of good research -**Problems encountered by researchers in India. Defining the research problem:** What is a research problem? - Selecting the problem - Necessity of defining the problem - **Technique involved in defining a problem**

UNIT II

(12 Hrs)

Reviewing the literature: Literature review in research - How to review the research? - **Writing about the literature reviewed - Formulating a research problem. Research Design:** Research Design: Meaning of research design - Need for research design - Features of a good design - **Important concepts relating to research design - Different research designs** - Basic principles of experimental designs

UNIT III**(12 Hrs)**

Data Collection: Introduction - Experiments and Surveys - Collection of primary data - Collection of secondary data - **Selection of appropriate method for data collection** - Case study method. **Data Preparation:** Data Preparation Process - Some problems in preparation process- **Missing values and outliers** -Types of analysis - Statistics in research

UNIT IV**(12 Hrs)**

Interpretation and report writing: Meaning of interpretation - Technique of interpretation -Precaution in interpretation - Significance of report writing - Different steps in writing report - Layout of the research report - Types of reports - Oral Presentation - Mechanics of writing a research report - Precautions for writing research reports

Research Publications: Preparing Research papers for journals, Seminars and Conferences – Design of paper using template, Plagiarism, Calculations of Impact factor of a journal, citation Index, ISBN & ISSN, IPR, Patent.

UNIT V**(12 Hrs)**

Research Ethics and Responsible Conduct in Research: Brief history and analytical basis of research ethics, responsible conduct in research (Honesty in Science: Integrity, Authorship, Conflicts of Interest, Privacy and Confidentiality, Informed Consent, Risk/Benefit Assessment), The legal regulation of research ethics in India (From UGC, MHRD and other governing agencies), Regulatory requirements relevant to international research.

TEXT BOOKS

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION/ EDITION
1.	Kothari, GauravGarg	Research Methodology- Methods and Techniques	New Age International Publishers	2021,4th Edn

REFERENCE BOOKS

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS	YEAR OF PUBLICATION/ EDITION
1.	RanjitKumar	Research Methodology A step-by-step guide for beginners	Pearson Education	2015,3rd Edn

Pedagogy:Lectures, Demonstration, Case Studies

Course Code	Course Title	Category	L	T	P	Credit
MCS23P5	ADVANCED JAVA PROGRAMMING LAB	III	-	-	75	3

Preamble

This course provides exercises to design and develop web-based applications using MVC concepts. It also provides exercises to implement Spring, Java Persistence API, Hibernate and Struts concepts to create an interactive application.

Prerequisite

- Java
- HTML

Course Learning Outcomes

On completion of the course, the students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the method of compiling and running web-based applications	K2
CLO2	Implement database connectivity techniques to connect application with the database	K3
CLO3	Analyze the importance of web services in making a webpage interoperable	K4
CLO4	Design web-based applications using Spring and Java Persistence API	K5
CLO5	Develop modern Web Applications using the client and server-side technologies	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4
CLO1	S	S	M	S
CLO2	M	S	M	S
CLO3	M	S	M	S
CLO4	M	S	M	S
CLO5	S	S	M	S

S- Strong; M-Medium

Syllabus

- Exercise to implement web sockets.
- Exercise to implement form validation techniques.
- Exercise to implement file upload.
- Exercise to implement exception handling.
- Exercise to inject data into spring bean property.
- Exercise to develop a servlet application.

- Exercise to implement dependency injection in spring.
- Exercise to implement JPA and Hibernate.
- Exercise to design a web application using struts.

Pedagogy: Demonstrations

List of Programs

Application :

1. Develop a product-based web application using struts.
2. Develop a Java Spring program to raise exceptions for invalid bank transactions.
3. Create an application for employee details using Hibernate.
4. Develop a student internship JSP application to display values obtained from the use of intrinsic objects of various types.
5. Develop a Employee age and hobbies application to pass values from one page to another with validations. (Name-txt, age-txt, hobbies-checkbox, email-txt, gender-radio button) using JSP.
6. Test RESTFUL Webservices Using Spring Boot.
7. Develop a Parents details using struts and store datas and retrieve using Rabbit Message Queue.
8. Develop a student's admission basic registration form using JSF along email validation.
9. Develop an JSF application with a prime faces data tables, fetching product details from a database and enable the sorting, filtering and pagination.
10. Create an application for patient appointment details using Hibernate.
11. Develop to store the alumni details-based web application using struts.
12. Develop an online feedback system using struts.
13. Develop a Employee registration form as a web-based application using Spring Django framework.

Pedagogy: Demonstrations

Course Code	Course Title	Category	L	T	P	Credit
MCS23P6	ROBOTIC PROCESS AUTOMATION LAB	Practical	-	-	75	3

Preamble

This course provides an understanding of basic concepts of Robotic Process Automation and also various exercises to implement RPA Design and Development strategies in the context of UiPath. This course also develops the competence to design and develop a robot for a defined process

Prerequisite

Basic Programming Concepts

Course Learning Outcomes

On successful completion of the course, the students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand Ui-Path Studio	K2
CLO2	Apply simple RPA basics	K3
CLO3	Analyse arithmetic operations for different fields from an excel file	K4
CLO4	Evaluate different formats for input and output validations	K5
CLO5	Develop bots for real time automation applications	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4
CLO1	S	L	M	M
CLO2	S	S	M	M
CLO3	S	S	M	L
CLO4	S	S	S	M
CLO5	S	S	S	M

S- Strong, M-Medium, L-Low

Syllabus

- Exercises to implement basics of RPA (Variables, Arguments, Control Flow. etc)
- Exercises to empty the trash folder in Gmail and recycle Bin
- Exercises to implement loops. (if, switch, while, do-while, for loop, etc.)
- Exercise to implement static and Dynamic table
- Exercise to implement separate workflow and arguments
- Exercise to implement clipboard management
- Exercise to perform operations on excel file (Read cell, Write Cell, arithmetic operations. Etc.,)
- Exercise to implement controls using mouse and keyboard activities
- Develop simple bots. (data transfer from one system to another, Email Automation, Password Generator, Generating mass emails etc.,)

Pedagogy: Demonstrations

List of Exercises:

1. Design Read and Replace a text in word document using UiPath.
2. Design a bot that automates the on boarding process for new employees.
3. Create a Screen scraping using UiPath.
4. Demonstrate Data manipulation using Contains method in UiPath.
5. Implement sorting in the list with manipulation of data using UiPath.
6. Demonstrate Exception handling in UiPath.
7. Design a Bot for clipboard management.
8. Demonstrate the invoke method activity to perform operations in UiPath
9. Design a process to secure the text from the user, using keyboard activities in UiPath

Applications

1. Create a UiPath Orchestrator process to configure the process settings, adding robots, and defining schedules to run the robots.
2. Build a bot that assists customer support agents by fetching relevant information from databases or knowledge bases.
3. Design Captcha Automation in UiPath.
4. Develop simple bots (data transfer from one system to another, Password Generator and Generating mass emails).
5. Design a simple Bot for reading Email using Ui Path.
6. Develop a bot that extracts data from a webpage and saves it into a structured format such as Excel.
7. Develop a Bot to find movie rating.
8. Design a Bot to create and deliver the invoice.

Pedagogy: Demonstrations

ELECTIVES

Course Code	Course Title	Category	L	T	P	Credits
MCS24E3	DEEP LEARNING	Theory	58	2	-	4

Preamble

This course covers the context of deep learning, know how to use a neural network, understand the data needs of deep learning, have a working knowledge of deep learning, and explore the parameters for deep learning

Prerequisite

- Artificial Intelligence
- Machine Learning

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the basics of deep learning	K2
CLO2	Apply the concept of optimization and generalization in deep learning.	K3
CLO3	Explore the deep learning applications.	K4
CLO4	Evaluate the analysis of algorithm efficiency using different notations.	K5
CLO5	Implement various deep learning models.	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4
CLO1	S	M	S	S
CLO2	S	S	S	M
CLO3	S	S	M	S
CLO4	L	M	S	S
CLO5	S	M	L	M

S- Strong; M-Medium; L-Low

UNIT I

(11 Hrs)

Introduction to Deep Learning: Gradient-Based Learning - Architecture Design - Optimization for Training Deep Models: Learning Differs from Pure Optimization, Challenges in Neural Network Introduction to Neural Networks - Training a network: loss functions, back propagation and stochastic gradient descent- **Neural networks as universal function approximate.**

UNIT II**(11 Hrs)**

Deep Learning Probabilistic Approach: Random Variables - Probability Distributions - Marginal Probability - Conditional Probability - **A Probabilistic Theory of Deep Learning- Back propagation and regularization, batch normalization**- What a shallow network computes - VC Dimension and Neural Nets-Deep Vs Shallow Networks, Convolution Networks- The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Semi-supervised Learning.

UNIT III**(12 Hrs)**

Linear (PCA, LDA) and manifolds, metric learning: Probabilistic PCA and Factor Analysis, Independent Component Analysis (ICA), Slow Feature Analysis, Manifold Interpretation of PCA, Auto encoders and dimensional reduction in networks - Introduction to ConvNet - Architectures – Alex Net, VGG, Inception, Res Net - **Training a ConvNet: weights initialization, batch normalization, hyper parameter optimization.**

UNIT IV**(12 Hrs)**

Optimization in deep learning: Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - **Recurrent Neural Network Language Models**- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience.

UNIT V**(12 Hrs)**

Images segmentation – Object Detection – Automatic Image Captioning – Image generation with Generative adversarial networks – Video to Text with LSTM models – Attention models for Computer Vision. Applications of Deep Learning: Social media filters, Drowsy driver detection, Fake currency detection, Sign language recognition, Breast cancer detection, Emotion and gesture recognition, Enhanced Night Vision System Case Study: **Named Entity Recognition – Opinion Mining using Recurrent Neural Networks – Parsing and Sentiment Analysis using Recursive Neural Networks – Sentence Classification using Convolutional Neural Networks – Dialogue Generation with LSTMs.**

TEXT BOOKS

S.NO	AUTHOR	TITLE	PUBLISHERS	YEAR & EDITION
1.	Ian Goodfellow, Yoshua Bengio, Aaron Courville	Deep Learning	MIT Press	2017 / 1 st Edn
2.	<u>Christopher M. Bishop,</u> <u>Hugh Bishop</u>	Deep Learning: Foundations and Concepts	Springer Nature	2023 / 1 st Edn

REFERENCE BOOKS

S.NO	AUTHOR	TITLE	PUBLISHERS	YEAR & EDITION
1.	Simon J. D. Prince Book preview	Understanding Deep Learning	MIT Press	2023 / 1 st Edn
2.	Francois Chollet	Deep Learning with Python	Manning Publications	2018 / 2 nd Edn

3.	Phil Kim	Matlab Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence	Apress	2017 / 3 rd Edn
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Pedagogy: Lectures, Group Discussions, Case studies

Course Code	Course Title	Category	L	T	P	Credits
MCS23E4	CYBER SECURITY AND FORENSICS	Theory	58	2	-	4

Preamble

This course covers the fundamental techniques of security aspects like threats, attacks and authentication procedures. It also presents effective security systems and investigates security incidents.

Prerequisite

- Computer Security

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the concepts of various security aspects like threats, attacks and authentication procedures	K2
CLO2	Apply various type security attacks by inspecting their characteristics.	K3
CLO3	Analyze security issues in network and computer systems	K4
CLO4	Evaluate and communicate the human role in security systems	K5
CLO5	Interpret and forensically investigate security incidents	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4
CLO1	S	M	S	S
CLO2	S	S	S	M
CLO3	S	S	L	S
CLO4	M	S	S	S
CLO5	S	S	M	L

S- Strong; M-Medium; L-Low

UNIT I

(11 Hrs)

Introduction to Cybercrime: Cybercrime and Information Security - Classifications of Cybercrimes – Legal Perspectives of Cybercrimes - Indian Perspectives of Cybercrimes –Cybercrime and the Indian ITA 2000 – Global Perspective on Cybercrimes. Cyber offenses: Categories of Cybercrime – **How Criminal Plan the Attacks – Social Engineering – Cyberstalking – Cybercafé and cybercrimes- Botnets.**

UNIT II

(11 Hrs)

Cybercrime in Mobile and Wireless Devices: Introduction – proliferation of Mobile and Wireless Devices – Trends in mobility – **Credit card Frauds in Mobile and Wireless Computing Era** – Security Challenges posed by Mobile Devices – Registry settings for Mobile Devices –Authentication Service

Security – **Attacks on Mobile/Cell Phones** – Mobile Devices Security Implications for Organizations – Organizational Measures for Handling Mobile Devices – Organizational Security Policies and Measures in Mobile Computing Era. Phishing and Identity Theft: – Introduction – Phishing – **Identity Theft**.

UNIT III

(12 Hrs)

Cyber Crime and Cyber Laws: Cybercrime and the legal landscape around the World – Need for Cyber Laws – Indian IT Act – **Challenges in Indian law and Cybercrime Scenario in India – Consequences of Not Addressing the weakness in IT Act** - Digital Signatures and the Indian IT Act – Amendments to the Indian IT Act – Cybercrime and Punishment.

UNIT IV

(12 Hrs)

Understanding Computer Forensics: Historical Background – Need for Computer Forensics – Cyber forensics and Digital Evidence – Forensics Analysis of Email – Digital Forensics Life Cycle- Chain of Custody Concept – Network forensics – Approaching a Computer Forensics Investigation – **Forensics and Social Networking Sites – Computer forensics from Compliance perspectives- Challenges in Computer Forensics.**

UNIT V

(12 Hrs)

Digital Forensics: Overview - Preparing for Digital Investigations – Maintaining Professional Conduct – Preparing a Digital Forensics Investigation – Procedures for Private Sector High Tech Investigations – **Understanding Data Recovery Workstations and Software – Conducting an Investigation.** Data Acquisition: Understanding Storage Formats for Digital Evidence – Determining the Best Acquisition Method – Contingency planning for Image Acquisitions - Using Acquisition Tools – **Validating Data Acquisitions – Using Other Forensics Acquisitions Tools.**

TEXT BOOKS

S.NO	AUTHOR	TITLE	PUBLISHERS	YEAR & EDITION
1.	Bill Nelson, Amelia Phillips and Christopher Steuart	Guide to Computer Forensics and Investigations	Cengage	2019 / 6 th Edn
2.	Nina Godbole and SunitBela pore	Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives	Wiley Publications	2011 / 4 th Edn

REFERENCE BOOKS

S.NO	AUTHOR	TITLE	PUBLISHERS	YEAR & EDITION
1.	Harlan Carvey	Windows Forensic Analysis Toolkit	Syngress	2012 / 4 th Edn

Pedagogy: Lectures, Group Discussions, Case studies

Course Code	Course Title	Category	L	T	P	Credits
MCS23E6	NATURAL LANGUAGE PROCESSING	Theory	58	2	-	4

Preamble

This course introduces the methods in Natural Language Processing (NLP). This course includes the various algorithms used in NLP. This course also covers various NLP tools and techniques

Prerequisite

- Data mining concepts
- Machine Learning Concepts

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the concepts of NLP in handling text data	K2
CLO2	Apply NLP analytical techniques on real time text data	K3
CLO3	Analyze text data with appropriate NLP algorithms and techniques.	K4
CLO4	Evaluate different NLP algorithms for handling and optimizing text data	K5
CLO5	Design and develop models for accomplishing NLP task	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4
CLO1	S	S	M	L
CLO2	S	S	L	M
CLO3	S	S	S	S
CLO4	S	M	S	S
CLO5	S	L	S	S

S- Strong; M-Medium; L-Low

UNIT I

(11 Hrs)

Introduction to NLP - Regular Expressions – **Words – Corpora** – Text Normalization – N-gram Language Models – N-Grams – Evaluating Language Models – Smoothing – Naïve Bayes Classifiers Training the NB Classifier – **Worked example.**

UNIT II

(11 Hrs)

Logistic Regression: Learning in Logistic Regression – The cross-entropy loss function – Gradient Descent – **Regularization** - Vector semantics and embeddings – Lexical semantics – vector semantics - **words and vectors** – TF-IDF: weighing terms in the vector – **Word2vec** – **visualizing embeddings.**

UNIT III**(12 Hrs)**

Sequence labelling for parts of speech and named entities: English word classes – parts-of-speech tagging – **named entities and named entities tagging** – Constituency Grammars: constituency – context-free grammar. Logical representation of sentence meaning – first-order logic - **event and state representation**. Information Extraction: relation extraction – extraction events and their time

UNIT IV**(12 Hrs)**

Word senses and wordnet – word sense – relation between sense – **wordnet: a database of lexical relations**. Semantic role labelling – semantic roles – Frame net - **semantic role labelling**– Lexicons for Sentiment, Affect and Connotation: Defining emotion – available sentiment and affect lexicons – creating affect lexicons by human labelling.

UNIT V**(12 Hrs)**

Question Answering: Information retrieval - **Knowledge based question answering - Chatbots & dialog system: properties of human conversation – chatbots**. Phonetics: Speech Sounds and Phonetic Transcription – Automatic Speech Recognition and Text-to-Speech: The automatic speech recognition task – Feature extraction for ASR: Log Mel Spectrum – Speech Recognition Architecture.

TEXT BOOKS

S.NO	AUTHOR	TITLE	PUBLISHERS	YEAR & EDITION
1.	Daniel J and James H. Martin	Speech and language processing An introduction to natural language processing, computational linguistics & speech recognition	Prentice hall Publishers	2020 / 1 st Edn

REFERENCE BOOKS

S.NO	AUTHOR	TITLE	PUBLISHERS	YEAR & EDITION
1.	Dwight Gunning, Sohom Ghosh	Natural Language Processing Fundamentals	Packt Publishers	2019 / 3 rd Edn
2.	Hobson Lane, Hannes Hapke, and Cole Howard	Natural Language Processing in Action: Understanding, analyzing, and generating text with Python	Manning Publications	2019 / 4 th Edn

Pedagogy: Lectures, Group Discussions, Case studies

Course Code	Course Title	Category	L	T	P	Credit
MCS23E7	SOCIAL MEDIA ANALYTICS	Theory	58	2	-	4

Preamble

The course covers concepts and techniques for retrieving, exploring, visualizing, and analyzing social network and social media data. Students learn the key metrics to assess social media goals, perform social network analysis to apply social media analytics processes and formulate effective strategies based on the analytics.

Prerequisite

Foundations of Data Science

Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand sources and limitations of social media data.	K2
CLO2	Apply social media analytics and evaluate metrics.	K3
CLO3	Examine different social media platforms and their associated tools	K4
CLO4	Apply social media information to create dashboards and reports for visualization.	K5
CLO5	Design effective strategy based on the social media analytics data.	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4
CLO1	S	M	M	M
CLO2	S	S	M	M
CLO3	S	M	S	L
CLO4	S	L	S	M
CLO5	S	S	M	M

S- Strong, M-Medium, L-Low

UNIT I

(11 Hrs)

Foundation for Analytics: – Digital Gap – Social Media Data Sources – Defining Social Media Data– Data Sources – Estimated vs. Factual Data Sources – Data Gathering in Social Media Analytics. **From Data to Insights:** Actionable Analytics – Focus on objective – Plan to shape data to insights – choosing a good analytics tool – Data Aggregation calculations and display – Data display – social media and its data – Potential Challenges. **Data Identification:** Professional networking sites - social sites – formation sharing sites – micro blogging sites – blogs /wikis.

UNIT II

(12 Hrs)

Analytics in social media: Types of analytics. Dedicated Vs. Hybrid Tools – Dedicated tools – Hybrid tools – Data Integration Tools – Best Setup. **Social Network Landscape:** Concept and UX on social networks – Interactivity of social network – Content flow on social network – **Interaction Pattern**

between users –social media as a two-way channel.

UNIT III

(12 Hrs)

Analytics Process: Analysis – Insight – Investigation beyond social analytics – Shaping a method – analysis cycle – Community Activity – Resources – Attention span – Dynamic cycles – Short Periods – Long Periods – Analyst Mindset – Instinctive Analyst. **Metrics: Introduction – Default and custom metrics – Metrics Categories – Graph Types – Metric Capabilities – Metrics and Strategy – Estimated Metrics–Metrics and Tactics.**

UNIT IV

(12 Hrs)

Dashboards: Purpose and Objectives – Default Vs. Custom Dashboards – Linearity and order of metrics – Metrics Positioning and Correlation – Metric and dashboard layout – Graphic design – Data Integration dashboards. **Reports:** Elements of reporting – **Reporting approaches and formats – Animation and effects in reporting – Stake holders and feedback – Reporting with teams.**

UNIT V

(11 Hrs)

Strategy: Strategy in social media analytics – Strategic planning – Data availability and data sources – Knowledge beyond social media – Tools and technology preparation – Team Preparation – Goals and objectives – Contingency plans – **application of social media analytics strategy – Strategy and tactics – Evaluation of a strategic analytics cycle.**

Case Studies: Targeting the audience using Facebook Analytics, Tracking profile analytics in LinkedIn, Analysis of Political Tweets, ROI Analytics using Facebook, Marketing Strategy in Pinterest.

TEXT BOOKS

S.NO	AUTHOR	TITLE	PUBLISHERS	YEAR & EDITION
1.	Alex Goncalves	Social Media Analytics Strategy: Using Data to Optimize Business Performance	APress	2022/1 st Edn

REFERENCE BOOKS

S.NO	AUTHOR	TITLE	PUBLISHERS	YEAR & EDITION
1.	Ganis, Kohirkar	Social Media Analytics	IBM Press PTG	2016 / 4 th Edn
2.	Nancy Flynn	The Social Media Hand book Policies, and Best Practices	Wiley	2012 / 3 rd Edn

Pedagogy: Lectures, Demonstrations, Group Discussions, Case studies

Course Code	Course Title	Category	L	T	P	Credit
MCS23E9	VIRTUAL REALITY	Theory	58	2	-	4

Preamble

This course provides the technology behind virtual reality and introduces input, output devices used for virtual reality. It also presents the techniques and applications used for augmented reality.

Prerequisite

- Animation Techniques
- Image Processing

Course Learning Outcomes

On successful completion of the course, the students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the basic concepts of virtual reality	K2
CLO2	Apply appropriate techniques and design augmented reality applications	K3
CLO3	Analyze the techniques required for virtual reality environments	K4
CLO4	Assess the methods and techniques appropriate for virtual reality applications	K5
CLO5	Design and manipulate objects within the virtual environment.	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4
CLO1	S	M	S	M
CLO2	M	S	S	M
CLO3	M	L	M	M
CLO4	S	M	L	M
CLO5	S	M	M	L

S- Strong; M-Medium; L-Low

UNIT I

(11 Hrs)

Introduction: The Three I's of Virtual Reality - A Short History of Early Virtual Reality – Early Commercial VR Technology - **VR Becomes an Industry - The Five Classic Components of a VR System.**

UNIT II

(12 Hrs)

Input Devices: Three – Dimensional Position trackers - Hybrid Inertial Trackers - Navigation and Manipulation Interfaces - Tracker-Based Navigation/Manipulation Interfaces – **Three-Dimensional Probes** - Gesture Interfaces - The Pinch Glove - The 5DT Data Glove - The Didjiglove - The Cyber

Glove. Output Devices: Graphics Displays: The Human Visual System -Personal Graphics Displays - Large- Volume Displays - Sound Displays - The Human Auditory System - The Convolvotron– **Speaker Based Three-Dimensional Sound - Haptic Feedback: The Human Haptic System - Tactile Feedback Interfaces - Force Feedback Interfaces**

UNIT III

(12 Hrs)

Getting started with Unity and Playmaker: **Downloading and Installing Unity – Buying and importing playmaker – Setting up your project.** Unity's and Playmaker's User Interface: Interface overview and main menu – Hierarchy panel – Inspector panel – Project panel – Project panel – Views – Playmaker interface. Components and State Machines: Game objects, components and properties – Working with prefabs – Finite state machines, states and actions – **Interaction between game objects**

UNIT IV

(11 Hrs)

Scripting and Custom Actions: Writing unity script – Overview of standard unity classes – Creating a playmaker action. Networking and Multiplayer: **Understanding networking and multiplayer – Setting up photon unity networking – Making multiplayer**

UNIT V

(12

Hrs)

Introduction to Augmented Reality: Definition – Examples – Displays - Visual perception -Requirements and characteristics – Tracking - Characteristics of tracking technology- Stationary tracking systems - Mobile sensors. Computer Vision for Augmented Reality: **Natural feature tracking by detection – Simultaneous localization and mapping – Interaction - Output modalities** – Input modalities – Tangible interfaces –Navigation

TEXT BOOKS

S.NO	AUTHOR	TITLE	PUBLISHERS	YEAR & EDITION
1.	Jonathan Linowes ,Krystian Babilinski	Augmented reality for developers	Packt Publishing	2017,1st Edn

REFERENCE BOOKS

S.NO	AUTHOR	TITLE	PUBLISHERS	YEAR & EDITION
1.	Jonathan Linowes ,Krystian Babilinski	Augmented Reality : Principles and Practice	Pearson education Inc	2016,1st Edn

Pedagogy: Lectures, Group Discussions, Demonstrations

Course Code	Course Title	Category	L	T	P	Credit
MCS23E10	QUANTUM COMPUTING	Theory	58	2	-	4

Preamble

This course introduces the fundamentals of Quantum Computing. It also covers basic architecture of quantum computing.

Prerequisite

Basic Skills in Maths and Physics

Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the fundamental concepts of quantum mechanics	K2
CLO2	Apply the Quantum Architecture and cryptographic techniques related with Quantum Computation.	K3
CLO3	Analyze the Algorithms required for reality environments	K4
CLO4	Assess the hardware methods and techniques available for Quantum Computing	K5
CLO5	Designing appropriate solution to more complex quantum mechanical systems	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4
CLO1	M	S	M	M
CLO2	S	M	S	M
CLO3	S	M	S	M
CLO4	S	S	L	S
CLO5	S	L	S	S

S- Strong; M-Medium; L-Low.

UNIT I

(12 Hrs)

Classical to Quantum: Classical Deterministic Systems, Probabilistic Systems, Quantum Systems, Assembling Systems. **Basic Quantum Theory: Quantum States, Observables, Measuring, Dynamics, Assembling Quantum Systems.**

UNIT II

(12 Hrs)

Architecture: Bits and Qubits, Classical Gates, Reversible Gates, Quantum Gates. Algorithms: Deutsch's

Algorithm, The Deutsch–Jozsa Algorithm, Simon’s Periodicity Algorithm, **Grover’s Search Algorithm**, **Shor’s Factoring Algorithm**.

UNIT III

(12 Hrs)

Programming Languages: Programming in a Quantum World, Quantum Assembly Programming, Toward Higher-Level Quantum Programming, **Quantum Computation Before Quantum Computers**. Theoretical Computer Science: Deterministic and Nondeterministic Computations, Probabilistic Computations, Quantum Computations

UNIT IV

(10 Hrs)

Cryptography: Classical Cryptography, Quantum Key Exchange I: The BB84 Protocol, Quantum Key Exchange II: The B92 Protocol, Quantum Key Exchange III: **The EPR Protocol, Quantum Teleportation**.

UNIT V

(12 Hrs)

Information Theory: Classical Information and Shannon Entropy, Quantum Information and von Neumann Entropy, **Classical and Quantum Data Compression, Error-Correcting Codes**. Hardware: Implementing a Quantum Computer I: Ion Traps, Implementing a Quantum Computer II: Linear Optics.

TEXT BOOKS

S.NO	AUTHOR	TITLE	PUBLISHERS	YEAR & EDITION
1.	Noson S. Yanofsky Mirco A. Mannucci Holo Mathics, LLC	Quantum Computing for Computer Scientists	Cambridge University Press	2008

REFERENCE BOOKS

S.NO	AUTHOR	TITLE	PUBLISHERS	YEAR & EDITION
1.	Michael Nielsen, Isaac Chuang	Quantum Computation and Quantum Information	Cambridge University Press	2008

Pedagogy: Lectures, Group Discussions, Demonstrations.

JOB ORIENTED COURSE

Company: Fintech Software, Coimbatore

Course: Advance Excel & Power BI

Course Modules:

Advanced Excel

- Customizing Excel
- Absolute, Mixed and Relative Referencing
- Formatting and Proofing
- Protecting Excel
- Using 3-D map
- Macro Functions
- Lookup Function
- Data Validation
- Logical Function
- Advanced Paste Special Techniques

Power BI

- Introduction to Power BI
- Power BI Desktop
- Viz and Tiles
- Reports and Dashboards
- Publishing Workbooks and Workspace
- Power BI Report Servers
- Power Query: Text, Number, Append, Merge, Conditional Columns
- DAX Functions
- Table Relationship

Course Code	Course Code	Category	L	T	P	Credits
MNM22CS2	CYBER SECURITY II	Theory	-	-	-	-

Preamble

This course provides the classification of cyber security and cyber crime and its laws and data privacy and security in social media

Prerequisite

Basics of Internet

Course Learning Outcomes

On successful completion of the course, the students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the basic concepts of Cyber security and Cyber security threat landscape.	K2
CLO2	Apply the methods to identify the cyber-attacks and crimes.	K3
CLO3	Analyze the legal framework that exists in India for cybercrime and legal frame work followed by other countries.	K4
CLO4	Estimate the data privacy and security issues related to personal data privacy and security.	K5
CLO5	Create a privacy setting on social media platform and register complaints on a social media platform.	K6

UNIT I

(6 hrs)

Overview of cyber security: Cyber security terminologies - Cyberspace - Cyber attack - Cyber threats - Cyber terrorism - Cyber warfare.

UNIT II

(8 hrs)

Cyber crimes: Cyber Crimes targeting computer system and mobiles- Online scam frauds: emails Scams- Phishing- Vishing- Smishing- Online job fraud- online sextortion- Debit and credit card fraud- Online payment fraud- cyberbullying. Social Media Scam & Frauds: Impersonation- Identify theft -Job scams- Misinformation- Fake news cyber crime against persons - Cyber grooming - Child pornography - cyber stalking-Cyber police station -Crime reporting produce.

UNIT III

(4 hrs)

Cyber law: Cyber laws and legal and ethical aspects related to new technologies: AI/ML- IoT- Block chain - Darknet and social media- Cyber law of other countries.

UNIT IV

(5 hrs)

Data privacy and Data security: Defining data- Metro-Big data- Non personal data- Data protection-General Data Protection Regulations(GDPR)- 2016 Personal Information Protection and the Electronic document Act(PIPEDA)- Social media Data privacy and Security issues.

UNIT V

(7 hrs)

Social Media Platforms and Cyber Security : Case Study on Platform for reporting Cyber Crimes, Checklist for reporting cybercrimes online, Setting privacy settings on social media platforms, Registering complaints on social media platforms, Do's and Don'ts for posting content on social media platforms, prepare password policy for computer and mobile device, security controls for computer and mobile phones , digital Forensics, Cyber Bulling, Phishing, Facebook Attack, Cyber Security audit and Compliance and National Security Policies.

TEXT BOOKS

S.NO	AUTHOR	TITLE	PUBLISHERS	YEAR & EDITION
1.	Anand Shinde	Introduction to Cyber Security – Guide to the world of Cyber Security	Notion Press, Sumit Belapure, Nin a Godbole	2021 / 1 st Edn

REFERENCE BOOKS

S.NO	AUTHOR	TITLE	PUBLISHERS	YEAR & EDITION
1.	Martin Weiss, Michael G. Solomon	Auditing IT Infrastructure for compliance	JonesBartlett Learning.	2015, 2 nd Edn

Pedagogy: Video Lectures, Case studies



PSGR
Krishnammal College for Women



Affiliated to Bharathiar University \ Autonomous \ College of Excellence \ Accredited with A++ Grade \ Ranked 9th in NIRF

M.Sc. Computer Science

Programme Outcomes

After completion of the programme, the student will be able to,

PLO1: Demonstrate broad knowledge in core areas of computer science, current and emerging technologies in IT

PLO2: Apply higher degree of technical skills in problem solving and application development

PLO3: Gain analytical and managerial skills to enhance employment potential

PLO4: Acquire holistic development with strong emphasis on values and ethics

Programme Specific Outcomes

The students at the time of graduation will

PSO1: Identify and formulate complex problems to achieve solutions using concepts of algorithms, advanced networks, database management systems, artificial intelligence, and machine learning

PSO2: Design solutions for complex problems and design processes that meet the specific needs of the society.

PSO3: Create and apply appropriate techniques, resources and tools including prediction and modeling to multifaceted activities

PSO4: Apply programming and technical skills to solve real life complex problems and hence enhance employability

PSO5: Analyze research methods including interpretation of data and synthesis of the information to provide valid conclusions.

PSO6: Demonstrate skills as an individual and as a member or leader in diverse teams

PSO7: Recognize the need for life-long learning and pursue career as a researcher or software engineer.

PSO8: Apply ethical principles and contribute effectively to the welfare of the society



MASTER OF SCIENCE IN COMPUTER SCIENCE
CHOICE BASED CREDIT SYSTEM (CBCS) &
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)
SYLLABUS & SCHEME OF EXAMINATION
2024-2026 BATCH – SEMESTER IV

Semester	Course Code	Title of the Course	Course Type	Instruction hours/week	Contact hours	Tutorial hours	Duration of Examination	Examination Marks			Credits
								CA	ESE	Total	
IV	MCS23PW	Project and Viva-Voce	DSE	30	-	-	-	25	75	100	12
	MCS2014	Block Chain	ACC	-	-	-	3	25	75	100	5*
	MCS2213	Augmented Reality									

DSE - Discipline Specific Elective

*ACC - Additional Learner Courses

CA - Continuous Assessment

ESE - End Semester Examination

QUESTION PAPER PATTERN

Advanced Learners Course (ALC)

Continuous Internal Assessment: 25 Marks

Advanced Learners Course (ALC) Pattern:

One question with a weightage of 4 Marks (4 Questions out of 6 Questions) : $4 \times 4 = 16$

One question with a weightage of 9 Marks (1 Question out of 2 Questions) : $1 \times 9 = 9$

Total :25 Marks

ESE Question Paper Pattern:

One question with a weightage of 5 Marks (5 Questions out of 8 Questions) : $5 \times 5 = 25$

One question with a weightage of 10 Marks (5 Questions out of 8 Questions) : $5 \times 10 = 50$

Total :75 Marks

PROJECT AND VIVA VOCE

Students will undergo project work in the final semester for a period of 4 months (December to March) at any industry / institution approved by the staff coordinator and HOD. It will be evaluated for 100 marks comprising internal marks for 25 and external evaluation for 75 marks.

EVALUATION

Internal evaluation of the project will be carried out in stages as described below

I Review	Selection of the field of study, Topic and Literature Study	05 Marks
II Review	Research design and data Collection	10 Marks
III Review	Analysis and conclusion, preparation of rough Draft	10 Marks
Total		25 Marks

END SEMESTER EXAMINATION

Evaluation of the project marks	50 Marks
Viva Voce marks	25 Marks
Total	75 Marks

Viva Voce will be conducted by a panel of external examiner and staff coordinator guiding the project.

Course Code	Course Title	Category	L	T	P	Credit
MCS2014	BLOCKCHAIN	Theory	Self-Study			5*

Preamble

This course covers the technical principles of blockchain, cryptographic primitives used in blockchain, distributed system concepts, decentralization behind blockchain and the working of bitcoin. It also introduces the Ethereum platform and highlights the tools, use cases of blockchain technology.

Syllabus

UNIT I

Introduction to Blockchain: Distributed systems - History of block chain - Introduction to blockchain - Features -Applications -Tiers - Types of blockchain - Consensus in blockchain- Benefits and limitations

UNIT II

Decentralization: Decentralization using blockchain - Methods -Routes -Blockchain and full ecosystem decentralization Smart Contract Decentralized applications platforms for decentralization

UNIT III

Bitcoin : Bitcoin Public, Private keys Transaction life cycle Transaction structure Types of transaction - Block chain Structure of a block Mining Task of miners- Proof of work Mining algorithm- Bitcoin network - Wallets-Payments

UNIT IV

Ethereum 101: Introduction – Ethereum block chain - Currency Fork - Gas - Elements of Ethereum blockchain- EVM- Accounts- Transaction receipt - Block validation mechanism -Ether Ethereum network

UNIT V

Emerging trends - Tools: Solidity- MetamaskStratis Embark. Use cases: Know Your customer (KYC) and Syndicated loan use case in Finance domain, Interest rate swapping in Banking, Re-insurance in Insurance, Auditing in Hotel reservation, Loyalty management system in retail domain, Order management system in Supply chain.

Text Books

S.No.	AUTHORS	TITLE	PUBLISHERS	YEAR & EDITION
1.	Imran Bashir	Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks	Packt Publishing	2017, 1 st Edn
2.	Debajani Mohanty	Blockchain : From Concept to Execution	BPB Publications	2018, 1 st Edn

Reference Books

S.No.	AUTHORS	TITLE	PUBLISHERS	YEAR & EDITION
1.	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder	Bitcoin and cryptocurrency technologies: a comprehensive introduction	Princeton University Press	2016, 1 st Edn
2.	Joseph Bonneau et al	SoK: Research perspectives and challenges for Bitcoin and cryptocurrency	IEEE Symposium on security and Privacy	2015, 1 st Edn

Course Code	Course Title	Category	L	T	P	Credit
MCS2213	AUGMENTED REALITY	Theory	Self-Study			5*

Preamble

This course on Augmented Reality (AR) provides students with a comprehensive understanding AR technologies, principles, and applications. Students will learn about the underlying concepts of techniques used in developing AR systems and gain practical experience in creating AR applications.

Syllabus

UNIT I

Introduction to Augmented Reality: Basic concepts of Augmented Reality-Historical background and evolution of AR-AR applications and use cases-Challenges and future trends in AR- AR Technologies and Devices-Marker-based AR-Markerless AR-Projection-based AR-Wearable AR devices- Displays-Multimodal Displays - Audio Displays-Haptic, Tactile, and Tangible Displays- Olfactory and Gustatory Displays

UNIT II

AR Marker Detection and Tracking: Tracking, Calibration, and Registration- Coordinate Systems- Model Transformation - View Transformation - Projective Transformation - Frames of Reference- Mobile Sensors - Global Positioning System - Wireless Networks- Magnetometer- Gyroscope -Linear Accelerometer - Odometer- Computer Vision for Augmented reality- Marker Tracking

UNIT III

Integrating Virtual Content in AR: 3D modeling and animation for AR-Texture mapping and lighting in AR-Physics simulations in AR-Audio and haptic feedback in AR-Performance Optimization in AR-Rendering techniques for AR-Optimization for mobile devices-Handling large datasets in AR-Real-time performance considerations

UNIT IV

Interactive Techniques in AR: Spatial mapping and scene understanding-voice and speech recognition in AR-Natural uses interface of AR-Object recognition and tracking- Multi-user and collaborative AR-Networked AR and Remote Collaboration- Synchronization and consistency in multi-user AR.

UNIT V

Evaluation and Testing of AR Applications: Usability testing and user feedback-Performance benchmarking and optimization-User acceptance and adoption studies-Ethical and privacy considerations in AR

Text Books

S.No.	AUTHORS	TITLE	PUBLISHERS	YEAR & EDITION
1.	Dieter Schmalstieg, Tobias Hollerer	Augmented Reality : Principles and Practice	Pearson education Inc	2016, 1 st Edn
2.	Joseph Howse, Joe Minichino, and Vikas Gupta	Learning OpenCV 4 Computer Vision with Python 3: Get to grips with tools, techniques, and algorithms for computer vision and augmented reality	<u>Packt Publishing</u>	2019, 1 st Edn
3	Val Head	Designing Interface Animation: Meaningful Motion for User Experience	Rosenfeld	2019, 1 st Edn
4	Mohammad Azam	ARKit and Unity: Build 15 Augmented Reality apps with ARKit 2.0 and Unity	Packt Publishing	2020, 1 st Edn

Reference Books

S.No.	AUTHORS	TITLE	PUBLISHERS	YEAR & EDITION
1.	Jonathan Linowes , Krystian Babilinski	Augmented reality for developers	Packt Publishing	2017, 1 st Edn
2.	William R. Sherman, Alan B. Craig	Understanding Virtual Reality: Interface, Application and Design	Morgan Kaufmann Publishers	2018, 2 nd Edn

Pedagogy

Lectures, Group Discussions, Demonstrations