IGNOU MCA Syllabus 2026: Complete Semester-Wise Guide

Programme: Master of Computer Applications (MCA_NEW)
Programme Code: MCA_NEW
School: School of Computer and Information Sciences (SOCIS)
Duration: Minimum 2 Years | Maximum 4 Years
Total Credits: 80
Total Courses: 22 (15 Theory + 6 Practical + 1 Project)
Medium of Instruction: English
Official Website: https://www.ignou.ac.in/schools/programme/MCA_NEW

Programme Overview

The IGNOU MCA (ODL) programme prepares graduate students for productive careers in the software industry and academia. The programme's focus is on providing a thorough and sound background in both theoretical and application-oriented courses relevant to the latest computer software development. It emphasises the application of software technology to solve mathematical, computing, communications/networking, and commercial problems.

The first year (Semesters I and II) is aimed at theoretical knowledge and practical skills development in core Computer Science subjects. The second year (Semesters III and IV) is more focused on advanced courses providing a conceptual framework along with a final project.

Programme Structure at a Glance

Semester	Course Code	Course Title	Type	Credits
I	MCS-211	Design and Analysis of Algorithms	Theory	4
I	MCS-212	Discrete Mathematics	Theory	4
I	MCS-213	Software Engineering	Theory	4
I	MCS-214	Professional Skills and Ethics	Theory	2
I	MCS-215	Security and Cyber Laws	Theory	2
I	MCSL-216	DAA and Web Design Lab	Practical	2
I	MCSL-217	Software Engineering Lab	Practical	2
II	MCS-218	Data Communication and Computer Networks	Theory	4
II	MCS-219	Object Oriented Analysis and Design	Theory	4

Semester	Course Code	Course Title	Type	Credits
II	MCS-220	Web Technologies	Theory	4
II	MCS-221	Data Warehousing and Data Mining	Theory	4
II	MCSL-222	OOAD and Web Technologies Lab	Practical	2
II	MCSL-223	Computer Networks and Data Mining Lab	Practical	2
III	MCS-224	Artificial Intelligence and Machine Learning	Theory	4
III	MCS-225	Accountancy and Financial Management	Theory	4
III	MCS-226	Data Science and Big Data	Theory	4
III	MCS-227	Cloud Computing and IoT	Theory	4
III	MCSL-228	AI and Machine Learning Lab	Practical	2
III	MCSL-229	Cloud and Data Science Lab	Practical	2
IV	MCS-230	Digital Image Processing and Computer Vision	Theory	4
IV	MCS-231	Mobile Computing	Theory	4
IV	MCSP-232	Project	Project	12
		Total Credits		80

Bridge Courses (For Non-CS Background Students)

Students who have passed B.Sc./B.Com./B.A. with Mathematics at 10+2 or graduation level (but without a Computer Science degree) must register and complete the following bridge courses alongside the main programme:

Course Code	Course Title	Type	Credits
MCS-201	Programming in C and Python	Theory	4
MCS-208	Data Structures and Algorithms	Theory	4

> **Note:** Students WITHOUT Mathematics at 10+2 level or at Graduation level are NOT eligible for the ODL/Online MCA programme.

Semester I: Detailed Syllabus

MCS-211: Design and Analysis of Algorithms

Credits: 4 | **Type:** Theory

This course is the core of Computer Science study. It introduces both foundational and advanced algorithm design techniques, including deterministic and stochastic algorithms,

recurrence relations, graph algorithms, string matching, NP-completeness, and approximation algorithms.

Block 1: Introduction to Algorithms

- **Unit 1: Basics of an Algorithm and its Properties**
  - Example of an Algorithm, Basic building blocks
  - Survey of common running time
  - Analysis and Complexity of Algorithms, Types of problems
  - Problem Solving Techniques, Deterministic and Stochastic Algorithms
- **Unit 2: Some Pre-requisites and Asymptotic Bounds**
  - Useful Mathematical Functions and Notations
  - Modular Arithmetic, Mathematical Expectation
  - Principle of Mathematical Induction
  - Concept of Efficiency of an Algorithm
  - Well-known Asymptotic Functions and Notations (Big-O, Omega, Theta)
- **Unit 3: Analysis of Simple Algorithm**
  - Complexity Analysis: Euclid Algorithm, Polynomial Evaluation, Exponent Evaluation, Sorting
  - Analysis of Non-Recursive Control Structures: Sequencing, For Construct, While and Repeat Constructs
  - Recursive Constructs
- **Unit 4: Solving Recurrences**
  - Substitution Methods, Iteration Methods
  - Recursive Tree Methods, Master Methods

Block 2: Design Techniques I

- **Unit 1: Greedy Technique**
  - Formalization of Greedy Techniques
  - Overview of local and global optima
  - Fractional Knapsack Problem, Huffman Codes
  - Task Scheduling Algorithm
- **Unit 2: Divide and Conquer Technique**
  - General Issues in Divide and Conquer
  - Binary Search Algorithm
  - Merge Sort, Quick Sort, Matrix Multiplication Algorithm
- **Unit 3: Graph Algorithm I**

- Basic Definitions and Terminologies
- Graph Representation: Adjacency Matrix and Adjacency List
- Graph Traversal: Depth First Search (DFS) and Breadth First Search (BFS)
- Topological Sort, Strongly Connected Components

Block 3: Design Techniques II

- **Unit 1: Graph Algorithms II**
  - Minimum Cost Spanning Tree: Kruskal's and Prim's Algorithms
  - Single Source Shortest Path: Bellman Ford and Dijkstra's Algorithms
  - Maximum Bipartite Matching Problem
- **Unit 2: Dynamic Programming Technique**
  - Principle of Optimality
  - Chained Matrix Multiplication, Optimal Binary Search Trees
  - Binomial Coefficient Computation, Floyd Warshall Algorithm
- **Unit 3: String Matching Techniques**
  - Naive String Matching Algorithm
  - Rabin Karp Algorithm
  - Knuth-Morris Pratt (KMP) Algorithm

Block 4: NP-Completeness and Approximation Algorithms

- **Unit 1: NP-Completeness**
  - Class P, NP-Completeness, NP-Hard, Unsolvable Problems
  - Polynomial-time Reductions, Knapsack and TSP Problems
- **Unit 2: NP-Completeness and NP-Hard Problems**
  - Polynomial Time Verification
  - Techniques to show NP-Hardness
  - NP-Complete problems and P vs NP
- **Unit 3: Handling Intractability**
  - Approximation Algorithms for Vertex Cover problem
  - Minimizing makespan as parallel machines (Graham's Algorithm)
  - Parameterized Algorithm for Vertex Cover
  - Meta-heuristic Algorithms

MCS-212: Discrete Mathematics

Credits: 4 | **Type:** Theory

This course provides mathematical foundations critical for Computer Science, covering logic, set theory, graph theory, combinatorics, and algebraic structures.

Block 1: Elementary Logic and Proofs

- **Unit 1: Propositional Calculus**
  - Propositions, Logical Connectives (Disjunction, Conjunction, Negation, Conditional)
  - Precedence Rules, Logical Equivalence, Logical Quantifiers
  - Applications: Web Page Searching, Logic Circuits
- **Unit 2: Methods of Proof**
  - Indirect Proofs, Counter Examples
  - Principle of Mathematical Induction
- **Unit 3: Boolean Algebra and Circuits**
  - Boolean Algebras, Logic Circuits, Boolean Functions

Block 2: Sets and Languages

- **Unit 1: Sets, Relations and Functions**
  - Introducing Sets, Basic Operations on Sets
  - Properties of Relations
  - Types of Functions, Composition of Functions
- **Unit 2: Strings and Languages**
  - Strings, Languages and Regular Expressions
- **Unit 3: Finite State Machines**
  - Deterministic Finite Automata (DFA), Non-deterministic Finite Automata (NFA)

Block 3: Combinatorics

- **Unit 1: Combinatorics**
  - Counting Techniques: Permutations and Combinations
  - Binomial Theorem and Coefficients
- **Unit 2: Advanced Counting Principles**
  - Pigeonhole Principle, Inclusion-Exclusion Principle
- **Unit 3: Recurrence Relations**
  - Linear Recurrence Relations with Constant Coefficients
  - Solving Recurrences

- Unit 4: Partitions and Distributions
  - Integer Partitions, Distribution Problems

Block 4: Graph Theory and Algebra

- Unit 1: Introduction to Graphs
  - Basic Concepts: Vertices, Edges, Degree
  - Types of Graphs: Simple, Directed, Weighted
- Unit 2: Graph Properties and Algorithms
  - Euler and Hamiltonian Paths/Circuits
  - Spanning Trees, Planar Graphs
- Unit 3: Algebraic Structures
  - Groups, Rings, Fields, Lattices
- Unit 4: Coding Theory
  - Error Detection and Correction Codes, Binary Codes

MCS-213: Software Engineering

Credits: 4 | **Type:** Theory

This course covers the engineering principles of software development from requirements through testing and maintenance, including agile methods and quality assurance.

Block 1: Software Process and Requirements

- Unit 1: Introduction to Software Engineering
  - Software Engineering Concepts, Principles
  - Software Crisis and the need for Software Engineering
- Unit 2: Software Process Models
  - Waterfall Model, Incremental Development
  - Spiral Model, Agile Methods, DevOps
- Unit 3: Requirements Engineering
  - Requirements Elicitation and Analysis
  - Functional and Non-functional Requirements
  - Requirements Documentation and Validation
- Unit 4: System Modeling
  - Context and Process Models
  - Data Models, Behavioral Models

Block 2: Software Design

- **Unit 5: Architectural Design**
  - Architectural Design Decisions
  - Architectural Patterns: MVC, Layered, Repository, Client-Server
- **Unit 6: Design and Implementation**
  - Object-Oriented Design, Design Patterns
  - Implementation Issues, Open-Source Development
- **Unit 7: Software Testing**
  - Development Testing (Unit, Integration)
  - Test-Driven Development, Release Testing
  - User Testing
- **Unit 8: Software Evolution**
  - Evolution Processes, Software Maintenance
  - Legacy Systems, Software Re-engineering

Block 3: Quality and Estimation

- **Unit 9: Software Project Management**
  - Project Planning, Project Scheduling
  - Risk Management, Managing People
- **Unit 10: Software Cost Estimation**
  - COCOMO Model, Algorithmic Cost Modelling
- **Unit 11: Quality Management**
  - Software Quality, Software Standards
  - Reviews and Inspections, Statistical Quality Assurance
- **Unit 12: Process Improvement**
  - Process Measurement, Process Analysis
  - Process Change, The CMMI Process Improvement Framework

Block 4: Advanced Topics

- **Unit 13: Embedded Software**
  - Embedded Systems, Real-Time Systems
  - Monitoring and Control Systems
- **Unit 14: Component-Based Software Engineering**
  - Components and Component Models
  - CBSE Processes, Component Composition

- **Unit 15: Distributed Software Engineering**
  - Distributed Systems, Client-Server Architecture, SOA
  - Microservices, Cloud-Based Software
- **Unit 16: Service-Oriented Software Engineering**
  - Services, Service Engineering, RESTful Services

MCS-214: Professional Skills and Ethics

Credits: 2 | **Type:** Theory

This course develops communication, interpersonal, and professional skills alongside ethical understanding required for the IT workplace.

Block 1: Communication and Professional Skills

- **Unit 1:** Written Communication Skills — Technical Writing, Report Writing, Emails
- **Unit 2:** Oral Communication — Presentations, Group Discussions, Interviews
- **Unit 3:** Interpersonal Skills — Teamwork, Leadership, Conflict Resolution
- **Unit 4:** Time Management and Productivity Skills
- **Unit 5:** Resume Writing and Career Planning

Block 2: Ethics and Professional Responsibility

- **Unit 6:** Introduction to Ethics — Ethical Theories and Frameworks
- **Unit 7:** Professional Ethics in Computing — ACM and IEEE Codes of Ethics
- **Unit 8:** Intellectual Property Rights, Privacy and Data Protection
- **Unit 9:** Social and Environmental Responsibility of IT Professionals
- **Unit 10:** Case Studies in IT Ethics
- **Unit 11:** Workplace Ethics — Diversity, Inclusion, and Harassment Prevention

MCS-215: Security and Cyber Laws

Credits: 2 | **Type:** Theory

This course covers the legal framework governing cybercrime and the foundational concepts of information security.

Block 1: Information Security Concepts

- **Unit 1: Introduction to Information Security**
  - Concepts of Security, Security Threats and Vulnerabilities
  - Types of Attacks: Active and Passive Attacks
  - Security Services and Mechanisms
- **Unit 2: Cryptography and Network Security**
  - Symmetric and Asymmetric Encryption
  - Public Key Infrastructure (PKI)
  - Digital Signatures, Hash Functions, SSL/TLS
- **Unit 3: Security Measures and Controls**
  - Firewalls, Intrusion Detection Systems
  - Antivirus and Anti-malware Tools
  - Security Auditing and Penetration Testing

Block 2: Cyber Laws

- **Unit 1: IT Act 2000 and Amendments**
  - Overview of Information Technology Act, 2000
  - IT (Amendment) Act 2008
  - Key Provisions: Electronic Records, Digital Signatures, Offences and Penalties
- **Unit 2: Cybercrime and Legal Framework**
  - Types of Cybercrime: Hacking, Phishing, Identity Theft, Cyber Stalking
  - IPC Provisions Applicable to Cybercrime
  - Jurisdiction Issues in Cyberspace
- **Unit 3: Data Protection and Privacy Laws**
  - Personal Data Protection Concepts
  - GDPR Overview
  - Indian Perspective on Data Privacy
  - Copyright in Digital Media, Domain Name Disputes

MCSL-216: DAA and Web Design Lab

Credits: 2 | **Type:** Practical

- **Sessions 1–10:** Design and Analysis of Algorithms Lab
  - Implementation of sorting algorithms, graph traversal, greedy and dynamic programming problems, string matching

- **Sessions 11–20:** Web Design Lab
  - HTML5, CSS3, JavaScript basics, Responsive Web Design, Form Validation

MCSL-217: Software Engineering Lab

Credits: 2 | **Type:** Practical

- **Sessions 1–20:** Software Engineering Lab covering all practical topics including SRS document preparation, DFDs, UML diagrams (Use Case, Class, Sequence, Activity), Test Case Design, and Project Management tools

Semester II: Detailed Syllabus

MCS-218: Data Communication and Computer Networks

Credits: 4 | **Type:** Theory

This course covers data transmission fundamentals, network architectures, protocols, and security concepts in modern communication systems.

Block 1: Data Communication Fundamentals

- **Unit 1:** Introduction to Data Communications — Components, Data Representation, Data Flow
- **Unit 2:** Network Models — OSI Model, TCP/IP Model, Layers and Functions

Block 2: Physical and Data Link Layer

- **Unit 1:** Physical Layer — Transmission Media, Multiplexing, Switching
- **Unit 2:** Data Link Layer — Error Detection and Correction, Framing
- **Unit 3:** Flow Control and Error Control Protocols (ARQ, Sliding Window)
- **Unit 4:** Medium Access Control — CSMA/CD, CSMA/CA, Token Ring

Block 3: Network and Transport Layer

- **Unit 1:** Network Layer — IP Addressing (IPv4, IPv6), Subnetting, Routing
- **Unit 2:** Routing Algorithms — Distance Vector, Link State, OSPF, BGP
- **Unit 3:** Transport Layer — TCP, UDP, Connection Management, Flow Control, Congestion Control
- **Unit 4:** NAT, DHCP, ARP, ICMP

Block 4: Application Layer and Network Security

- **Unit 1:** Application Layer Protocols — HTTP, FTP, SMTP, DNS, TELNET
- **Unit 2:** Network Security — Firewalls, VPN, Secure Protocols (HTTPS, SSH)
- **Unit 3:** Wireless Networks — Wi-Fi Standards, Mobile IP
- **Unit 4:** Network Management — SNMP, Network Monitoring

MCS-219: Object Oriented Analysis and Design

Credits: 4 | **Type:** Theory

This course focuses on object-oriented principles and UML-based modelling for system analysis and design.

Block 1: OOP Fundamentals and UML Basics

- **Unit 1:** Introduction to OOP — Objects, Classes, Inheritance, Polymorphism, Encapsulation, Abstraction
- **Unit 2:** Introduction to UML — History, Diagrams Overview, Notation
- **Unit 3:** Use Case Diagrams — Actors, Use Cases, Relationships
- **Unit 4:** Class Diagrams — Classes, Attributes, Operations, Associations, Aggregation, Composition
- **Unit 5:** Object Diagrams and Collaboration Diagrams

Block 2: Behavioural Modelling

- **Unit 1:** Sequence Diagrams — Messages, Lifelines, Interaction Fragments
- **Unit 2:** Activity Diagrams — Actions, Control Flow, Object Flow, Swimlanes
- **Unit 3:** State Machine Diagrams — States, Transitions, Events, Guards

Block 3: Structural and Architectural Modelling

- **Unit 1:** Component Diagrams — Components, Interfaces, Dependencies
- **Unit 2:** Deployment Diagrams — Nodes, Artefacts, Communication Paths
- **Unit 3:** Package Diagrams — Packages, Dependencies, Visibility

Block 4: OOAD Process and Design Patterns

- **Unit 1:** OOAD Process — Requirements, Analysis, Design, Implementation
- **Unit 2:** Design Patterns — Creational (Singleton, Factory), Structural (Adapter, Decorator), Behavioural (Observer, Strategy)
- **Unit 3:** Refactoring and Best Practices in OOD

MCS-220: Web Technologies

Credits: 4 | **Type:** Theory

This course covers the full web development stack from client-side to server-side technologies and modern web frameworks.

Block 1: Client-Side Technologies

- **Unit 1:** HTML5 — Structure, Semantic Elements, Forms, Media
- **Unit 2:** CSS3 — Selectors, Box Model, Flexbox, Grid, Animations, Responsive Design
- **Unit 3:** JavaScript — Variables, Data Types, Functions, DOM Manipulation, Events
- **Unit 4:** Advanced JavaScript — AJAX, JSON, Fetch API, ES6+ Features

Block 2: Server-Side Technologies

- **Unit 5:** Introduction to Server-Side Programming
- **Unit 6:** PHP / Node.js Basics — Variables, Control Structures, Functions
- **Unit 7:** Database Connectivity — MySQL with PHP/Node.js, CRUD Operations
- **Unit 8:** Session Management, Cookies, Authentication

Block 3: Web Frameworks and Tools

- **Unit 9:** Introduction to Web Frameworks (e.g., Bootstrap, React/Angular overview)
- **Unit 10:** Web Services — REST, SOAP, XML, JSON
- **Unit 11:** Introduction to Web Security — XSS, SQL Injection, CSRF Prevention

Block 4: Modern Web Development

- **Unit 12:** Introduction to Cloud Deployment for Web Applications
- **Unit 13:** Web Application Architecture — MVC, Microservices overview
- **Unit 14:** Web Accessibility and Performance Optimization

MCS-221: Data Warehousing and Data Mining

Credits: 4 | **Type:** Theory

This course covers data warehouse design, OLAP systems, and core data mining techniques for knowledge discovery.

Block 1: Data Warehousing Concepts

- **Unit 1:** Introduction to Data Warehousing — Concepts, Architecture, Differences from OLTP
- **Unit 2:** Data Warehouse Design — Star Schema, Snowflake Schema, Fact and Dimension Tables

Block 2: OLAP and ETL

- **Unit 4:** ETL (Extract, Transform, Load) — Data Extraction, Transformation, Loading
- **Unit 5:** OLAP — MOLAP, ROLAP, HOLAP, OLAP Operations (Roll-up, Drill-down, Slice, Dice, Pivot)
- **Unit 6:** Data Cube — Materialisation, Indexing Techniques

Block 3: Data Mining Techniques

- **Unit 7:** Introduction to Data Mining — KDD Process, Data Mining Tasks
- **Unit 8:** Classification — Decision Trees (ID3, C4.5), Naive Bayes, SVM basics
- **Unit 9:** Clustering — K-Means, Hierarchical Clustering, DBSCAN

Block 4: Advanced Data Mining

- **Unit 10:** Association Rule Mining — Apriori Algorithm, FP-Growth
- **Unit 11:** Regression and Prediction — Linear and Logistic Regression basics
- **Unit 12:** Evaluation of Data Mining Models — Accuracy, Precision, Recall, F1, ROC Curve

MCSL-222: OOAD and Web Technologies Lab

Credits: 2 | **Type:** Practical

- **Sessions 1–10:** OOAD Lab — UML diagram creation using tools (ArgoUML/StarUML/Enterprise Architect), Use Case, Class, Sequence, Activity, State diagrams
- **Sessions 11–20:** Web Technologies Lab — HTML5, CSS3, JavaScript projects, PHP/Node.js server-side scripting, Form handling, Database connectivity (MySQL)

MCSL-223: Computer Networks and Data Mining Lab

Credits: 2 | **Type:** Practical

- **Sessions 1–10:** Computer Networks Lab — Network simulation tools (Cisco Packet Tracer/GNS3), Configuring protocols, Socket Programming in Java/Python
- **Sessions 11–20:** Data Mining Lab — Python-based data mining (NumPy, Pandas, Scikit-learn), Classification, Clustering, Association Rule Mining

Semester III: Detailed Syllabus

MCS-224: Artificial Intelligence and Machine Learning

Credits: 4 | **Type:** Theory

This course introduces core AI and ML principles including search, knowledge representation, reasoning, and supervised/unsupervised/deep learning techniques.

Block 1: Introduction to AI

- **Unit 1:** Introduction to Artificial Intelligence — History, Goals, Applications
- **Unit 2:** Problem Solving Using Search — State Space Representation, Search Strategies
- **Unit 3:** Uninformed and Informed Search — BFS, DFS, A*, Best-First Search, Heuristics
- **Unit 4:** Predicate and Propositional Logic — Syntax, Semantics, Inference Rules

Block 2: Knowledge Representation and Reasoning

- **Unit 5:** First Order Logic (FOL) — Quantifiers, Unification, Resolution
- **Unit 6:** Rule-Based Systems — Forward and Backward Chaining, Expert Systems
- **Unit 7:** Probabilistic Reasoning — Bayes' Theorem, Bayesian Networks
- **Unit 8:** Fuzzy and Rough Set Theory — Fuzzy Logic, Membership Functions

Block 3: Machine Learning Fundamentals

- **Unit 9:** Introduction to Machine Learning — Supervised, Unsupervised, Reinforcement Learning
- **Unit 10:** Supervised Learning — Linear Regression, Logistic Regression, Decision Trees
- **Unit 11:** Ensemble Methods — Random Forest, Boosting (AdaBoost, Gradient Boosting)
- **Unit 12:** Support Vector Machines (SVM), k-Nearest Neighbours (k-NN)

Block 4: Deep Learning and Advanced ML

- **Unit 13:** Neural Networks — Perceptron, Multilayer Neural Networks, Backpropagation
- **Unit 14:** Deep Learning Basics — CNNs, RNNs, LSTMs
- **Unit 15:** Unsupervised Learning — K-Means, Hierarchical Clustering, PCA
- **Unit 16:** Natural Language Processing Basics — Tokenization, Text Classification

MCS-225: Accountancy and Financial Management

Credits: 4 | **Type:** Theory

This course provides IT professionals with a working knowledge of accounting principles, financial statements, and managerial finance relevant to the software and IT industry.

Block 1: Fundamentals of Accounting

- **Unit 1:** Introduction to Accounting — Concepts, Conventions, Significance for IT Managers
- **Unit 2:** Journal, Ledger and Trial Balance — Double Entry System, Books of Accounts
- **Unit 3:** Final Accounts — Trading Account, Profit and Loss Account, Balance Sheet

Block 2: Financial Statements and Analysis

- **Unit 1:** Understanding Financial Statements — Income Statement, Balance Sheet, Cash Flow Statement
- **Unit 2:** Financial Ratios and Analysis — Liquidity, Profitability, Efficiency, Solvency Ratios
- **Unit 3:** Fund Flow Statement and Cash Flow Analysis
- **Unit 4:** Depreciation and Valuation Methods

Block 3: Financial Management

- **Unit 1:** Introduction to Financial Management — Goals, Functions, Role in IT Organisations
- **Unit 2:** Capital Budgeting — NPV, IRR, Payback Period
- **Unit 3:** Working Capital Management — Current Assets, Inventory, Receivables Management
- **Unit 4:** Sources of Finance — Short-term, Long-term, Equity, Debt
- **Unit 5:** Cost of Capital — WACC, Capital Structure

Block 4: Managerial Finance and Taxation Basics

- **Unit 1:** IT Project Cost Estimation and Budget Management
- **Unit 2:** Basics of Taxation — Income Tax Overview, GST Introduction
- **Unit 3:** Financial Planning for IT Startups and SMEs

MCS-226: Data Science and Big Data

Credits: 4 | **Type:** Theory

This course covers the complete data science pipeline from data collection to model deployment, along with Big Data technologies including Hadoop and Spark.

Block 1: Introduction to Data Science

- **Unit 1:** Data Science Overview — What is Data Science, Data Science Lifecycle
- **Unit 2:** Data Collection and Preprocessing — Data Sources, Handling Missing Values, Outliers
- **Unit 3:** Exploratory Data Analysis (EDA) — Descriptive Statistics, Visualisation Techniques
- **Unit 4:** Feature Engineering and Feature Selection

Block 2: Statistical Methods and Modelling

- **Unit 5:** Statistical Foundations — Probability Distributions, Hypothesis Testing, ANOVA
- **Unit 6:** Regression Analysis — Simple and Multiple Linear Regression
- **Unit 7:** Time Series Analysis — Components, ARIMA Models
- **Unit 8:** Dimensionality Reduction — PCA, LDA

Block 3: Big Data Technologies

- **Unit 9:** Introduction to Big Data — 5Vs (Volume, Velocity, Variety, Veracity, Value)
- **Unit 10:** Hadoop Ecosystem — HDFS, MapReduce, YARN, Hive, Pig, HBase
- **Unit 11:** Apache Spark — RDDs, DataFrames, SparkSQL, SparkML basics

Block 4: Advanced Data Science

- **Unit 12:** NoSQL Databases — MongoDB, Cassandra, Neo4j
- **Unit 13:** Data Visualisation Tools — Matplotlib, Seaborn, Tableau basics
- **Unit 14:** Model Deployment and MLOps Basics
- **Unit 15:** Data Ethics and Privacy in Data Science
- **Unit 16:** Real-World Case Studies in Data Science

MCS-227: Cloud Computing and IoT

Credits: 4 | **Type:** Theory

This course covers cloud computing service and deployment models, virtualisation, and the principles and applications of the Internet of Things.

Block 1: Cloud Computing Fundamentals

- **Unit 1:** Introduction to Cloud Computing — Definition, Characteristics, Advantages
- **Unit 2:** Cloud Service Models — IaaS, PaaS, SaaS with examples (AWS, Azure, Google Cloud)
- **Unit 3:** Cloud Deployment Models — Public, Private, Hybrid, Community Cloud

Block 2: Cloud Technologies and Architecture

- **Unit 4:** Virtualisation — Hypervisors, VM vs Containers (Docker), Kubernetes basics
- **Unit 5:** Cloud Storage — Object Storage, Block Storage, File Storage
- **Unit 6:** Cloud Security — Data Security, Identity Management, Compliance
- **Unit 7:** Cloud Networking — VPC, Load Balancing, CDN, DNS in Cloud

Block 3: Internet of Things (IoT)

- **Unit 8:** Introduction to IoT — Definition, Architecture, Applications (Smart Home, Smart City, Healthcare, Agriculture)
- **Unit 9:** IoT Protocols and Standards — MQTT, CoAP, HTTP, ZigBee, Z-Wave, LoRa

Block 4: IoT Technologies and Integration

- **Unit 10:** IoT Hardware — Arduino, Raspberry Pi, Sensors, Actuators
- **Unit 11:** IoT Data Processing — Edge Computing, Fog Computing
- **Unit 12:** Cloud-IoT Integration — AWS IoT, Azure IoT Hub, Google Cloud IoT

MCSL-228: AI and Machine Learning Lab

Credits: 2 | **Type:** Practical

- **Sessions 1–10:** AI Lab — Search Algorithm implementations (BFS, DFS, A*), Prolog-based logical reasoning, Expert System building
- **Sessions 11–20:** Machine Learning Lab — Python with Scikit-learn: Regression, Classification (Decision Tree, SVM), Clustering (K-Means), Neural Networks (TensorFlow/Keras basics)

MCSL-229: Cloud and Data Science Lab

Credits: 2 | **Type:** Practical

- **Sessions 1–10:** Cloud Lab — Setting up virtual machines, working with AWS/Azure free tier, Deploying web applications on cloud, Docker container basics
- **Sessions 11–20:** Data Science Lab — Python-based EDA, Data Visualisation (Matplotlib, Seaborn), Hadoop MapReduce exercises, Spark basics, MongoDB querying

Semester IV: Detailed Syllabus

MCS-230: Digital Image Processing and Computer Vision

Credits: 4 | **Type:** Theory

This course covers image acquisition, enhancement, segmentation, and advanced computer vision techniques including deep learning-based approaches.

Block 1: Image Processing Fundamentals

- **Unit 1:** Introduction to Digital Image Processing — Definition, Applications, Human Visual System
- **Unit 2:** Digital Image Fundamentals — Image Sampling and Quantisation, Pixel Relationships, Colour Models (RGB, YUV, HSV)
- **Unit 3:** Image Enhancement in Spatial Domain — Histogram Equalisation, Filtering, Smoothing
- **Unit 4:** Image Enhancement in Frequency Domain — Fourier Transform, Low-pass/High-pass Filters

Block 2: Image Restoration and Compression

- **Unit 5:** Image Restoration — Noise Models, Inverse Filtering, Wiener Filter
- **Unit 6:** Image Compression — Lossless (Huffman, LZW) and Lossy Compression (DCT-based, JPEG, MPEG)
- **Unit 7:** Morphological Image Processing — Dilation, Erosion, Opening, Closing

Block 3: Image Segmentation and Analysis

- **Unit 9:** Image Segmentation — Thresholding, Edge Detection (Sobel, Canny), Region-based Methods
- **Unit 10:** Feature Extraction — Shape, Texture, Colour Features, HOG
- **Unit 11:** Object Detection — Classical Methods (Viola-Jones), Introduction to YOLO and R-CNN

Block 4: Computer Vision

- **Unit 12:** Introduction to Computer Vision — Cameras, Stereo Vision, 3D Reconstruction
- **Unit 13:** Deep Learning for Vision — CNN-based Image Classification (AlexNet, VGG, ResNet overview)
- **Unit 14:** Applications — Face Recognition, Object Tracking, Medical Image Analysis, Autonomous Vehicles

MCS-231: Mobile Computing

Credits: 4 | **Type:** Theory

This course covers mobile networks, wireless protocols, mobile application development, and emerging mobile computing paradigms.

Block 1: Mobile Computing Fundamentals

- **Unit 1:** Introduction to Mobile Computing — Characteristics, Challenges, Applications
- **Unit 2:** Mobile Wireless Networks — GSM, GPRS, CDMA Architecture and Working
- **Unit 3:** 3G, 4G LTE, and 5G — Architecture, Features, Differences

Block 2: Wireless Protocols and Standards

- **Unit 4:** IEEE 802.11 (Wi-Fi) — Architecture, Security (WEP, WPA, WPA2, WPA3)
- **Unit 5:** Bluetooth and BLE — Architecture, Piconet, Scatternet, Applications
- **Unit 6:** Mobile IP — Home Agent, Foreign Agent, Registration, Tunnelling
- **Unit 7:** WAP (Wireless Application Protocol) — Architecture, WML Basics
- **Unit 8:** Mobile Ad Hoc Networks (MANETs) — Characteristics, Routing Protocols (AODV, DSR)

Block 3: Mobile Application Development

- **Unit 9:** Android Platform — Architecture (Linux Kernel, ART, Framework, Applications Layer)
- **Unit 10:** Android Development Basics — Activities, Intents, Layouts, UI Components
- **Unit 11:** Data Storage in Android — Shared Preferences, SQLite, File Storage, Room Database

Block 4: Advanced Mobile Computing

- **Unit 12:** Mobile Security — Threats (Malware, Phishing), Security Mechanisms, Secure Coding
- **Unit 13:** Location-Based Services — GPS, A-GPS, Geocoding, Maps API Integration
- **Unit 14:** Mobile Cloud Computing — Offloading, Mobile Backend as a Service (MBaaS)
- **Unit 15:** IoT and Mobile Integration — Smart Devices, Wearables
- **Unit 16:** Emerging Trends — AR/VR on Mobile, Mobile AI, 5G Applications

MCSP-232: Project

Credits: 12 | **Type:** Project

The MCA Project is a significant component of the programme, carrying 12 credits. It is carried out during the final (4th) semester and involves individual or group work on a real-world computing problem.

Project Guidelines

- **Objective:** To apply knowledge gained across all four semesters to develop a complete software solution or conduct research in a computing domain
- **Duration:** Full Semester IV
- **Scope:** The project can cover any area in Computer Science/Applications such as Web Applications, Mobile Applications, Data Science, AI/ML, Cloud-based Systems, IoT Applications, or Security Systems
- **Deliverables:**
  - Project Proposal / Synopsis
  - Mid-term Review
  - Final Project Report (as per IGNOU guidelines)
  - Project Demonstration and Viva Voce

Project Evaluation

Component	Marks
Project Report	50 marks
Project Demonstration and Viva Voce	50 marks
Total	100 marks

- **Minimum Passing Marks:** 40% in each component
- Students must submit the project synopsis and get it approved before commencing work
- The project counsellor at the Learner Support Centre (LSC) guides and evaluates the project
- 4 counselling sessions are available for project discussions

Bridge Courses: Detailed Syllabus

MCS-201: Programming in C and Python

Credits: 4 | **Type:** Theory (Bridge Course)

Covers programming fundamentals using C and Python, designed for non-CS background students.

- **Block 1:** Introduction to C — Variables, Data Types, Operators, Control Structures
- **Block 2:** Functions, Arrays, Strings, Pointers in C
- **Block 3:** File Handling in C, Structures and Unions
- **Block 4:** Introduction to Python — Variables, Lists, Tuples, Dictionaries, Functions, File I/O, OOP basics in Python

MCS-208: Data Structures and Algorithms

Credits: 4 | **Type:** Theory (Bridge Course)

Covers fundamental data structures and their algorithm implementations.

- **Block 1:** Arrays, Linked Lists (Singly, Doubly, Circular)
- **Block 2:** Stacks, Queues, Priority Queues
- **Block 3:** Trees — Binary Trees, BST, AVL Trees, Heaps
- **Block 4:** Graphs — Representation, Traversals; Sorting and Searching Algorithms

Evaluation Scheme

Theory Courses

Component	Weightage	Minimum Passing Marks
Assignment (Continuous Evaluation)	30%	40% (Grade D)
Term-End Examination (TEE)	70%	40% (Grade D)
Total	100%	Both components must be passed separately

Practical Courses

Component	Weightage	Minimum Passing Marks
Practical Assignment / Lab Record	30%	40%
Term-End Practical Examination	70%	40%
Total	100%	Both components must be passed separately

Project (MCSP-232)

Component	Marks
Project Report	50
Viva Voce and Demonstration	50
Total	100

> **Important:** Students must submit assignments before the due date to be eligible to appear in the Term-End Examination for that course.

Counselling Sessions Summary

Semester	Theory Sessions	Practical Sessions	Theory Hours	Practical Hours
I	24	40	48 hrs	120 hrs
II	24	40	48 hrs	120 hrs
III	24	40	48 hrs	120 hrs
IV	12 + 4 (Project)	—	32 hrs	—
Total	84	120	176 hrs	360 hrs

> **Note:** 75% attendance is compulsory for all Practical Lab Sessions. Students who fail to fulfil this requirement must re-register for the lab course.

Key Programme Information

Parameter	Details
Programme Duration	Minimum 2 Years, Maximum 4 Years
Total Credits	80
Medium of Instruction	English
Exam Frequency	Twice a year (June for Jan–June Sem; December for July–Dec Sem)
Study Material	Available on eGyankosh (egyankosh.ac.in) and IGNOU eContent App
Assignment Submission	At Learner Support Centre (LSC) before stipulated due date
Contact Email	mca@ignou.ac.in
Official Portal	https://www.ignou.ac.in/schools/programme/MCA_NEW
Result Portal	https://result.ignou.ac.in