



MANIPAL UNIVERSITY
JAIPUR
(University under Section 2(f) of the UGC Act)



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UNIVERSITY JAIPUR
University under Section 2(f) of the UGC Act

PROGRAMME PROJECT REPORT (PPR)

For

**Master of Computer Application (MCA)
(ONLINE DEGREE PROGRAMME)**

CENTRE FOR DISTANCE AND ONLINE EDUCATION (CDOE)

MANIPAL UNIVERSITY JAIPUR

Dehmi Kalan, Off Jaipur-Ajmer Expressway,

Jaipur, Rajasthan 303007

Director
Centre for Distance and Online Education
Manipal University Jaipur



PROGRAMME PROJECT REPORT

Introduction

The Programme leading to the award of Master of Computer Applications (MCA) is developed to prepare students to take up a career in the field of IT and Computer Applications. This is a Post Graduate Programme where students are exposed to various areas of Computer Applications including the latest developments in the industry.

1. Programme's Mission and Objectives

To afford a Quality Postgraduate Degree in Information Technology (MCA) through Online Learning mode to impart high quality training to students using the latest tools in computer technology. To upkeep the high standard of education, the academic syllabus is designed keeping in view the latest trends and technologies in the field of Computer Science. The coursework is designed to be flexible and wide-ranging, incorporating cutting-edge technology and ensuring that the students have a firm grasp on the core fundamentals of IT, and its applications.

The objectives of the programme are to enable students:

- To work productively as an IT professionals both at supportive and leadership roles
- To advance successfully in their chosen career path utilizing technical abilities, leadership qualities, communication, and interpersonal skills with high regard to legal and ethical responsibilities, in IT domain.
- To build their profession adaptable to the changes in technology, with lifelong learning

2. Relevance of Programme with Manipal University, Jaipur Mission and Goals

In order to align with the mission and goals of Manipal University Jaipur, the Online MCA Programme is planned to enable students and working professionals gain knowledge in various domains of IT, specialize in a domain of their choice, gain knowledge of not only IT, but also managerial skills including analysis, data based decision making and entrepreneurship, in newer and emerging markets, products and technologies.

Vision

Global Leadership in Higher Education and Human Development

Mission

- Be the most preferred University for innovative and interdisciplinary learning
- Foster Academic research and professional excellence in all domains
- Transform young minds into competent professionals with good human values.

3. Nature of Prospective Target Group of Learners

It is by now well accepted that an MCA degree is an important tool for professionals to contribute to business in all areas of IT, expand their career options and move up their career ladder, acquire Leadership skills or embark on an entrepreneurial journey.

This Online programme has been designed for conventional learners, as well as working professionals and other individuals aspiring to acquire knowledge and associated academic credentials. Considering that all candidates interested in pursuing a degree may not be able to afford the same through a campus mode for reasons of paucity of time or financial constraints, online delivery is a feasible option to enable them to acquire knowledge and skills. Delivery through this mode also contributes towards Gross Enrolment Ratio (GER) of 50% by 2035, as envisaged by the Government of India.

4. Appropriateness of programme to be conducted in Online mode to acquire specific skills and competence

The programme is so designed that the prospective students who may not be able to afford full time, residential MCA are provided with high value learning, anytime, anyplace, at one's own pace.

The courses in the programme are delivered through Self-Learning e-Module which is a modular unit of e-learning material which is inter-alia self-explanatory, self-contained, self-directed at the learner, and amenable to self-evaluation, and enables the learner to acquire the prescribed level of learning in a course of study and includes contents in the form of a

combination of the following e-Learning content, and made available through four-quadrant approach namely,

(a) e-Tutorial - faculty led Audio - Video Lectures, (b) e-Content (combination of PDF/ epub) Text Materials, (c) Discussion forum for raising of doubts and clarifying the same on real time basis by the Course Coordinators/Course Mentors assigned to students (d) Self- Assessment Quiz, Test and Assignments to reinforce learning. Reference books are also mentioned in the syllabus. Latest Edition of Reference books may be referred to.

A robust Learning Management System that keeps track of delivery of e-Learning Programmes, learner's engagement, assessment, results and reporting in one centralized location, is in place. All of the above can be done/delivered by online and other platforms without much loss of fidelity. Hence the MCA programme is suited for Online mode of learning.

5. Instructional Design

5.1. Curriculum design

Curriculum has been designed by experts in the area of Management and Information Technology and care has been taken to include contemporary topics, as well as topics that also inculcate environmental awareness in students. The curriculum and syllabus are approved by the Board of Studies, Centre for Internal Quality Assurance (CIQA) and University Academic Council which consists of experts from Academia and Industry.

5.1.a: Detailed Syllabus

First Semester		
Course Code	Course Name	Cr
DCA6106	Fundamentals of Computer & IT	0
DCA6107	Fundamental of Mathematics	0
DCA6108	Discrete Mathematics and Graph Theory	4
DCA6109	Python Programming	4
DCA6110	Programming & Problem-Solving using C	4
DCA6111	Relational Database Management System	4
DCA6112	Data Visualization	4
DCA6132	Relational Database Management - Lab	1
DCA6133	Programming & Problem-Solving using C - Lab	1
DCA6134	Python Programming- Lab	1
TOTAL CREDITS		23

Second Semester		
Course Code	Course Name	Cr
DCA6206	Computer Networks & Protocols	4
DCA6207	Object Oriented Programming using JAVA	4
DCA6208	Operating System	4
DCA6209	Data Structures and Algorithms	4
DCA6210	Computer Architecture	2
DCA62X1	Program Elective-I	4
DCA6233	Object Oriented Programming using Java- Lab	1
DCA6234	Data Structures and Algorithms - Lab	1
TOTAL CREDITS		24

Third Semester		
Course Code	Course Name	Cr
DCA7105	Unix & Shell Programming	4
DCA7106	Web Technology	4
DCA7107	Software Engineering & Project Management	4
DCA71X2	Program Elective-II	4
DCA71X3	Program Elective-III	4
DCA7133	Unix & Shell Programming Lab	1
DCA7134	Web Technology Lab	1
TOTAL CREDITS		22

Fourth Semester		
Course Code	Course Name	Cr
DCA7201	Mobile Application Development	4
DCA7231	Project Work	8
DCA72X4	Program Elective-IV	4
TOTAL CREDITS		16
GRAND TOTAL OF CREDITS		85

5.1.b: Program Electives

	AI & DATA SCIENCE	CLOUD COMPUTING	CYBER SECURITY	COMPREHENSIVE EMERGING TECHNOLOGIES	AI & ML
Program Elective-I (Sem II)	DCA62A1- Artificial Intelligence	DCA62C1- Fundamentals of Cloud Computing	DCA62S1 - Cyber Security Essentials	DCA62T1 - IoT Essentials	DCA62M1- Fundamentals of Artificial Intelligence and Problem Solving
Program Elective-II (Sem III)	DCA71A5- Categorical Data Analysis and Generalized Linear Models	DCA71C5-Cloud Architecture and Services	DCA71S5-Cyber Laws and Ethics	DCA71T5- Data Mining Techniques	DCA71M5- Introduction to Machine Learning
Program Elective-III (Sem III)	DCA71A6- Deep Learning and Text Mining	DCA71C6- Google Cloud Essentials	DCA71S6-Ethical Hacking	DCA71T6- Blockchain Technologies	DCA71M6- Fundamentals of Unsupervised Learning
Program Elective-IV (Sem IV)	DCA72A7- Applied Data Analytics	DCA72C7- Cloud Application Development	DCA72S7- Cryptography and Network Security	DCA72T7- Big Data Analytics and Business Intelligence	DCA72M7- AI in Project Management

5.1.c : Detailed Syllabus

MCA Sem 1:

DCA6106 - Fundamentals of Computer	
Unit 1	Introduction to Computers: Introduction to Computers: Evolution of Computers, Characteristics of Computers, Organisation of a Computer Part I, Organization of a Computer Part II.
Unit 2	Computer Generation and Classification: Generation of Computer, Classification of Computer Part I, Classification of Computer Part II, Distributed and Parallel Computing.
Unit 3	Number Systems and Boolean Algebra: Introduction to Number System, Types of Number System Number System Conversion Part I, Number System Conversion Part II, Complement.
Unit 4	Logical Circuits: Introduction to Circuits, Flip Flops Part I, Flip Flops Part II, Shift Registers.
Unit 5	Central Processing Unit: Introduction to CPU, Modern CPU Concepts, Architectural Performance, Processors, CPU Overclocking.
Unit 6	Computer Memory: Memory System, Primary Memory, Secondary Memory.
Unit 7	BUS Architecture: Bus, Industry Standard Architecture, Peripheral Component Interconnect, Accelerated Graphic Port.
Unit 8	Storage Devices: Introduction, The Hard Drive, CD-ROM Drive, DVD Drive, Blu-Ray DISC Drive, Flash Memory Drive.
Unit 9	Input Output Devices: Mice, Keyboards, Sound Boards, Troubleshooting a Soundboard.
Unit 10	Introduction to Computer Software: Operating System Software, Application Software Part I, Proprietary Software, Open-Source Technology.
Unit 11	Software Development, Design, and Testing: Introduction to Software, Introduction to Software Coding & Testing, Software Paradigms, Programming Approach, Software Applications
Unit 12	Operating System Concepts: Introduction to OS, Development of OS, OS Components, Operating System Services, OS for different Computers.
Unit 13	Communication System Concepts: Introduction to Communication System, Data Communication, Network Types, OSI Reference Model, TCP-IP Model.
Unit 14	TCP IP and Internet: TCP IP Protocol Suite, History of the Internet, Concepts of the Internet, Internet Backbone, Requirements of the Internet, Internet Explorer, and Applications.

DCA6107 - Fundamental of Mathematics

Unit 1	Set Theory: Sets and Their representation, Empty Set, Finite and Infinite sets, Equal and Equivalent sets, Subset and powerset.
Unit 2	Differential Calculus: Differentiation of powers of x , e^x , $\log x$, Trigonometric functions.
Unit 3	Integral Calculus: Introduction to Integration. Integration of standard function
Unit 4	Calculus of Functions of Several Variables: Partial Derivatives.
Unit 5	Vector Calculus - 1: Vector, Vector Addition and Subtraction.
Unit 6	Vector Calculus - 2: Multiplication of Vector, Vector Multiplication.
Unit 7	Matrices: Matrix and operations, Determinants, Inverse Matrix, Solution of Linear Equation.
Unit 8	Complex Variables: Complex Numbers, Conjugate of a Complex Number, Modulus of a Complex Number, Geometrical Representation of a Complex Number, Exponential Form of a Complex Number.

DCA6108 - Discrete Mathematics and Graph Theory

Unit 1	Introduction to POSET: Definitions, Examples, Basic Properties.
Unit 2	Basics of Logic: Propositional Logic, Logical Connectives.
Unit 3	Introduction to Functions: Definitions, Types of Functions.
Unit 4	Fundamentals of Number Systems: Binary, Octal, Decimal, Hexadecimal.
Unit 5	Introduction to Boolean Algebra: Basic Operations, Properties.
Unit 6	Basic Graph Theory: Definitions, Types of Graphs.
Unit 7	Mathematical Logic: Statements and Notations, Connectives, Normal Forms, Well-formed Formulas, Implication, Tautology.
Unit 8	Basic Statistics: Mean, Median, Mode, Variance, Standard Deviation.
Unit 9	Graphs and Their Properties: Introduction, Isomorphism, Subgraphs, Walks, Paths, Circuits, Connectedness, Components.
Unit 10	Matrices and Determinants: Basics, Operations, Inverse, Cramer's Rule.
Unit 11	Linear Equations: Solving Systems of Linear Equations.
Unit 12	Introduction to Set Theory: Basics, Operations, Venn Diagrams.
Unit 13	Logic Gates and Circuits: Basic Logic Gates, Truth Tables, Logic Circuits.
Unit 14	Sequences and Series: Arithmetic and Geometric Progressions.

DCA6109 - Python Programming	
Unit 1	Introduction to Python: Introduction to Programming, Python Basics, Installation of Python, Interactive Mode, and Script Mode.
Unit 2	Python Syntax and Variables: Basic Python Syntax, Variable Assignment, Data Types, Type Conversion.
Unit 3	Control Structures: Conditional Statements (If, Elif, Else), Looping (While, For), Break, Continue, Pass.
Unit 4	Functions and Modules: Introduction to Functions, Defining and Calling Functions, Scope of Variables, Modules and Packages, Import Statement.
Unit 5	Data Structures: List, Tuple, Set, Dictionary, Operations on Data Structures, Built-in Functions.
Unit 6	File I/O: Reading and Writing to Files, File Modes, Use of with statement.
Unit 7	Exception Handling: Error Types, Try, Except, Finally Blocks, Raising Exceptions.
Unit 8	Object-Oriented Programming: Class and Objects, Encapsulation, Inheritance, Polymorphism.
Unit 9	Regular Expressions and Text Processing: Introduction to Regular Expressions, Text Processing, String Formatting.
Unit 10	Database Interaction: SQL Basics, SQLite module, CRUD operations, Transactions.
Unit 11	Python for Web Development: Introduction to Flask/Django, Building a Basic Web App, Routing, Templates.
Unit 12	Python for Data Science: Introduction to NumPy, Pandas, Data Cleaning and Processing, Basic Statistics.
Unit 13	Python for Game Development: Introduction to Pygame, Building a Simple Game, Events and Animation.
Unit 14	Python Best Practices: Code Formatting (PEP8), Testing and Debugging, Virtual Environments, and Deploying Python Applications.

DCA6110 - Programming and Problem-Solving using C	
Unit 1	Introduction to C Programming: Introduction, Features of C and its Basic Structure, Simple C Programs, Constants, Concept of an Integer and Variable.
Unit 2	Operators and Expressions: Introduction, Arithmetic Operators, Unary, Relational and Logical Operators, Conditional Operators, Bitwise Operators, Increment and Decrement Operators, Size.
Unit 3	Data Types and Input/Output Operators: Introduction, Floating-point Numbers, Type Cast Operator, Type Char, Keywords, Character Input and Output, Formatted Input and Output, gets () and puts () functions.

Unit 4	Control Statements and Decision Making: Introduction, Goto Statement, If Statement, Conditional Expression, Switch Statement, Types of Loops, Do While For.
Unit 5	Functions: Basic, Prototype, Recursion.
Unit 6	Storage Classes: Introduction, Storage Classes, Visibility, Automatic or Local Variables, Global Variables, Static Variables, External Variables.
Unit 7	Arrays and Strings: Introduction, One dimension and Multi dimension array, Strings.
Unit 8	Pointers: Basic, Pointers and One-dimensional Arrays, Null Pointers, Pointers and Strings, Pointers, and Two-dimensional Arrays.
Unit 9	Structures and Unions: Introduction, Basics of Structures, Structures and Functions, Arrays of Structures, Pointers to Structures, Self-Referential Structures, Unions.
Unit 10	File management: Introduction, Defining and Opening a file, Closing Files, Input/Output Operations on Files, Error Handling during I/O Operations, Random Access to Files, Command Line Arguments.
Unit 11	Advanced Dynamic Memory Allocation: Understanding malloc, calloc, realloc and free, Linked list
Unit 12	Error Handling: Using errno, perror and strerror.
Unit 13	Advanced Pointers: Pointers to Pointers, Pointers to Functions.
Unit 14	Graphical Programming in C: Understanding Graphics.h, Simple Graphics Programs.

DCA6111 - Relational Database Management System

Unit 1	Comparison between Different Databases: Introduction, Significance of Databases, Applications of Database Systems, Personal databases, Two-Tier client/server databases, multi-tier client/server databases, Enterprise application, Different Types of DBMS, based on the data model, based on the number of users, based on the number of sites, based on cost, Based on purpose, Comparison between Centralised and Distributed Database, Graph databases, Time-series databases.
Unit 2	RDBMS and SQL: Introduction, Relational Query Languages, SQL, Integrity Constraints, Entity integrity, Domain integrity, Referential integrity, Data Definition Statements, Creating relations in SQL, Adding and deleting tuples, Destroying and altering relations, Data Manipulation Language, SELECT statement, Subquery, Querying multiple relations, Functions, GROUP BY, Updating the database, Views, Embedding SQL Statements, Transaction Processing, Dynamic SQL, Normalisation and Database Design, De-normalisation, NoSQL databases: Types, Use cases, Comparison with RDBMS.

Unit 3	Query Optimisation: Introduction, Query Execution Algorithm, External sorting, Implementing the SELECT operation, Methods to implement JOIN operation, Project and Set operations implementation, Aggregate operations implementation, Heuristics in Query Optimisation, Notation for query trees and query graphs, General transformation rules for relational algebraic operations, Conversion of query trees into the query execution plans, Semantic Query Optimisation, Multi-Query Optimisation and Application, Execution Strategies for SQL Sub Queries, Query Processing for SQL Updates, Machine Learning-Based Query Optimisation.
Unit 4	Query Execution: Introduction, Introduction to Physical-Query-Plan Operators, Scanning tables, Sorting while scanning tables, One-Pass Algorithms for Database Operations, Nested-Loop Joins, Tuple-based nested-loop join, Iterator for a tuple-based nested-loop join, Two-Pass Algorithms based on Sorting, Two-Pass Algorithms Based on Hashing, Index- Based Algorithms, Buffer Management, Parallel Algorithms for Relational Operations, Using Heuristics in Query Optimisation, Basic Algorithm for Executing Query Operations, Distributed Query Execution.
Unit 5	Adaptive Query Processing and Query Evaluation: Introduction, Query Processing Mechanism: Eddy, Eddy Architecture and how Eddy allows Extreme flexibility, Properties of Query Processing Algorithms, Need and Uses of Adaptive Query Processing, Complexities, Robust Query Optimisation through Progressive Optimisation, Query Evaluation Techniques for Large Databases, Query Evaluation Plans.
Unit 6	Transaction Processing: Introduction, Transaction Processing: An Introduction, Advantages and Disadvantages of Transaction Processing System, Advantages of a transaction processing system, Disadvantages of a transaction processing system, Online Transaction Processing System, Serialisability and Recoverability, Cascading rollback, Recoverable schedules, Managing rollbacks using locking, View Serialisability, Resolving Deadlocks, Deadlock detection by timeout, The waits-for graph, Distributed Locking, Centralised lock systems, Primary-copy locking, Transaction Management in Multi-Database System, Long-Duration Transactions, High-Performance Transaction Systems, Distributed Transactions and Blockchain-based Transactions.
Unit 7	Concurrency Control: Introduction, Enforcing Serialisability by Locks, Locks, Locking scheduler, Two-phase locking, Locking Systems with Several Lock Modes, Architecture for a Locking Scheduler, Two-part scheduler, The lock table, Managing Hierarchies of Database Elements, Concurrency Control by Timestamps, Timestamp resolution, Timestamp locking, Concurrency Control by Validation, Database Recovery Management, Concurrency Control in Distributed Databases.

Unit 8	Parallel Database Architectures for Parallel Databases: Introduction, Parallel Database, Advantages of a parallel database, Disadvantages of a parallel database, Parallelism in Database Management System, Parallel Query Evaluation, Parallel query processing, When to implement parallelism, How parallel-execution works, Parallelised SQL statements, Parallelising Individual Operations, I/O Parallelism, Partitioning techniques (number of disks = n), Comparison of partitioning techniques, Inter-Query Parallelism, Intra Query Parallelism, Intra partition parallelism, Inter partition parallelism, Inter Operation and Intra Operation Parallelism, Design of Parallel Systems.
Unit 9	Object Oriented DBMS: Introduction, Object Oriented Paradigm, OODBMS Architectural Approaches, Distributed client-server approach, Data access mechanism, Object clustering, Heterogeneous operation, Object Identity, Procedures and Encapsulation, Object Oriented Data Model, Relationships, Identifiers, Basic OODMS Terminology, Basic Interface and Class Structure, Type Hierarchies and Inheritance, Type Extents and Persistent Programming Languages, Document-Oriented Databases.
Unit 10	Distributed Databases: Introduction, Introduction of Distributed Databases, DDBMS architectures, Functions of distributed database management system, Components of distributed database management system, Homogeneous and Heterogeneous Database, Distributed Data Storage, Data fragmentation, Data replication, Advantages and Disadvantages of Data Distribution, Advantages of data distribution, Disadvantages of data distribution, Distributed Transaction, Commit Protocols, Components of atomic commit, Two-phase commit, Concurrency Control, Recovery of Distributed Database, Directory Systems, DDBMS Transparency Features, Distribution Transparency, Apache Cassandra, Google Spanner.
Unit 11	Object Relational and Extended Relational Databases: Introduction, Object Relational Database, Reasons behind the development of ORDBMS, Advantages of ORDBMS, Disadvantages of ORDBMS, Characteristics of object-relational databases, Extension Techniques in RDBMS, Standards for OODBMS Products and Applications, ODMG-93 standards, ODMG Smalltalk binding, SQL3, Nested Relations and Collections, Storage and Access Methods, Implementation Issues for Extended Type, Comparing RDBMS, OODBMS and ORDBMS, Hybrid Databases.
Unit 12	JSON Query Processing: Introduction to JSON, Reading and Writing JSON, JSON Querying and Processing Advanced JSON Query Techniques, Using JSON in Databases, JSON Schema and Validation, JSON, and REST APIs JSON Security Considerations, Processing, Future of JSON.
Unit 13	Database Application-Active and Temporal Database: Introduction, Active Database, Design principles for active rules, Starburst, Oracle, DB2, Application of active database (Active DB), Temporal Database, Big Data Databases

Unit 14	Database Application-Multimedia Database: Introduction, Multimedia Database, Video Database Management, Storage management for video, Video pre-processing for content representation and indexing, Image and semantic-based query processing, Real-time buffer management, Managing Unstructured Data in Databases.
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DCA6112 - Data Visualization	
Unit 1	Introduction to Data Visualization: Definition, Importance, Applications, Data Types in Visualization.
Unit 2	Excel in Data Visualization: Introduction to Excel, Data Types, Visualization Capabilities.
Unit 3	Basic Chart Types in Excel: Pie Chart, Bar Chart.
Unit 4	Advanced Chart Types in Excel: Histogram, Gantt Chart, Heat Map.
Unit 5	Statistical Charts in Excel: Box and Whisker Plot, Waterfall Chart, Area Chart.
Unit 6	Advanced Plot Types in Excel: Scatter Plot, Pictogram Chart, Timeline.
Unit 7	Introduction to Python for Data Visualization: Overview, Setup, Basics of Python, Visualization Libraries (Matplotlib, Seaborn, etc.)
Unit 8	Visualization of Text Data in Python: Word Cloud, Frequency Distributions.
Unit 9	Correlation and Geographical Plots in Python: Correlation Matrices, Geographical plots, Density Maps.
Unit 10	Advanced Visual Techniques in Python: Bubble Chart, Tree maps.
Unit 11	Data Cleaning and Preparation in Python: Dealing with missing data, data transformation, and applying filters.
Unit 12	Time Series and Trend Analysis in Python: Time Series Analysis, Working with Dates, Trend Analysis.
Unit 13	3D Visualizations in Python: 3D Scatter Plots, 3D Mash
Unit 14	Dashboard and Story Development in Python: Introduction to Dashboards, Dashboard Design Principles, Dashboard Development with Dash or Plotly, Story Development.

MCA Sem 2:

DCA6206 - Computer Networks & Protocol	
Unit 1	Introduction to Computer Networks and Standards: OSI, TCP/IP, Internet Models, Network Types, Protocols, Addressing, and Network Hardware Components.
Unit 2	Multiplexing and Local Area Networks: Frequency Division Multiplexing, Time Division Multiplexing, LAN Technologies, Circuit Switching, Packet Switching, Message Switching, Classful and Classless addressing, subnetting, and Network Address Translation.
Unit 3	Optical Networking: SONET/SDH, Wavelength Division Multiplexing, Devices, Dense Wavelength Division Multiplexing.
Unit 4	Encapsulation, operation Data Link Layer: ARP package & RARP- Introduction, packet format.
Unit 5	Network Layer: IP Package, Types of messages, message format, error reporting, Query, Checksum, and Debugging tools.
Unit 6	Transport Layer: Process to process communication, User datagram, checksum, UDP operation UDP package.
Unit 7	Transport Layer-TCP Variants - Introduction, TCP services, TCP features, segment, TCP connection, Flow control, Error control, Congestion control, TCP timers, options, TCP package, UDP, ICMP, HTTP.
Unit 8	Dynamic Routing Protocols: Unicast Routing Protocols, Intra-Domain Routing, Inter-Domain Routing Protocol (IDRP, RIP, OSCP, BGP), Multicast Routing Protocols.
Unit 9	Network Management: Network Management System Architecture, Simple Network Management Protocol (SNMP), Network Management Challenges.
Unit 10	Network Security Basics: Basics of Cryptography, Symmetric Key Encryption, Public Key Encryption, Digital Signatures, Current Threat Landscape, Modern Security Measures.
Unit 11	Web Security and Traffic Management Basics: Web Security Requirements, Secure Socket Layer (SSL), Traffic Management, Network Characteristics and Requirements.
Unit 12	Quality of Service and Queue Analysis: Quality of Service Aspects, Queue Analysis, Queuing Models, Queue Management Algorithms.
Unit 13	Multimedia Over the Internet: Quality of Service for Multitasking, Multicast Transport Protocol, Resource Reservation Protocol (RSVP), Real-Time Transport Protocol (RTP), Introduction to MANET & VANET.
Unit 14	VLAN & Wireless Network Protocols: Demilitarized Zone (DMZ), Network Address Translation, Secure Network Address Translation (SNAT), Packet Filtering, Application Gateway, Introduction to VLAN concept, WAP Architecture introduction.

DCA6207 - Object oriented Programming using Java	
Unit 1	Introduction to Java: Introduction, Evolution of Java, Features of Java, Understanding Java Virtual Machine (JVM), Java Runtime Environment (JRE), Java Development Kit (JDK), Security in Java, Java and Cloud Computing.
Unit 2	Java Basics: Java Basics: Primitives Data Types, Abstract/Derived Data Types, Variables in Java, Introduction to Classes in Java, Declaring Methods in Java, Java Generics, Lambda Expressions.
Unit 3	Operators and Control Statements: If-else Statement, Switch Statement, For Loop, While Loop, Do-While Loop, Break Statement, Continue Statement.
Unit 4	Arrays, Strings and Streams in Java: String Handling, Special String Operations, Character Extraction, String Comparison, Searching Strings, String Modification, String Buffer, Introduction to Arrays, Introduction to Strings, String Handling in Java, Introduction to Java Streams.
Unit 5	Inheritance, Package, Interface, and Functional Programming: Inheritance in Java, Packages in Java, Interfaces in Java, Introduction to Functional Programming in Java.
Unit 6	Exception and Error Handling in Java: Introduction to Exceptions, Error Handling in Java, Custom Exceptions.
Unit 7	Streams in Java: Stream basics, Abstract stream, Stream classes, readers and writers, random access files and serialization, stream API
Unit 8	Collections: Need of collections in Java, List, set, Map, comparable object, iterators, utility classes, hash table
Unit 9	Multi-threading: Thread concept-life cycle and types, creating and starting thread, advanced concepts of multi-threading
Unit 10	New Features in Java: Introduction to Modules, Factory Methods for Collections, Interface Private Methods.
Unit 11	Introduction to Junit: Unit testing and Junit, Junit assertions
Unit 12	Front-End Development with Java: Introduction, JavaFX, Vaadin, Thymeleaf, Javascript interoperability.
Unit 13	Database Connectivity in Java: JDBC, Introduction to JPA and Hibernate, Integrating hibernates with Spring boot.
Unit 14	Web Development in Java: Introduction to Servlets, JavaServer Pages, Introduction to Spring MVC.
Unit 15	Networking in Java - Basics of Networking in Java, Working with Sockets, Introduction to REST API in Java.

DCA6208 - Operating Systems	
Unit 1	Introduction to Operating Systems: Overview of Operating Systems, Functions of Operating Systems, Types of Operating Systems, Structure of Operating Systems.
Unit 2	Operating Systems Structures and Architectures: Extended Machine and User Interface, System Components, Operating System Services, System Calls, System Structure, Layered Approach, Micro-Kernels, and Modules.
Unit 3	Process Management: Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication, Multithreading Models, Thread Libraries, Threading Issues.
Unit 4	CPU Scheduling: CPU Scheduler, Pre-emptive Scheduling, CPU Scheduling Algorithms, Multiple-Processor Scheduling, Real-Time Scheduling.
Unit 5	Process Synchronization and Deadlocks: The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors, Deadlocks - System Model, Deadlock Characterization, Deadlock Prevention, Avoidance and Detection, Recovery from Deadlock.
Unit 6	Advanced Memory Management: Logical vs. Physical Address Space, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with Paging, Garbage Collection, Virtual Machines.
Unit 7	Virtual Memory: Demand Paging, Copy-on-Write, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped Files, and Allocating Kernel Memory.
Unit 8	Modern File Systems: File Concept, Access Methods, Directory Structure, Protection, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management, Distributed File Systems, Journaling File Systems.
Unit 9	Advanced I/O Systems: I/O Systems, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O Requests to Hardware Operations, Performance.
Unit 10	Advanced Storage Systems: Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management, RAID Structure, Stable-Storage Implementation, SSDs, SAN and NAS, Cloud Storage.
Unit 11	Distributed Systems: Distributed System Structures, Network Structures, Network Topologies, Communication Protocols, Robustness, Distributed File Systems.
Unit 12	Security and Protection: Protection, Goals of Protection, Principles of Protection, Domain of Protection, Access Matrix, Security Problem, Security Attacks, Security Services, Cryptography as a Security Tool, User Authentication, Firewalling to Protect Systems and Networks.
Unit 13	Multiprocessor Systems: Symmetric Multiprocessing, Asymmetric Multiprocessing, Multicore Processors, Multithreading, Multiprocessing Issues.

Unit 14	Case Study: Real-Time Operating System. Use of RTOS, Types, components of RTOS, GPOS and RTOS
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DCA6209 - Data Structures and Algorithms	
Unit 1	Introduction to Data Structures and Algorithms: Structure and Problem Solving, Data Structures, Data Structure Operations, Algorithm: Complexity and Time-Space Tradeoff.
Unit 2	Algorithm Complexity: Mathematical Notation and Functions, Algorithm Notation, Control Structures, Complexity of Algorithm, Rate of Growth.
Unit 3	Linked List: Linked List and its Representation in Memory, traversing a Linked List, Searching a Linked List, Memory Allocation and Garbage Collection, Insertion into a Linked List, Deletion from a Linked List, and Types of Linked List.
Unit 4	Stacks and Queues: Definition and Implementation of Stacks, Applications of Stacks, Definition, and Implementation of Queues.
Unit 5	Trees and Binary Trees: Definition and Concepts of Trees, Traversal on Binary Tree, Representation of Binary Tree.
Unit 6	Binary Search Trees: Conversion of General Tree to Binary Tree, Sequential and Other Representations of Binary Trees, Concept of Binary Search Tree (BST), Operations on BST.
Unit 7	Balanced Trees and Modern Variants: Definition and Structure of AVL Tree, Operations on AVL Tree, Definition and Structure of B-Tree, Operations on B-Tree, Applications of B-Tree,
Unit 8	Advanced Graph Theory and Applications: Basic Concepts about Graphs, Matrix Representation of Graphs, List Structures, Other Representations of Graphs, Algorithms for Graph Traversal, Spanning Trees, Topological Sorting, Weighted Shortest Path – Dijkstra’s Algorithm, Minimum Spanning Tree (MST), Union, find DS, Introduction to NP-Completeness, Bellman ford.
Unit 9	Advanced Dynamic Storage Management: Introduction to Memory Management, First-fit Storage Allocation, Storage Release, Buddy Systems, Garbage Collection.
Unit 10	Advanced Searching and Sorting Techniques: Sequential Searching, Binary Searching, Bubble Sort, Merge Sort, Selection Sort, Heap Sort, QuickSort, Radix Sort, Bucket Sort.
Unit 11	External Sorting Techniques: External Sorting, Sorting on Disks, Generating Extended Initial Runs.
Unit 12	External Searching Techniques: External Searching, Introduction to Static Hashing, Organizing Direct Files with Hashing, Collision Resolution Methods, and Dynamic Hashing Techniques.
Unit 13	File Structures: External Storage Devices, Introduction to File Organization, Sequential Files, Indexed Sequential Files, Direct Files.

Unit 14	Advanced Data Structures: Introduction to Heaps, Priority Queues, Red-Black Trees, Splay Trees, Trie.
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DCA6210 - Computer Architecture	
Unit 1	Fundamentals of Computer Architecture: Computational Model, Evolution of Computer Architecture, Process and Thread, Concepts of Concurrent and Parallel Execution, Classification of Parallel Processing, Parallelism and Types of Parallelism, Levels of Parallelism.
Unit 2	Fundamentals of Computer Design: Changing Face of Computing, Computer Designer, Technology Trends, Quantitative Principles in Computer Design, Power Consumption.
Unit 3	Instruction Set Principles: Classifying instruction set architecture, Memory Addressing, Address Modes for Signal Processing, Operations in the instruction sets, Instructions for Control Flow, MIPS Architecture, and ARM Architecture.
Unit 4	Pipelined Processor: Pipelining, Types of Pipelining, Pipelining Hazards, Data Hazards, Control Hazards, Techniques to Handle Hazards, Performance Improvement Pipeline, Effects of Hazards on Performance.
Unit 5	Design Space of Pipelines: Design Space of Pipelines, Pipeline Instruction Processing, Pipelined Execution of Integer and Boolean Instructions, Pipelined Processing of Loads and Stores.
Unit 6	Instruction-Level Parallelism and its Exploitation: Dynamic Scheduling, Overcoming Data Hazards, Dynamic Scheduling Algorithm – The Tomasulo Approach, High-performance Instruction Delivery, Hardware-based Speculation.
Unit 7	Exploiting Instruction-Level Parallelism with Software Approach: Types of Branches, Branch Handling, Delayed Branching, Branch Processing, Branch Prediction, The Intel IA-64 Architecture and Itanium Processor, ILP in the Embedded and Mobile Markets, Multi-core and Many-core systems.
Unit 8	Memory Hierarchy Technology: Memory Hierarchy, Cache Addressing Modes, Mapping, Elements of Cache Design, Cache Performance, Shared Memory Organisation, Interleaved Memory Organisation, Bandwidth and Fault Tolerance, and Consistency Models.
Unit 9	Vector Processors: Use and Effectiveness of Vector Processors, Types of Vector Processing, Vector Length and Stride Issues, Compiler Effectiveness in Vector Processors, Basics of GPU, CUDA and OpenCL concepts.
Unit 10	SIMD Architecture: Parallel Processing: An Introduction, Classification of Parallel Processing, Fine-Grained SIMD Architecture, Coarse-Grained SIMD Architecture.
Unit 11	Vector Architecture and MIMD Architecture: Vectorisation, Pipelining, MIMD Architectural Concepts, Problems of Scalable Computers, Main Design Issues of Scalable MIMD Architecture, Multiprocessor Systems and Design.

Unit 12	Storage Systems: Introduction, Types of Storage Devices, Connecting I/O devices to CPU/Memory, Reliability, Availability and Dependability of Storage System, RAID, I/O Performance Measures.
Unit 13	Scalable, Multithreaded and Data Flow Architecture: Multithreading, Principles of Multithreading, Scalable and Multithreaded Architecture, Computational Models, Von Neumann- based Multithreaded Architecture, Dataflow architecture, Hybrid Multithreaded Architecture.
Unit 14	Case Study: Basic Features of Current Architectural Trends, DSP Processor, Dual Core Technology, Case Study 1: Architecture of Pentium Microprocessors, Case Study 2: Choosing A DSP Processor, Case Study 3: Tenasys Intime* RTOs Intel® Core™ Duo Processor.

	DCA62A1 - Artificial Intelligence
Unit 1	Introduction to Artificial Intelligence: Definition and history of AI, Goals and applications of AI, AI as a problem-solving tool, Ethical considerations in AI.
Unit 2	Intelligent Agents: Types of agents, Agent architecture, Problem-solving agents, Search algorithms.
Unit 3	Knowledge Representation and Reasoning: Propositional and first-order logic, Knowledge representation schemes, Inference, and resolution.
Unit 4	Machine Learning: Supervised learning, Unsupervised learning, Reinforcement learning, Neural networks, and deep learning.
Unit 5	Natural Language Processing (NLP): Syntax and semantics, Language models, NLP applications in AI, Chatbots and conversational AI.
Unit 6	Expert Systems: Expert system components, Rule-based systems, Knowledge acquisition and representation, Expert system development.
Unit 7	Fuzzy Logic and Fuzzy Systems: Fuzzy sets and operations, Fuzzy inference systems, Fuzzy logic applications, Fuzzy control systems.
Unit 8	Computer Vision: Image processing and analysis, Feature extraction, Object recognition, and Computer vision applications.
Unit 9	Planning and Decision Making: Problem-solving by search, Heuristic search algorithms, Decision making under uncertainty, Markov decision processes.
Unit 10	Robotics and Autonomous Systems: Robotics fundamentals, Robot sensors and actuators, Robot programming, Autonomous navigation, and control.
Unit 11	Natural Language Generation (NLG): NLG systems, NLG architectures, Generating coherent and context-aware text, NLG applications.
Unit 12	Reinforcement Learning: Markov decision processes (MDP), Q-learning and policy learning, Deep reinforcement learning, Applications in game playing and control systems.

Unit 13	AI in Business and Industry: AI in business strategy, Industry-specific AI applications, Case studies and success stories, Challenges, and future trends.
Unit 14	Ethical and Social Implications of AI: Bias and fairness in AI, AI and privacy, AI in healthcare and ethics, AI regulation and responsible AI development.

	DCA62C1 - Fundamentals of Cloud computing
Unit 1	Introduction to Cloud Computing: Definition and history of cloud computing, Cloud service models (IaaS, PaaS, SaaS), Cloud deployment models (Public, Private, Hybrid, Community).
Unit 2	Virtualization and Cloud Infrastructure: Virtualization principles, Hypervisors, and virtual machines, Cloud infrastructure components (compute, storage, networking).
Unit 3	Cloud Security and Privacy: Security challenges in cloud computing, Identity and access management, Data encryption and privacy in the cloud.
Unit 4	Cloud Service Providers: Major cloud service providers (e.g., AWS, Azure, Google Cloud), Service offerings and pricing models, Vendor lock-in and multi-cloud strategies.
Unit 5	Cloud Storage and Data Management: Cloud-based storage solutions (e.g., Amazon S3, Azure Blob Storage), Data backup and recovery in the cloud, and Database as a Service (DBaaS).
Unit 6	Cloud Application Development: Building and deploying applications on the cloud, Platform as a Service (PaaS) and its benefits, Containers, and container orchestration (e.g., Docker, Kubernetes).
Unit 7	Cloud Networking: Virtual Private Cloud (VPC) and network configuration, Content Delivery Networks (CDNs), and Network security in the cloud.
Unit 8	Cloud Performance and Scalability: Monitoring and optimisation in the cloud, Auto-scaling and load balancing, High availability, and disaster recovery planning.
Unit 9	Serverless Computing: Serverless architecture and benefits, AWS Lambda and Azure Functions, Building serverless applications.
Unit 10	Cloud Compliance and Governance: Regulatory compliance and legal considerations, Cloud governance and policy management, Audit, and compliance tools.
Unit 11	Cloud Migration Strategies: Assessing on-premises workloads for the cloud, Migration methodologies (re-host, re-platform, re-factor), and best practices for successful migration.
Unit 12	Cloud Economics and Cost Management: Understanding cloud cost structures, Cost management tools and techniques, Cost optimisation strategies
Unit 13	Emerging Trends in Cloud Computing: Edge computing and fog computing, Quantum computing and its impact on cloud, Ethical considerations in cloud technology

Unit 14	Legal and Regulatory Considerations in Cloud Computing: Data Protection Laws and Regulations, Intellectual Property Rights, Contractual and Service-Level Agreements (SLAs), Jurisdictional Issues and International Law.
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	DCA62S1 - Cyber Security Essentials
Unit 1	Introduction to Cybersecurity: Definition, Importance, Cyber Threat Landscape, Components of Cybersecurity.
Unit 2	Cybersecurity Concepts: Confidentiality, Integrity, Availability, Non-Repudiation, Authentication, Authorization.
Unit 3	Types of Cyber Attacks: Malware, Phishing, Man-in-the-Middle Attacks, Denial-of-Service Attacks, SQL Injection, Zero-Day Exploit.
Unit 4	Cybersecurity Threat Actors: Hackers, Insiders, Nation States, Organized Criminal Groups.
Unit 5	Cybersecurity Technologies: Firewalls, Intrusion Detection Systems, Antivirus Software, Cryptographic Techniques.
Unit 6	Secure Network Design: Network Segmentation, Demilitarized Zone, Network Access Control, Virtual Private Networks.
Unit 7	Security for Cloud and IoT: Cloud Security Considerations, IoT Security Risks, Best Practices for Securing Cloud and IoT.
Unit 8	Vulnerability Assessment and Penetration Testing: Purpose and Scope, Vulnerability Scanning, Penetration Testing Techniques.
Unit 9	Incident Response: Incident Response Plan, Incident Response Team, Phases of Incident Response (Preparation, Identification, Containment, Eradication, Recovery, Lessons Learned).
Unit 10	Cybersecurity Policies and Laws: Overview of Key Cybersecurity Policies, Cybersecurity Laws and Regulations, Ethical Issues in Cybersecurity.
Unit 11	Disaster Recovery and Business Continuity Planning: Importance of DRP and BCP, Key Elements of DRP and BCP, Testing DRP and BCP.
Unit 12	Cybersecurity Awareness and Training: Importance of User Awareness, Phishing Awareness, Security Training for IT Staff.
Unit 13	Future Trends in Cybersecurity: AI in Cybersecurity, Quantum Cryptography, Threat Intelligence.
Unit 14	Case Studies in Cybersecurity: Analysis of Major Cybersecurity Incidents, Lessons Learned, Impact on Cybersecurity Practices.

DCA62T1 - IoT Essentials	
Unit 1	Introduction to IoT: Overview of IoT, Benefits and Challenges, IoT Applications.
Unit 2	IoT System Architecture: Basic Architecture of IoT, Components of IoT Architecture, Role of IoT Devices, Servers, and Cloud in IoT.
Unit 3	Design Principles for Connected Devices: Principles for IoT Device Design, Considerations for IoT Connectivity, Device Management.
Unit 4	Design Principles for Web Connectivity for Connected Devices: Web Connectivity Considerations, IoT Protocols, RESTful IoT, MQTT.
Unit 5	Internet Connectivity Principles: Connectivity in IoT, IPv6 and IoT, Wireless Technologies for IoT, Edge Computing.
Unit 6	Data Acquisition, Organization and Analytics in IoT: Data Generation and Collection, Data Storage and Organization, IoT Analytics and Visualization.
Unit 7	Data Collection, Storage and Computing Using Cloud Platform: Role of Cloud in IoT, Cloud Storage for IoT, Cloud Computing Models for IoT.
Unit 8	Sensors and Actuators: Types of Sensors, Actuators in IoT, Role and Application of Sensors and Actuators in IoT.
Unit 9	IoT Communication Protocols: Introduction to LoRaWAN, Sigfox, NB-IoT, Z-Wave, Zigbee.
Unit 10	IoT Hardware Platforms and Edge Computing: Microcontrollers for IoT, Introduction to Raspberry Pi, Arduino, Edge Computing in IoT.
Unit 11	Gateways, Internet, and Web/Cloud Services Software Component: IoT Gateways, Web/Cloud Services for IoT, Middleware for IoT.
Unit 12	IoT Privacy, Security and Governance: Privacy Challenges in IoT, Security Issues and Solutions in IoT, Governance and Compliance in IoT.
Unit 13	Advanced IoT Concepts: Role of AI in IoT, Edge and Fog Computing, Predictive Analytics in IoT.
Unit 14	IoT Case Studies: Application of IoT in Different Domains: Smart Home, Smart Cities, Industrial IoT, Healthcare IoT.

DCA62M1 - Fundamentals of Artificial Intelligence and Problem Solving	
Unit 1	Introduction to Artificial Intelligence: What is AI? Foundations of AI, History of AI, State of the Art, Ethical Considerations in AI, Current trends in AI.
Unit 2	Intelligent Agents: Agents and environments, The concept of rationality, The nature of environments, the structure of agents, Multi-Agent Systems.

Unit 3	Solving Problems by Searching: Problem-solving agents, Toy Problems, searching for solutions, Uninformed search strategies, Avoidance of repeated states, and searching with partial Information, real-world examples (e.g., pathfinding in games).
Unit 4	Informed Search and Exploration: Heuristic Search Strategies, Heuristic Functions, Local Search Algorithms and Optimization Problems, Local Search in Continuous Spaces, Online Search Agents and Unknown Environments, and real-world Applications (e.g., resource allocation).
Unit 5	Constraint Satisfaction Problems: Definition, Backtracking search for CSPs, Local search for constraint satisfaction problems, the structure of problems
Unit 6	Adversarial Search: Games, optimal Decisions in Games, Alpha-Beta Pruning, Imperfect real-time decisions, Games that include an element of chance, State-of-the-art game programs, Monte Carlo Tree Search (MCTS), and applications in modern AI gaming (e.g., Go, Chess).
Unit 7	Knowledge and reasoning: Logical Agents, knowledge-based agents, The Wumpus World, Logic, Propositional Logic, Reasoning patterns in propositional logic, Effective propositional inference, Agents based on propositional logic.
Unit 8	First-Order Logic: Syntax and Semantics of First-Order Logic, Assertions and Queries in first-order Logic, Knowledge Engineering in First-Order Logic
Unit 9	Inference in First-Order Logic: Propositional vs First-Order Inference, Unification and Lifting, Forward Chaining, Backwards Chaining, Resolution.
Unit 10	Knowledge representation: Ontological Engineering, Categories and Objects, Actions, situations and Events, Mental Events and Mental Objects, the Internet Shopping World.
Unit 11	Learning: Forms of learning, Inductive learning, Learning Decision tree, Ensemble Learning.
Unit 12	Statistical Learning Methods: Statistical learning involves learning with complex data and hidden variables, EM algorithms, Instance-Based learning, and Neural networks.
Unit 13	Reinforcement Learning: Definition, Passive reinforcement Learning, Active reinforcement learning, generalisation in Reinforcement learning, Policy Search.
Unit 14	Case Study: Intelligent Chatbot Development, Pathfinding for Autonomous Robots, AI-Powered Game Development.

MCA Sem 3:

DCA7105 - Unix & Shell programming	
Unit 1	UNIX System Overview: Introduction to UNIX, Historical Perspective, UNIX Architecture, UNIX Variants.
Unit 2	UNIX Program and Processes: Process Structure in UNIX, Creating and Managing Processes, Process Execution, Process Termination.
Unit 3	User Identification: User Authentication in UNIX, User and Group IDs, Password Management, and Superuser (root) Access. User authentication mechanism in Unix, Account management.
Unit 4	File I/O in UNIX: File Descriptors, File Open, Read, Write, Close Operations, File Permissions, Atomic File Operations.
Unit 5	Shell Programming: Basics of Shell Programming, UNIX Shell Commands, Shell Scripts, Variables, Loops, Conditional Statements, Shell Variables and Arguments, Interactive Shell Procedures.
Unit 6	File Modification and File Sharing: File Locking and Concurrency Control, Managing File Attributes, File Sharing Mechanisms, File System Quotas.
Unit 7	Directories in UNIX: Directory Structure, Directory Access and Manipulation, Symbolic Links, File Types and Attributes.
Unit 8	Signals in UNIX: Signal Concepts, Types of Signals, Raising and Handling Signals, Signal Functions.
Unit 9	System Calls and Library Functions: Introduction to System Calls, Standard C Library Functions, Interfacing with the Kernel, Writing System Calls.
Unit 10	System Data Files and Information: Password File, Shadow Passwords, Other System Data Files, Configuration and Management.
Unit 11	Process Environment: Memory Layout of a C Program, Memory Allocation Mechanisms, setjmp and longjmp Functions, Environment Variables.
Unit 12	Process Control in UNIX: fork Function, vfork Function, Process Termination, Changing User IDs and Group IDs.
Unit 13	Process Relationships: Logins and Sessions, Process Groups, Controlling Terminals, Job Control in UNIX.
Unit 14	Error Handling: Error Handling Mechanisms, errno and perror, Error Codes and Error Messages, Error Handling Best Practices.

DCA7106 - Web Technology	
Unit 1	Introduction to Web Technology: Evolution of the World Wide Web, Internet Fundamentals, Web Standards and Consortia

Unit 2	HTML and CSS: Introduction to HTML, HTML5 Features, CSS Fundamentals, CSS3 Features.
Unit 3	JavaScript Programming: Introduction to JavaScript, Variables, Data Types, and Operators, Control Structures, Functions and Events.
Unit 4	Document Object Model (DOM): Understanding the DOM, Manipulating the DOM with JavaScript, Event Handling with DOM.
Unit 5	Responsive Web Design: Principles of Responsive Web Design, Media Queries, Flexbox and Grid Layout, CSS Frameworks (e.g., Bootstrap).
Unit 6	Web Graphics and Multimedia: Introduction to Web Graphics, Image Formats (JPEG, PNG, SVG), Video and Audio in Web Pages.
Unit 7	Web Page Layout: Box Model, Positioning Elements, Creating Layouts, Web Typography.
Unit 8	Server-Side Scripting: Introduction to Server-Side Scripting, PHP Programming, ASP.NET and C#, Python Web Frameworks.
Unit 9	Databases and Web Development: Introduction to Databases, SQL and Relational Databases, Database Connectivity in Web Applications, NoSQL Databases.
Unit 10	Web Application Security: Common Web Vulnerabilities, Authentication and Authorization, Secure Coding Practices, SSL, and HTTPS.
Unit 11	Web Services and APIs: Introduction to Web Services, RESTful Web Services, SOAP and XML-RPC, Consuming APIs in Web Applications.
Unit 12	Web Content Management Systems (CMS): Overview of CMS, WordPress, Joomla, Drupal, Creating and Managing Content, Themes and Plugins.
Unit 13	Web Hosting and Deployment: Web Hosting Options, Domain Registration and DNS, Deploying Web Applications, Cloud-Based Hosting.
Unit 14	Emerging Trends in Web Technology: Progressive Web Apps (PWAs), WebAssembly, WebVR and WebAR, Internet of Things (IoT) and the Web.

DCA7107 - Software Engineering & Project Management	
Unit 1	Introduction to Software Engineering: Introduction, Basics of Software Engineering, Principles of Software Engineering, Software Characteristics, Software Applications, Objectives of Software Engineering, Phases of S/W Engineering.
Unit 2	Software Process and Life Cycle Models: Introduction, Software Process, Project, and Product Process Assessment, Software Process Capability Maturity Model, Software Development Life Cycle Model.

Unit 3	Software Life Cycle Model 2: Prototyping Model, Object Oriented Model, Agile Model, Rapid Application Development Model, Iterative Enhancement Model, V-Model, Extreme Programming.
Unit 4	Software Requirements: Introduction, Functional Requirements, Non Functional Requirements, User Requirements, System Requirements, Software Requirements documentation.
Unit 5	Software requirements Engineering process: Introduction, Feasibility Study, Requirements Elicitation and Analysis, Requirements Validation, Software Prototyping, Requirements Management.
Unit 6	Software Reliability: Introduction, Software Reliability, Software Reliability Metrics, Programming for Reliability, Software Reuse.
Unit 7	Software Design: Basics of Software Design, Data Design, Architectural Design, Component Level Design, User Interface Design, Fundamental Design Concepts, Design Techniques.
Unit 8	Object Oriented Design: Object and Object Classes, Relationship, Object Oriented Design Process, Object Identification, Design Models.
Unit 9	Software implementation: Structured Coding Techniques, Coding Styles, Coding Methodology Code Verification Techniques, Coding Tools, Coding Documentation, Coding Standards and Guidelines.
Unit 10	Software Maintenance: Software Re-engineering, Change Management, Configuration Management, Software Maintenance Tools, and Techniques.
Unit 11	Software Testing Strategies: A Strategic Approach to Software Testing, Testing Strategies for Convention Software, Black-Box Testing, White Box Testing, Validation Testing, System Testing, Debugging.
Unit 12	Software Metrics: Software Quality Metrics, Metrics for Analysis Models, Metrics for Design Model, Metrics for Source Code, Metrics for Testing, Metrics for Software Maintenance.
Unit 13	Quality Management: Introduction, Quality Concepts, Software Quality Assurance, Software Reviews, Formal Technical Reviews, The ISO 9000 Quality Standards.
Unit 14	Software Project Management: Project Planning, Project Scheduling, Project Staffing, People Capability Maturity Model(P-CMM).

DCA71A5 - Categorical Data Analysis and Generalized Linear Models	
Unit 1	Fundamentals of Categorical Data in AI & DS: Categorical data types, Ordinal vs. nominal data, Importance in AI/DS, Challenges in handling categorical data
Unit 2	Data Summarization and Visualization Techniques: Frequency tables and cross-tabulations, Visualization methods, Data exploration techniques

Unit 3	Handling Imbalanced Categorical Data: Challenges with imbalanced datasets, Techniques for handling imbalances, Overview of sampling techniques (SMOTE, oversampling, Under sampling) , Applications in fraud detection and anomaly detection.
Unit 4	Feature Engineering for Categorical Variables: One-hot encoding and embeddings, Interaction terms in predictive modelling, Role in AI pipelines
Unit 5	Introduction to Generalized Linear Models (GLMs): GLM concepts: Link functions and error structures, Types of response variables, Applications in AI and DS
Unit 6	Logistic Regression for Categorical Data: Binary logistic regression: Odds and log-odds, Applications in classification, Advantages and limitations
Unit 7	Multinomial Logistic Regression: Concepts of multinomial logistic regression, Applications in sentiment analysis and text categorization, Comparison with binary logistic regression
Unit 8	Poisson Regression for Count Data: Concept and assumptions, Predicting event counts, Limitations of Poisson models
Unit 9	Extensions of Generalized Linear Models: Negative binomial regression, Zero-inflated Poisson models, Advanced GLMs
Unit 10	Statistical Assumptions and Limitations: Common statistical assumptions, Diagnosing and addressing limitations, Real-world challenges and solutions
Unit 11	Model Diagnostics and Evaluation: Model evaluation metrics, Likelihood ratio tests and residual analysis, Challenges in evaluating GLMs
Unit 12	Applications in Text and Image Categorizations: Text classification, Image annotation and tagging, Case studies.
Unit 13	Advanced Categorical Data Applications: Recommendation systems, Predictive modeling in healthcare and e-commerce, Emerging trends in categorical data
Unit 14	Tools for Interpretability and Fairness: SHAP and LIME overview, Bias detection and mitigation, Ethical considerations
Unit 15	Future Directions and Case Studies: Trends in GLMs and categorical data analysis, Case studies in AI/DS, Open research areas

DCA71C5 - Cloud Architecture and Services	
Unit 1	Introduction to Cloud Computing: Definition and Concepts of Cloud Computing, Evolution of Cloud Computing, Cloud Service Models (IaaS, PaaS, SaaS), Deployment Models (Public, Private, Hybrid, Community).
Unit 2	Virtualisation and Cloud Infrastructure: Virtualization Technologies, Hypervisors and Virtual Machines, Cloud Data Centres and Infrastructure, Scalability and Elasticity in the Cloud.
Unit 3	Cloud Storage and Databases: Cloud Storage Models, Object Storage (e.g., Amazon S3), Cloud Databases (e.g., AWS RDS, Google Cloud SQL), Data Backup and Recovery in the Cloud.
Unit 4	Cloud Networking and Security: Cloud Network Fundamentals, Virtual Private Cloud (VPC), Security in the Cloud, Identity and Access Management (IAM).
Unit 5	Cloud Service Models and Providers: IaaS, PaaS, and SaaS in Detail, Leading Cloud Service Providers (e.g., AWS, Azure, Google Cloud), Evaluating Cloud Providers.
Unit 6	Cloud Deployment and Management Tools: Cloud Orchestration Tools (e.g., AWS CloudFormation), Infrastructure as Code (IaC), Cloud Management Platforms, Monitoring and Performance Tuning.
Unit 7	Cloud Application Development: Building and Deploying Cloud Applications, Serverless Computing, Microservices Architecture, Containers and Container Orchestration (e.g., Docker, Kubernetes).
Unit 8	Cloud Migration and Integration: Cloud Migration Strategies, Legacy System Integration with the Cloud, Challenges and Best Practices.
Unit 9	Cloud Security and Compliance: Cloud Security Challenges, Compliance and Regulations, Security as a Shared Responsibility, Cloud Security Best Practices.
Unit 10	Cloud Cost Management: Cloud Cost Structure, Cost Estimation and Budgeting, Cost Optimization Strategies, Billing and Pricing Models.
Unit 11	High Availability and Disaster Recovery: Ensuring High Availability in the Cloud, Disaster Recovery Strategies, Backup and Restore in the Cloud.
Unit 12	Big Data and Analytics in the Cloud: Big Data Concepts, Cloud-Based Data Analytics, Machine Learning and AI Services, Data Warehousing in the Cloud.
Unit 13	Cloud Governance and Best Practices: Cloud Governance Frameworks, Best Practices for Cloud Adoption, Risk Management in the Cloud.
Unit 14	Future Trends in Cloud Computing: Emerging Technologies and Trends, Edge Computing, Quantum Computing and Cloud, Green Computing in the Cloud.

DCA71S5 - Cyber Laws and Ethics	
Unit 1	Introduction to Cyber Laws and Ethics: Definition and Scope of Cyber Laws, Historical Perspective of Cyber Laws, Importance and Relevance in the Digital Age/Cyberspace, Role of Ethics in Cyberspace.
Unit 2	Fundamentals of Jurisprudence: Basic Legal Concepts and Terminology, Jurisdictional Issues in Cyberspace, Sources of Cyber Law.
Unit 3	Digital Signatures and Electronic Authentication: Concepts and Applications, Regulatory Framework and Standards, Digital Signature Certificate Authorities.
Unit 4	Intellectual Property Rights (IPR) in Cyberspace: Introduction to IPR, Copyright Issues in Digital Content, Trademarks and Domain Names, Patents in the Software Domain.
Unit 5	Cyber Crimes and Frauds: Types of Cyber Crimes, Hacking, Phishing, Digital Frauds, Cyberstalking and Cyberbullying, Legal Remedies and Reporting Mechanisms.
Unit 6	Data Protection and Privacy: Personal Data and Sensitive Personal Data, Data Protection Legislations Globally, Rights of Data Subjects, Data Breach Notification and Penalties.
Unit 7	E-commerce and Legal Aspects: E-contracts and Their Validity, Consumer Protection in E-commerce, Online Dispute Resolution Mechanisms, and Taxation Issues in E-commerce.
Unit 8	Cyber Ethics and Netiquette: Defining Cyber Ethics, Code of Conduct in Online Communities, Plagiarism and Content Sharing Ethics, Digital Rights and Responsibilities.
Unit 9	Digital Forensics and Evidence: Basics of Digital Forensics, Collection and Preservation of Digital Evidence, Legal Considerations in Digital Investigations, Role of Forensic Experts in Litigations.
Unit 10	Cyber Laws in Different Jurisdictions: Cyber Laws in the USA, EU, and Asia, Comparative Analysis of Different Legislations, International Collaboration and Treaties, Challenges in Cross-Border Cyber Crimes.
Unit 11	IT Act and Amendments: Overview of the IT Act (Specific to the country in context, e.g., IT Act 2000 for India), Provisions and Penalties, Case Studies and Landmark Judgments, Criticisms and Areas of Improvement.
Unit 12	Ethical Hacking and Legal Implications: Definition and Importance of Ethical Hacking, Legal Rights and Boundaries of Ethical Hackers, Licensing and Certification, Case Studies: Ethical Hacking Gone Wrong.
Unit 13	Future of Cyber Laws and Ethics: Emerging Technologies and Legal Challenges, Artificial Intelligence, IoT, Legal Implications, Predictive Policing and Ethics, Future Amendments and Predicted Evolution.
Unit 14	Case Studies and Legal Precedents: Analysing Cyber Law Cases, Legal Precedents, and Implications, Lessons Learned.

DCA71T5 - Data Mining techniques	
Unit 1	Introduction to Data Mining: Overview of Data Mining, History and Evolution, Data Mining Process, Applications of Data Mining.
Unit 2	Data Preprocessing: Data Cleaning, Data Integration, Data Transformation, Data Reduction.
Unit 3	Exploratory Data Analysis (EDA): Descriptive Statistics, Data Visualization Techniques, Correlation Analysis, Outlier Detection.
Unit 4	Classification Techniques: Decision Trees, Naive Bayes Classifier, k-nearest Neighbors (k-NN), Support Vector Machines (SVM).
Unit 5	Regression Analysis: Linear Regression, Polynomial Regression, Multiple Regression, Evaluation Metrics for Regression Models.
Unit 6	Clustering Techniques: K-Means Clustering, Hierarchical Clustering, Density-Based Clustering, Evaluation Metrics for Clustering.
Unit 7	Association Rule Mining: Apriori Algorithm, FP-Growth Algorithm, Rule Generation, Evaluation Metrics for Association Rules.
Unit 8	Sequential Pattern Mining: Sequence Database Representation, GSP Algorithm, SPADE Algorithm, Applications of Sequential Pattern Mining.
Unit 9	Text Mining: Text Preprocessing, Term Frequency-Inverse Document Frequency (TF-IDF), Text Classification, Topic Modeling (e.g., Latent Dirichlet Allocation).
Unit 10	Web Mining: Web Content Mining, Web Structure Mining, Web Usage Mining, Challenges and Opportunities in Web Mining.
Unit 11	Social Media Mining: Social Network Analysis, Sentiment Analysis, Community Detection, Virality and Influence Analysis.
Unit 12	Ensemble Learning Techniques: Bagging, Boosting, Random Forest, Ensemble Model Evaluation.
Unit 13	Dimensionality Reduction Techniques: Principal Component Analysis (PCA), Singular Value Decomposition (SVD), t-distributed Stochastic Neighbor Embedding (t-SNE), and Applications of Dimensionality Reduction.
Unit 14	Big Data Analytics and Data Mining: Introduction to Big Data, Challenges in Big Data Analytics, Distributed Data Mining Techniques, Case Studies in Big Data Analytics.

DCA71M5 - Introduction to Machine Learning	
Unit 1	Introduction to Machine Learning: Definition and Importance of Machine Learning, Machine Learning Applications, Types of Machine Learning, Historical Developments
Unit 2	Data Preprocessing: Data Collection and Integration, Data Cleaning and Transformation, Handling Missing Data, Feature Engineering and Selection
Unit 3	Supervised Learning: Classification and Regression, Decision Trees and Random Forests, Support Vector Machines, k-Nearest Neighbours, Linear and Logistic Regression

Unit 4	Unsupervised Learning: Clustering Algorithms (e.g., K-Means, Hierarchical), Dimensionality Reduction (e.g., PCA), Association Rule Mining, Outlier Detection
Unit 5	Model Evaluation and Selection: Cross-Validation Techniques, Bias-Variance Trade-off, Metrics (e.g., Accuracy, Precision, Recall, F1-Score), Hyperparameter Tuning
Unit 6	Neural Networks and Deep Learning: Introduction to Neural Networks, Feedforward and Backpropagation, Deep Learning Architectures (e.g., CNN, RNN), TensorFlow and Keras
Unit 7	Reinforcement Learning: Basics of Reinforcement Learning, Markov Decision Processes, Q-Learning and Policy Gradient Methods, Applications in Gaming and Robotics
Unit 8	Natural Language Processing (NLP): Text Preprocessing, Text Classification, Named Entity Recognition, Sentiment Analysis
Unit 9	Recommender Systems: Collaborative Filtering, Content-Based Filtering, Hybrid Recommender Systems, Recommendation Algorithms
Unit 10	Anomaly Detection: Anomaly Detection Techniques, Applications (e.g., Fraud Detection, Intrusion Detection), Evaluation and Metrics
Unit 11	Machine Learning in Big Data: Challenges of Big Data, Distributed Computing and MapReduce, Hadoop and Spark for Machine Learning, Scalable ML Algorithms
Unit 12	Ethical and Legal Aspects of Machine Learning: Bias and Fairness in Machine Learning, Privacy and Security Concerns, Regulatory Compliance (e.g., GDPR), Responsible AI
Unit 13	Real-world Machine Learning Applications: Case Studies in Healthcare, Finance, Marketing.
Unit 14	Industry Use Cases: Challenges and Success Stories

DCA71A6 - Deep Learning and Text Mining	
Unit 1	Introduction to Deep Learning and Text Mining: Overview of deep learning concepts, an introduction to text mining and its applications, Challenges in processing textual data
Unit 2	Neural Networks and Deep Learning Basics: Perceptrons and multilayer perceptrons (MLPs), Activation functions and backpropagation, Introduction to deep neural networks, Foundations of Neural Network Training
Unit 3	Text Preprocessing Techniques: Tokenization, stemming, and lemmatization, Stopword removal and handling special characters, Ngrams and feature selection for textual data
Unit 4	Word Embeddings and Text Representation: Bagofwords and TFIDF, Word2Vec and GloVe embeddings, Contextual embeddings (e.g., BERT, ELMo conceptual)
Unit 5	Sequence Models and RNNs: Basics of RNNs and vanishing gradient problem, Challenges in Sequence Modeling, LSTM and GRU, Applications of RNNs in text data

Unit 6	CNNs for Text: CNN architecture and its adaptation for text, Feature extraction in text data using CNNs, Use cases in sentiment analysis and document classification
Unit 7	Attention Mechanisms and Transformers: Introduction to attention mechanisms, Selfattention and Transformer architecture, Conceptual overview of models: BERT, GPT, T5, Advanced Applications of Transformers
Unit 8	Text Classification Techniques: Overview of text classification tasks, Deep learning based classification approaches, Challenges in multiclass and multilabel classification
Unit 9	Sentiment Analysis and Opinion Mining: Theoretical overview of sentiment analysis, Sentiment analysis using deep learning models, Applications in business and social media analytics
Unit 10	Named Entity Recognition (NER) and Topic Modeling: Overview of NER and its applications, Latent Dirichlet Allocation (LDA) for topic modelling, Case studies in news categorization and information extraction
Unit 11	Text Summarization Techniques: Extractive summarization concepts, Abstractive summarization with deep learning, Use cases in summarizing longform text and news articles
Unit 12	Ethics and Fairness in Text Mining: Bias and fairness in NLP models, Ethical challenges in text data processing, Guidelines for responsible text mining, Navigating Ethical Pitfalls in Text Mining
Unit 13	Performance Metrics and Model Evaluation: Precision, recall, F1score, and confusion matrix, Frameworks for NLP Model Evaluation, BLEU and ROUGE scores for text generation, Challenges in evaluating NLP models
Unit 14	Deep Generative Models for Text: Variational Autoencoders (VAEs) for text, Generative Adversarial Networks (GANs) for text, Applications in text synthesis and paraphrasing, Emerging Use Cases in Generative Text Modeling
Unit 15	Future Trends and Applications in Deep Learning and Text Mining: Emerging models and frameworks (e.g., ChatGPT, BERT advancements), Applications in healthcare, legal tech, and education, Open research problems, Interdisciplinary Advances in Text Mining Applications

DCA71C6 - Google Cloud Essentials	
Unit 1	Introduction to Cloud Computing: Understanding Cloud Computing, Cloud Service Models (IaaS, PaaS, SaaS), Cloud Deployment Models (Public, Private, Hybrid), Benefits and Challenges of Cloud Computing.
Unit 2	Google Cloud Platform Overview: Introduction to Google Cloud, GCP Services and Products, GCP Regions and Zones, Billing and Pricing Models.
Unit 3	Setting Up a Google Cloud Environment: Creating a GCP Account, GCP Console and CLI, Managing Identity and Access Management (IAM), Billing and Cost Management.
Unit 4	Google Compute Engine: Virtual Machines on GCP, Creating and Managing VM Instances, Customizing VMs, Preemptible VMs.

Unit 5	Google Cloud Storage: Google Cloud Storage Classes, Uploading and Managing Data, Access Control and Permissions, Data Transfer Options.
Unit 6	Google Kubernetes Engine (GKE): Introduction to Containers and Kubernetes, Deploying and Managing Applications with GKE, Scaling and Load Balancing, Continuous Integration and Deployment (CI/CD) with GKE.
Unit 7	Google App Engine: Platform as a Service (PaaS) with App Engine, Building and Deploying Web Applications, Scaling and Monitoring, App Engine Services and APIs.
Unit 8	Google Cloud Functions: Serverless computing with cloud functions, creating event-driven functions, triggering functions with cloud pub/sub, and monitoring and debugging functions.
Unit 9	Google Cloud Databases: Google Cloud SQL (MySQL and PostgreSQL), Google Cloud Fire store, Datastore and NoSQL Databases, Data Backup and Recovery.
Unit 10	Google Cloud Networking: Virtual Private Cloud (VPC), Network Security and Firewall Rules, Load Balancers and CDN, Network Monitoring and Troubleshooting.
Unit 11	Big Data and Machine Learning on GCP: Introduction to Big Data on GCP, Google Cloud Big Query, Machine Learning with GCP AI and ML APIs, Data Analysis and Visualization.
Unit 12	Identity and Security on Google Cloud: Identity and Access Management (IAM) in Depth, Security Best Practices, Data Encryption and Compliance, Managing Security Incidents.
Unit 13	Monitoring and Operations: Google Cloud Monitoring and Logging, Error Reporting and Debugging, Stack driver and Trace, Automating Operations with Google Cloud Deployment Manager.
Unit 14	Google Cloud Governance and Compliance: Overview of Governance in Google Cloud, Compliance and Regulatory Considerations, Resource Organization and Naming Conventions, Policies, Budgets, and Cost Controls.

DCA71S6 - Ethical Hacking	
Unit 1	Introduction to Ethical Hacking: What is Ethical Hacking? Differentiating Ethical Hacking from Unethical Hacking, Scope, and Significance of Ethical Hacking, Legal and Ethical Aspects of Hacking.
Unit 2	Information Security Fundamentals: Information Security Concepts, The CIA Triad: Confidentiality, Integrity, Availability, Security Policies and Procedures, Risk Management in Ethical Hacking.
Unit 3	Footprinting and Reconnaissance: Footprinting Concepts, Information Gathering Techniques, DNS Interrogation, Enumeration and Banner Grabbing.
Unit 4	Scanning Networks: Port Scanning Techniques, Vulnerability Scanning, Network Mapping, Countermeasures and Detection.
Unit 5	Enumeration and System Hacking: Enumeration Techniques, Exploiting Vulnerabilities, Privilege Escalation, Password Cracking and Password Policies.

Unit 6	Malware Threats and Defense: Types of Malware (Viruses, Worms, Trojans, Spyware, etc.), Malware Analysis and Detection, Anti-Malware Tools and Techniques, and Best Practices for Malware Prevention.
Unit 7	Sniffing and Network Traffic Analysis: Sniffing Concepts, ARP Poisoning and DNS Spoofing, Sniffing Tools and Detection, Network Packet Analysis.
Unit 8	Social Engineering: Social Engineering Techniques, Phishing, Pretexting, and Baiting, Social Engineering Countermeasures, Educating Users.
Unit 9	Denial of Service (DoS) and Distributed Denial of Service (DDoS) Attacks: DoS and DDoS Concepts, Attack Methods and Tools, DoS Prevention and Mitigation.
Unit 10	Web Application Security: Common Web Application Vulnerabilities, SQL Injection, Cross-Site Scripting (XSS), CSRF, Web Application Scanning and Testing, and Security Best Practices for Web Apps.
Unit 11	Wireless Network Security: Wireless Networking Concepts, Wi-Fi Security (WEP, WPA, WPA2, WPA3), Cracking Wi-Fi Passwords, Wireless Intrusion Detection.
Unit 12	Evading IDS, Firewalls, and Honeypots: Intrusion Detection Systems (IDS) and Evasion Techniques, Firewall Evasion, Honeypots and HoneyNet Concepts, Techniques for Evasion Detection.
Unit 13	Cloud Security and IoT Security: Security Challenges in Cloud Computing, IoT Security Risks and Mitigations, Securing Data in the Cloud and IoT Devices, IoT Penetration Testing.
Unit 14	Penetration Testing and Reporting: The penetration testing process, reporting and documentation, ethics and responsibility, and disclosure.

DCA71T6 - Blockchain Technologies	
Unit 1	Introduction to Blockchain Technology: Overview of distributed ledger technology, Historical context, and evolution of blockchain, Understanding the fundamentals of blockchain architecture.
Unit 2	Cryptographic Principles: Basics of cryptography: encryption, hashing, digital signatures, Cryptographic algorithms used in blockchain: SHA-256, ECDSA, etc. Importance of cryptographic techniques in ensuring security in blockchain.
Unit 3	Blockchain Data Structures: Data structure of blocks and transactions, Merkle trees and their role in maintaining integrity, Consensus mechanisms: Proof of Work (PoW), Proof of Stake (PoS), Practical Byzantine Fault Tolerance (PBFT).
Unit 4	Smart Contracts: Introduction to smart contracts and their significance, Programming smart contracts using Solidity, Ethereum Virtual Machine (EVM) and execution environment for smart contracts.
Unit 5	Decentralised Applications (DApps): Characteristics of DApps, Developing decentralised applications on blockchain platforms, Case studies of popular DApps and their use cases.
Unit 6	Blockchain Platforms: Overview of different blockchain platforms: Ethereum, Hyperledger, Corda, etc. Comparative analysis of blockchain platforms based on scalability, security, and consensus mechanisms.

Unit 7	Permissioned vs. Permissionless Blockchains: Understanding the difference between permissioned and permissionless blockchains, Use cases and advantages of each type of blockchain, and Implementation considerations for permissioned and permissionless blockchain networks.
Unit 8	Blockchain Security: Common security threats in blockchain systems, Securing blockchain networks: cryptographic techniques, key management, and secure coding practices, Case studies of major security breaches and their impact on blockchain ecosystems.
Unit 9	Scalability and Performance: Scalability challenges in blockchain networks, Techniques for improving blockchain scalability: sharding, off-chain transactions, sidechains, performance metrics and benchmarks for evaluating blockchain networks.
Unit 10	Regulatory and Legal Aspects: Legal implications of blockchain technology: data privacy, intellectual property rights, jurisdictional issues, Compliance with regulatory frameworks: GDPR, KYC/AML regulations, securities laws, Government initiatives and policies related to blockchain adoption.
Unit 11	Blockchain Use Cases: Real-world applications of blockchain across various industries: finance, supply chain, healthcare, etc. Case studies of successful blockchain implementations and their impact, Identifying potential use cases and opportunities for blockchain adoption.
Unit 12	Interoperability and Standards: Challenges of interoperability between different blockchain networks, Interoperability protocols and standards: Interledger Protocol (ILP), Atomic Swaps, etc. Efforts to standardise blockchain technology and promote interoperability.
Unit 13	Blockchain Governance: Governance models for blockchain networks: on-chain governance, off-chain governance, hybrid models, the role of stakeholders in decision-making processes, Address governance challenges such as decentralisation, scalability, and protocol upgrades.
Unit 14	Future Trends in Blockchain: Emerging trends and innovations in blockchain technology, Predictions for the future of blockchain: scalability solutions, integration with emerging technologies (IoT, AI, etc.), regulatory developments.

	DCA71M6- Fundamentals of Unsupervised Learning
Unit 1	Introduction to Unsupervised Learning: Definition and scope, Comparison between supervised, unsupervised, and semi-supervised learning, Key challenges in unsupervised learning, Applications, Role of unsupervised learning in modern AI systems.
Unit 2	Mathematical Foundations for Unsupervised Learning: Basics of linear algebra, Probability concepts, Statistical measures, Distance metrics, Importance of similarity and dissimilarity measures.
Unit 3	Clustering: Fundamental principles of clustering and grouping, Objective of clustering, Types of clustering, Key applications, Challenges of clustering.
Unit 4	Partition-Based Clustering: K-Means clustering, Variations of K-Means, Strengths and limitations of partition-based methods, Theoretical metrics for cluster evaluation.
Unit 5	Density-Based and Hierarchical Clustering: Density-based clustering - DBSCAN and OPTICS, Hierarchical clustering, Dendrograms, Linkage criteria, Applications.

Unit 6	Fuzzy and Constraint-Based Clustering: Fuzzy clustering, Constraint-based clustering, Comparison of fuzzy clustering with traditional clustering methods, Applications in uncertain data analysis and recommendation systems.
Unit 7	Dimensionality Reduction: Importance of dimensionality reduction, Principal Component Analysis (PCA), Singular Value Decomposition (SVD), Comparison between PCA, SVD, and Applications in data visualisation and feature selection.
Unit 8	Association Rule Mining: Basic concepts of association rules, Apriori algorithm, FP-Growth algorithm, Applications in market basket analysis and recommendation systems, Limitations of rule-based approaches.
Unit 9	Matrix Factorization and Collaborative Filtering: Concepts of matrix factorisation for unsupervised learning, Singular Value Decomposition (SVD) for latent feature extraction, Non-negative Matrix Factorization (NMF): Applications in collaborative filtering, Role of matrix factorisation in recommendation systems and topic modelling, Theoretical challenges: Sparsity, scalability, and overfitting.
Unit 10	Probabilistic Models and Gaussian Mixture Models: Probabilistic clustering, Gaussian Mixture Models, Expectation-Maximization (EM) algorithm, Use cases: Density estimation, customer behaviour analysis.
Unit 11	Anomaly Detection and Outlier Analysis: Definition, Statistical approaches, Techniques for unsupervised anomaly detection, Applications, challenges in anomaly detection
Unit 12	Clustering in High-Dimensional Data: Challenges of clustering in high-dimensional spaces, Subspace clustering, Spectral clustering, Applications, Evaluation metrics - high-dimensional data clustering.
Unit 13	Ethics and Bias in Unsupervised Learning: Ethical challenges in unsupervised learning models, Data bias in clustering and dimensionality reduction techniques, Impact of biased outcomes, Methods to mitigate bias, Importance of explainability in unsupervised models
Unit 14	Case Study: Clustering and Segmentation in Marketing, Anomaly Detection in Cybersecurity, Dimensionality Reduction in Healthcare Data.

MCA Sem 4:

DCA7201 - Mobile Application Development	
Unit 1	Introduction to Mobile Operating Systems: Overview of Mobile Operating Systems, Design Principles of Mobile OS, Structure of Mobile Operating Systems, Mobile OS Platforms and Features.
Unit 2	Comparing Mobile OS to Traditional OS: Key Differences between Mobile and Desktop OS, Mobile Hardware Constraints, Mobile Software Ecosystem.
Unit 3	Application Lifecycle in Android: Android Application Components, Activity, Service, Broadcast Receiver, Content Provider, Application States and Transitions.

Unit 4	Microkernel Design in Mobile Operating Systems: Micro Kernel Concepts, Advantages in Mobile OS, Case Study: Android Kernel.
Unit 5	Development Framework for Android: Introduction to Android Development, Dalvik Virtual Machine, Android Studio IDE, Android Virtual Device and SDK Manager.
Unit 6	Android Architecture and OOPs: Android Stack Layers, Object-Oriented Programming in Android, Java vs. Android Java.
Unit 7	Activity Lifecycle: Understanding Android Activities, Activity States and Transitions, Handling Configuration Changes.
Unit 8	Introduction to Application Manifest: Structure and Purpose of Android Manifest, Declaring Permissions and Components, Manifest File Elements.
Unit 9	Android Layouts: UI Layout Design in Android, XML Layout Resources, Common Layout Types.
Unit 10	Android Menus: Creating and Handling Android Menus, Options Menu and Context Menu, Menu Resources.
Unit 11	Inter-Process Communication: IPC Mechanisms in Android, Intents and Broadcasts, Content Providers for Data Sharing.
Unit 12	Multithreading in Android: Importance of Multithreading, Android's UI Thread and Worker Threads, Synchronization and Thread Management.
Unit 13	Data Handling and Storage: JSON Parsing, SQLite Database Basics, SQLite Data Types, Cursors, and Content Values, Using SQLite Open Helper, Adding, Updating, and Deleting Content.
Unit 14	Android Device Features and Sensors: Utilizing Android Sensors, Camera Operations in Android, Wi-Fi Connectivity and Features, and Developing Applications with Device Features.

DCA72A7 - Applied Data Analytics	
Unit 1	Introduction to Applied Data Analytics: Definition and scope of applied data analytics, Historical evolution of data analytics and its role in decision-making, Role of data analytics in decision making Overview of the data analytics lifecycle
Unit 2	Statistical Foundations for Data Analytics: Overview of inferential statistics, Hypothesis testing concepts (ttests, chisquare tests), Analysis of variance (ANOVA), Central limit theorem and its significance in data analysis.
Unit 3	Exploratory Data Analysis (EDA): Descriptive statistics for data summarization, Visualization techniques: histograms, box plots, scatter plots, Using correlation matrices and pair plots to identify relationships between variables, Identifying patterns and outliers
Unit 4	Data Preparation and Cleaning: Introduction to data profiling and exploratory checks, Importance of data preprocessing, Handling missing, inconsistent, and noisy data, Overview of data transformation and normalization

Unit 5	Supervised Learning Techniques: Overview of regression models (linear and logistic regression), Introduction to ensemble methods like boosting and bagging, Decision trees and random forests, Evaluation metrics for regression and classification models
Unit 6	Unsupervised Learning Techniques: Clustering techniques (KMeans, hierarchical clustering), Dimensionality reduction using PCA, Evaluation metrics for clustering, such as silhouette score
Unit 7	Time Series Analysis: Basics of time series data, Overview of advanced forecasting tools like Prophet, Moving averages and exponential smoothing, Introduction to ARIMA models
Unit 8	Big Data Analytics: Characteristics of big data (volume, velocity, variety), Overview of big data technologies: Hadoop and Spark, Practical applications of big data analytics in IoT and e-commerce, Challenges and opportunities in big data analytics
Unit 9	Applied Text Analytics: Overview of text analytics and NLP, Overview of pre-trained NLP models like BERT and GPT, Sentiment analysis and topic modeling applications, Text summarization techniques
Unit 10	Data Visualization and Storytelling: Principles of effective data visualization, Choosing the right visualization tools, Storytelling with data for actionable insights, Cognitive biases to avoid when interpreting visual data
Unit 11	Data Driven Decision Making: Framework for data driven decision making, Role of analytics in business intelligence, Case studies: Marketing and operations analytics
Unit 12	Applied Analytics in Healthcare: Role of data analytics in healthcare systems, Use cases: Patient management and resource allocation, Ethical concerns in healthcare data analytics, Regulatory considerations and ethical issues in healthcare analytics
Unit 13	Applied Analytics in Finance: Applications in fraud detection and risk assessment, Portfolio management and market analysis, Applications of blockchain and cryptocurrency analytics, Trends and challenges in financial analytics
Unit 14	Advanced Analytics Techniques: Overview of predictive analytics, Prescriptive analytics and optimization techniques, Emerging trends in advanced analytics, Emerging trends in AutoML and its implications
Unit 15	Future Directions in Data Analytics: Emerging trends in applied data analytics, Emerging focus on explainable AI (XAI) and sustainability analytics, Challenges in scaling analytics solutions, Open research areas in applied analytics

DCA72C7 - Cloud Application Development	
Unit 1	Introduction to Cloud Computing: Understanding Cloud Computing, Cloud Service Models (IaaS, PaaS, SaaS), Cloud Deployment Models (Public, Private, Hybrid), Benefits and Challenges of Cloud Computing
Unit 2	Cloud Service Providers and Platforms: Overview of Leading Cloud Service Providers (e.g., AWS, Azure, Google Cloud), Choosing the Right Cloud Platform, Accessing and Managing Cloud Services.

Unit 3	Cloud Development Tools and Environments: Introduction to Cloud Development Tools, Setting up Development Environments, Version Control, and Continuous Integration in the Cloud.
Unit 4	Building and Deploying Cloud Applications: Cloud Application Development Lifecycle, Designing Scalable and Resilient Cloud Applications, Deploying Applications to the Cloud.
Unit 5	Cloud Application Architecture: Microservices Architecture, Serverless Computing, Designing for High Availability and Load Balancing.
Unit 6	Cloud Database Services: Database Options in the Cloud, Working with Cloud Databases, Data Security and Management in the Cloud.
Unit 7	Cloud Storage and Content Delivery: Cloud Storage Services, Managing Data in the Cloud, Content Delivery Networks (CDN).
Unit 8	Security and Compliance in the Cloud: Cloud Security Best Practices, Identity and Access Management (IAM), Compliance and Data Privacy in the Cloud.
Unit 9	Cloud Monitoring and Management: Cloud Resource Monitoring and Optimization, Cost Management and Billing, Cloud Governance and Policies.
Unit 10	Serverless Computing and Function as a Service (FaaS): Introduction to Serverless Computing, AWS Lambda, Azure Functions, and Google Cloud Functions, Building Serverless Applications.
Unit 11	Cloud Application Integration: Integrating Cloud Services and APIs, Event-Driven Architectures, and Messaging Services in the Cloud.
Unit 12	DevOps in the Cloud: DevOps Practices in Cloud Development, Continuous Delivery and Deployment, Infrastructure as Code (IaC).
Unit 13	Cloud Security and Compliance: Cloud Security Challenges, Secure Development Practices, Compliance Frameworks in the Cloud.
Unit 14	Emerging Trends and Future of Cloud Application Development: Edge Computing and Fog Computing, Quantum Computing and Cloud, Future Directions in Cloud Application Development.

DCA72S7 - Cryptography and Network Security	
Unit 1	Introduction to Cryptography and Network Security: Overview of Cryptography, The Role of Network Security, Historical Perspective, Security Goals and Services.
Unit 2	Classical Encryption Techniques: Caesar Cipher, Vigenère Cipher, Substitution Ciphers, Transposition Ciphers.
Unit 3	Modern Symmetric Key Encryption: Data Encryption Standard (DES), Advanced Encryption Standard (AES), Block Cipher Modes of Operation, Stream Ciphers.
Unit 4	Public Key Cryptography: RSA Algorithm, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography, Public Key Infrastructure (PKI).

Unit 5	Cryptographic Hash Functions: Hash Functions and Properties, Secure Hash Algorithm (SHA), Message Authentication Codes (MACs), Digital Signatures.
Unit 6	Network Security Essentials: Network Threats and Vulnerabilities, Security Policies and Procedures, Network Security Controls, Security Models.
Unit 7	Security in the OSI Model: Security in Data Link and Network Layers, Transport Layer Security (TLS/SSL), Security in the Application Layer, and Virtual Private Networks (VPNs).
Unit 8	Wireless Network Security: Wi-Fi Security, WPA and WPA2, 802.11i (WPA3), Wireless Intrusion Detection.
Unit 9	Network Access Control: Authentication Methods, Access Control Models, RADIUS and TACACS+, 802.1X Authentication.
Unit 10	Intrusion Detection and Prevention Systems (IDPS): IDS and IPS Concepts, Signature-Based and Anomaly-Based Detection, Firewalls and Proxy Servers, and Honeypots.
Unit 11	Virtual Private Networks (VPNs): VPN Concepts and Types, IPsec and VPN Protocols, VPN Implementations, VPN Security.
Unit 12	Web Security: Web Threats and Attacks, Secure Web Development, Web Application Firewalls, Cross-Site Scripting (XSS) and SQL Injection.
Unit 13	Secure Electronic Transactions: E-commerce Security, Payment Card Industry Data Security Standard (PCI DSS), Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Online Payment Methods
Unit 14	Emerging Trends in Cryptography and Network Security: Quantum Cryptography, Blockchain and Security, IoT Security Challenges, Future of Cryptography and Network Security.

DCA72T7 - Big Data Analytics and Business Intelligence	
Unit 1	Introduction to Big Data and Business Intelligence: Understanding Big Data and its Challenges, Basics of Business Intelligence, Importance and Applications in Modern Enterprises.
Unit 2	Big Data Technologies: Hadoop Ecosystem, HDFS and MapReduce, Distributed File Systems, NoSQL Databases.
Unit 3	Data Warehousing and ETL: Data Warehousing Concepts, Extract, Transform, Load (ETL) Processes, Data Integration and Transformation.
Unit 4	Data Analytics and Data Mining: Basics of Data Analytics, Data Mining Techniques, Predictive Analytics, Clustering and Classification.
Unit 5	Business Intelligence Tools: Overview of BI Tools, Reporting and Dashboarding, OLAP and Data Visualization, BI for Decision Support.
Unit 6	Data Exploration and Visualization: Exploratory Data Analysis, Data Visualization Techniques, and Tools like Tableau and Power BI.

Unit 7	Big Data Storage and Processing: Data Storage in Hadoop, Batch and Real-time Processing, Apache Spark, and Streaming.
Unit 8	Big Data Analysis with Hadoop: Hadoop MapReduce Programming, Working with Hadoop Ecosystem, Hands-on Hadoop Projects.
Unit 9	Machine Learning for Big Data: Introduction to Machine Learning, Supervised and Unsupervised Learning, Machine Learning Algorithms for Big Data.
Unit 10	Data Governance and Quality: Data Quality Management, Data Governance Frameworks, Quality Assurance in Big Data.
Unit 11	Business Intelligence and Decision Support Systems: Building Decision Support Systems, BI in Enterprise Management, BI and Key Performance Indicators.
Unit 12	Data Ethics and Privacy: Data Privacy Laws and Compliance, Ethical Considerations in Data Analysis, Ensuring Data Security.
Unit 13	Big Data Case Studies: Real-world Case Studies, Industry Examples, Analysing Big Data for Business Insights.
Unit 14	Business Intelligence and Advanced Analytics: Advanced BI Techniques, Advanced Analytics Applications, The Future of Big Data and BI.

DCA72M7 - AI in Project Management	
Unit 1	Introduction to AI in Project Management: Definition and evolution, Importance and benefits of AI in project planning, execution, and monitoring, and Challenges of integrating AI into traditional project management frameworks, Case studies highlighting AI's impact on project success.
Unit 2	Basics of Traditional Project Management: Overview of project management principles: Initiation, Planning, Execution, Monitoring, and Closure, Overview of project management methodologies: Waterfall, Agile, and Scrum, Role of data and analytics in modern project management.
Unit 3	AI in Strategic Project Planning: Overview, Project planning enhancement with AI-driven tools, Predictive analytics for resource estimation and timeline forecasting, and Applications of AI.
Unit 4	AI Tools for Project Planning: AI in resource allocation and scheduling, Automated task assignment and workload distribution, Use of tools like Microsoft Project and Monday.com with AI features.
Unit 5	AI for Risk Management: AI tools for risk identification, assessment, and mitigation; prediction of project risks; Real-world applications of AI in risk management.
Unit 6	AI-Driven Decision Making: AI supports decision-making in complex project scenarios; Decision Support Systems (DSS); Benefits of AI-powered DSS for multi-criteria decision analysis; Examples of AI-based decision-making tools.

Unit 7	NLP and Chatbots in Project Communication: The role of Natural Language Processing (NLP), AI chatbots, and Examples of AI-based tools like Slack bots and Microsoft Teams bots.
Unit 8	AI for Monitoring and Control: AI in performance tracking and progress reporting; AI use in budget monitoring and forecasting; examples of AI tools like Jira and Trello.
Unit 9	AI in Project Portfolio Management: portfolio selection and prioritisation, AI techniques for aligning projects with organisational goals, use of machine learning in evaluating project portfolio performance.
Unit 10	AI-Driven Quality Management in Projects: Quality control techniques, monitoring project deliverables and quality metrics, Applications of computer vision for product and service quality assurance.
Unit 11	Predictive Analytics in Project Management: Introduction to predictive analytics concepts, Applications in project timeline estimation and resource planning, Case studies of predictive analytics in real projects.
Unit 12	Ethics and Challenges of AI in Project Management: Ethical considerations in using AI for project management, Challenges in integrating AI into project workflows, Addressing bias, data privacy, and accountability in AI systems.
Unit 13	Case Studies of AI in Project Management: Case studies of successful AI implementation in project management across industries, Analysis of tools like Asana, Trello, and Jira with AI-enabled features, Lessons learned from AI-driven project management strategies.
Unit 14	Emerging Trends in AI and Project Management: AI in remote and hybrid project management, The role of self-learning AI systems in project automation, Impact of AI on future project management roles.

5.2. Duration of the Programme

Programme	Level	Duration	Maximum duration for completion	Credits
MCA	Master's Degree	2 years	(2+ 2) years (As per UGC Notification on Specification of Degree, 2014)	85 Credits

5.3. Faculty and Support Staff Requirement

Academic Staff	Number available to meet the required delivery norms
Programme Coordinator	1 member
Course Coordinator	1 member
Course Mentor	1 member per batch of 250 students

5.4. Instructional Delivery Mechanisms

The Centre for Distance & Online Education of MUJ comprises of faculty members and staff who are well versed in Distance Education and Online delivery.

An Academic calendar depicting dates for all major events during each semester will be prepared by faculty members and shared with students through LMS, at the beginning of each academic session.

Apart from providing content in the form of Self Learning Material, enough e-learning resources in the form of Audio and Video content will be provided to students. Regular engagement of students will be ensured through the following means:

- Conduct of Webinars/live lectures/online lectures/Virtual Class
- By encouraging them to participate in mandatory Discussion Forums to stimulate their thinking, and to be able to fearlessly express their views in forums. These discussion forums will be moderated by faculty to provide equal opportunity for everyone to participate, as well as to ensure maintenance of decorum of the forum.
- Through periodic formative assessments

Regular evaluation of content learnt will be provided for, through Self-Assessment Questions within the SLM, as well as quizzes on the LMS. The quizzes can be taken any number of times, so that they reach a stage of being able to answer questions without errors, which is a reflection of their understanding of

the concept.

Efforts will be made to provide case studies to enhance their analytical ability and make right decisions.

Link to National Portals (SWAYAM/NPTEL) will be provided, as also link to University's digital library portal.

All links to additional reading will be provided in the LMS. Interested students can study beyond the confines of the syllabus.

5.5. Identification of media—print, audio or video, online, computer aided

LMS provides all audio video content (e-learning material, e-pubs, faculty-led video sessions, virtual classrooms and discussion boards), dashboard of their progress in learning, comparison with their peers in terms of learning, regular notifications regarding upcoming Webinars/virtual classes, Assignments, Discussion Forum participations and Examinations. It also provides an opportunity for raising queries if any, and seek answers to the same, by chat bot or course mentors.

5.6. Student Support Services

The Student Support services will be facilitated by the Centre for Distance & Online Education, Manipal University Jaipur, Rajasthan which includes the pre-admission student support services like counselling about the programme including curriculum design, mode of delivery, fee structure and evaluation methods. Post-admission student support services include guiding students towards accessing e-identity card, LMS portal, Academic calendar and academic delivery. Examinations support staff shall answer queries pertaining to conduct of end-semester examinations, evaluation and issue of certificates.

6. Procedure for Admission, Curriculum Transaction and Evaluation

The purpose of Online education by Manipal University, Jaipur is to provide flexible learning opportunities to students to attain qualification, wherever learners are not able to attend the regular classroom teaching. Academic programmes offered for such candidates under Online Learning mode will be conducted by Centre for Distance & Online Education-Manipal University, Jaipur with support of the various University schools. The programmes/courses may be termed Online mode for award of Degree. Eligibility criteria, programme/course structure, curriculum, evaluation criteria and duration of programme shall be approved by Board of Studies and Academic Council which are based on UGC guidelines.

Candidates seeking admissions in any programme offered by Centre for Distance & Online Education-Manipal University, Jaipur shall fill up online application form available on DOE- MUJ website. Before applying, candidates must check eligibility criteria for programme that they are interested in. Details about Eligibility criteria, programme structure, curriculum, duration, and fee structure are available on the website.

6.1. Procedure for Admission

6.1.1 Minimum Eligibility Criteria for admission

Candidate must have a 10 + 2 + 3 years bachelor degree from recognized University/ Institution or equivalent qualification as recognized by Association of Indian Universities (AIU) or other competent body in Computer Applications/Computer Science/Information Technology with a minimum 50% (45% for Reserved category) marks in aggregate.

Candidates from other streams like Science/Business Administration/ Business management/ Arts & Humanities/Commerce should have completed 10 + 2 + 3 years bachelor degree from recognized University or equivalent qualification as recognized by Association of Indian Universities (AIU) or other competent body with Mathematics at 10+2 level with a minimum 50% (45% for Reserved category) marks aggregate in graduation.

Such candidates need to attend and complete Bridge Course in Fundamentals of Computer and IT along with their Semester 1 courses.

Important Instructions:

- All admissions shall be provisional until and unless candidates meet the eligibility criteria.
- Admission will stand cancelled if a candidate does not meet eligibility criteria, or there is failure to pay programme/course fees.
- Admission will stand cancelled, if candidate does not submit proof of eligibility within stipulated time given by Centre for Distance & Online Education-Manipal University, Jaipur.
- Centre for Distance & Online Education-Manipal University, Jaipur has the right to make necessary changes from time to time as deemed fit in Eligibility criteria, programme/course structure, curriculum, duration, fee structure and programme announcement dates. All changes will be notified on website.

- Candidates should carefully read all instructions given in Programme prospectus before start of application form.

6.1.2. Fee Structure and Financial assistance policy

Suggested Fee for MCA programme is INR 1,58,000/- (One Lakh Fifty Eight Thousand only) List of scholarships are available for the students enrolling to online Program

- Upto 20% on tuition fees will be provided to Divyang / Defence students
- Upto 10% on tuition fees will be provided to students employed with Public Sector Undertaking
- Merit scholarships Upto 10% on tuition fees will be provided to students with 80 % and above in 10 + 2 / 3 year Diploma programs awarded by recognized Technical boards.

6.2. Curriculum Transactions

6.2.1. Programme Delivery

Manipal University, Jaipur has state-of-the-art mechanism for online mode of Academic delivery to ensure quality education. Faculty members at MUJ offer expert guidance and support for holistic development of the students. Faculty members are not mere facilitators of knowledge but they also mentor students to make learning more engaging and maintain high retention level. The programme will be delivered with an aim to provide expertise and ensure that students excel in their domains. The features of programme delivery are:

- Online Mode of Academic Delivery
- Periodic review of Curriculum and Study material
- Live Interactive lectures from faculty / Course coordinators
- Continuous Academic and Technical support
- Guidance from Course Co-ordinators
- Learning and delivery support from Course Mentors

6.2.2. Norms for Delivery of Courses in Online Mode

S. No.	Credit value of the course	No. of Weeks	No. of Interactive Sessions		Hours of Study Material		Self-Study hours including Assessment etc.	Total Hours of Study (based on 30 hours per credit)
			Synchronous On line Counselling/ Webinars/ Interactive Live Lectures (1 hour per week)	Discussion Forum/ asynchronous Mentoring (2 hours per week)	e-Tutorial in hours	e-Content hours		
1.	2 Credits	6 weeks	6 hours	12 hours	10	10	22	60
2.	4 Credits	12 weeks	12 hours	24 hours	20	20	44	120

6.2.3. Learning Management System to support Online mode of Course delivery:

LMS Platform has been built to help learners reach their potential in their chosen programme. It is a secure, reliable learning experience tool that works consistently on Web and Mobile devices. Its simple interface makes it easy for instructors to design courses, create content and grade assignments. It provides a great mobile experience due to the responsive design which is paired with purpose-built native apps. It provides seamless accessibility to ensure all tools are standards-compliant and easy for students to navigate using assistive technologies. It provides 24 X 7 learning experience to facilitate learning as per the pace chosen by learners. Digital portfolio functionality allows students to document and share their learning journey as it happens, on both web and mobile platforms.

6.2.4. Course Design

The Course content is designed as per the SWAYAM guidelines using 4-quadrant approach as detailed below to facilitate seamless delivery and learning experience

- (a) Quadrant-I i.e. e-Tutorial, that contains – Faculty led Video and Audio Contents, Simulations, video demonstrations, Virtual Labs
- (b) Quadrant-II i.e. e-Content that contains - Portable Document Format or e-Books or Illustration, video demonstrations, documents as required.
- (c) Quadrant-III i.e. Discussion forums to raise and clarify doubts on real time basis by the Course Coordinator and his team.
- (d) Quadrant-IV i.e. Self-Assessment, that contains MCQs, Problems, Quizzes, Assignments with solutions and Discussion forum topics.

6.2.5. Academic Calendar

SI No.	Event	Batch	Last Date (Tentative)
1	Commencement of semester	January	1 st January
		July	1 st July

2	Enrol student to Learning Management system	January	Within 2 working days of fee confirmation
		July	
3	Assignment Submission	January	March end and April end
		July	September end and October end
4	Submission of Synopsis (Applicable during Pre final semester)	January	30 th April
		July	30 th October
5	Project Report Submission (Applicable during Final semester)	January	30 th April
		July	30 th October
6	Webinars / Interactive Live Lectures and Discussion Forum for query resolution	January	Mar to May
		July	September to November
7	Admit Card Generation	January	3 rd week of May
		July	3 rd week of Nov
8	Term End Examination	January	2 nd week of June (TEE June)
		July	2 nd Week of December (TEE December)
9	Result Declaration of End Term Examination	January	Last week of August
		July	Last week of February

6.3. Evaluation

The students' learning in a course would be evaluated based on Internal assignments, students' response sheets, and semester end examinations. University adopts rigorous process in development of question papers, question banks, assignments and their moderation, conduct of examinations, evaluation of answer scripts by qualified teachers, and result declaration. The Directorate shall frame the question papers so as to ensure that no part of the syllabus is left out of study by a learner.

The evaluation shall include two types of assessments-continuous or formative assessment in the form of assignments, and summative assessment in the form of end semester examination or term end examination which will be held with technology supported remote proctored examination tool.

However, we shall be considering the guidelines issued by the Regulatory bodies from time-to-time about conduct of examinations.

The examinations shall be conducted to assess the knowledge acquired during the study. There shall be two systems of examinations viz., internal and external examinations. In the case of theory courses, the internal evaluation shall be conducted as Continuous Internal Assessment via Student assignments preparation, quizzes. The internal assessment shall comprise of maximum of 30 marks for each course (One Assignment for a two-credit paper and two assignments for a four-credit paper). The end semester examination shall be of three hours duration for each course at the end of each semester.

6.3.1. Question

Paper

Pattern

Time: 3

Hours

Max.

Marks: 70

Part A - (Multiple Choice Questions) - 10 x 2 Marks = 20 Marks

Part B - (Short Answers) - Answer any 4 (out of 6) 4 x 5 Marks =

20 Marks Part C – (Long Answers) – Any 3 (out of 4) x 10 Marks
= 30 Marks

6.3.2. Distribution of Marks in Continuous Internal Assessments

The following procedure shall be followed for awarding internal marks for theory courses. Students must submit two assignments for 4-credit paper (one assignment for 2-credit paper), each carrying 30 marks and average of both will be considered as internal assessment marks.

6.3.3. Passing Minimum

The students are considered as passed in a course if they score 40% marks in the Continuous Evaluation (IA) and Term-End Examinations (TEE) individually. If a student fails in any one component (failure to get 40% marks either in IA or TEE), then he/she will be required to re-appear for that component only (IA or TEE as the case may be).

6.3.4. Marks and Grades

Based on the total marks obtained for each course in Internal Assessment and Term End examinations, student will be awarded grade for that course. The following table gives the marks, grade points, letter, grades and classification to indicate the performance of the candidate.

Range of Marks	Grade Points	Letter Grade	Description
≥ 90 to ≤ 100	10	A+	Outstanding
≥ 80 to < 90	9	A	Excellent
≥ 75 to < 80	8	B+	Distinction
≥ 70 to < 75	7	B	Very Good
≥ 60 to < 70	6	C+	Good
≥ 50 to < 60	5	C	Average
≥ 40 to < 50	4	D+	Below Average
< 40	0	F	Re-appear
ABSENT	0	AAA	ABSENT

For a semester:

Grade Point Average [GPA] = $\sum_i C_i$

$G_i / \sum_i C_i$ Grade Point Average =

Sum of the multiplication of grade points by the credits of the courses

Sum of the credits of the courses in a semester

C_i = Credits earned for the course i in any semester

G_i = Grade Point obtained for course i in any semester.

n refers to the semester in which such courses were credited

For the entire programme:

Cumulative Grade Point Average [CGPA] = $\sum_n \sum_i C_{ni} G_{ni} / \sum_n \sum_i C_{ni}$

CGPA =

Sum of the multiplication of grade points by the credits of the entire programme

Sum of the credits of the courses for the entire programme

7. Requirement of the Laboratory Support and Library Resources

7.1. Laboratory Support

For practical courses (programming and coding) in syllabus, Learners will have access to lab guide for unguided exercise and online tools to carry out practice of suggested exercises. Video tutorials will be provided for better understanding of concepts and methods to practice. Lab based virtual classrooms in Learning portal will guide students about the laboratory support to the learners in order to carry out practical exercise covered in the programme. There shall be provision of a practical guide made available for learners.

7.2. Library Resources

Centre for Distance & Online Education, Manipal University Jaipur, Rajasthan has

excellent Library facility with adequate number of copies of books in relevant titles for MCA programme. The Central Library of Manipal University Jaipur is also having good sources of reference books. The books available at both the libraries are only for reference purposes and lending services. In addition, reference books as prescribed will be procured. The Digital library access will also be made available to students who are enrolled into online education. In addition, the university membership on Swayam/ NPTEL/ Knimbus will also be made available to students. Complete e-Learning resources to course would be made available on Learning management System for learning along with e-tutorial lectures. Further, expert lectures/workshops/ webinars by industry experts would also be conducted for the students.

8. Cost Estimate of the Programme and the Provisions

The cost estimate of the Programme and provisions for the fund to meet out the expenditure to be incurred in connection with M.B.A. Programme as follows:

Sl. No.	Expenditure Heads	Approx. Amount
1	Programme Development (Single Time Investment)	49,00,000 INR
2	Programme Delivery (Per Year)	6,00,000 INR
3	Programme Maintenance (Per Year)	27,00,000 INR

9. Quality assurance mechanism and expected programme outcomes

The quality of the programme depends on scientific construction of the curriculum, strong- enough syllabus, sincere efforts leading to skillful execution of the course of the study. The ultimate achievement of MCA programme of study may reflect the gaining of knowledge and skill in management area. Gaining of knowledge and skills in IT may help the students to get new job opportunities, upgrading their position not only in employment, but also in society,

The benchmark qualities of the programme may be reviewed based on the performance of students in their end semester examinations. Also, the feedback from the alumni, students, parents and employers will be received and analysed for further improvement of the quality of the programme.

Manipal University, Jaipur has constituted Centre for Internal Quality Assurance (CIQA), which will assist Director, Centre for Distance & Online Education to conduct periodic review and assessments and assist the Directorate to implement necessary quality measures and

effectiveness in programme delivery. CIQA is constantly involved in reviewing all materials prepared by DOE, including syllabus, SLMs and e-learning content. CIQA will be involved in conducting studies to measure effectiveness of methods adopted for learning. As we proceed further, CIQA will involve in benchmarking quality of academic delivery, and perform various analyses, and guide all stakeholders towards upgrading quality constantly.

Centre for Internal Quality Assurance Committee (CIQAC) chaired by the Vice Chancellor consisting of internal and external experts oversees the functioning of Centre for Internal Quality Assurance and approve the reports generated by Centre for Internal Quality Assurance on the effectiveness of quality assurance systems and processes.

In addition to CIQA, as per the guidelines of National Assessment and Accreditation Council (NAAC), Manipal University, Jaipur has constituted Internal Quality Assurance Cell (IQAC), in which academicians, industry representatives and other stakeholders are nominated as members. The IQAC is a part of the institution's system and work towards realization of the goals of quality enhancement and sustenance, as quality enhancement is a continuous process. The prime task of the IQAC is to develop a system for conscious, consistent, and catalytic improvement in the overall performance of institutions. The work of the IQAC is the first step towards internalization and institutionalization of quality enhancement initiatives. IQAC's elementary motive is to promote measures for institutional functioning towards quality enhancement through internalization of quality culture and institutionalization of best practices.

The guidelines on quality monitoring mechanism prescribed by the UGC have been adopted by the Centre for Internal Quality Assurance for conducting institutional quality audits, to promote quality assurance and enhance as well as spread best-in-class practices of quality assurance. University has setup an effective system for collecting feedback from the stakeholders regularly to improve its programmes. The University will conduct self- assessments regularly and use the results to improve its systems, processes etc. and finally quality of programmes.