Master of Computer Applications (MCA)

Syllabus

MATS Centre for Distance and Online Education (MCDOE)

MATS University, Raipur, Chhattisgarah

Detailed Syllabus & Reference Book

Master of Computer Applications (MCA) Sem I
Object Oriented Programming Concepts
Course Code: ODL MCA101   Credit: 04

No.		Module Description
1		**Programming Paradigms**
	1.1	Programming Language Concepts
	1.2	Types Of Programming Language and Its Applications Area
	1.3	Source File Creation, Compilation and Linking
	1.4	Features And Structure of C++ Program
	1.5	Data Types, Tokens: Keywords, Identifiers, Variables and Constants, Operators
	1.6	Control Statements: Branching, Looping and Jumping
	1.7	Array Declaration and Initialization
	1.8	Access the Array Elements
	1.9	Types of Arrays
2		**Class, Object, Constructor and Destructor**
	2.1	Object Oriented Programming Concepts, Advantage
	2.2	Object and Class
	2.3	Member Function
	2.4	Array within the Class
	2.5	Memory Allocation of Objects
	2.6	Friend Function
	2.7	Local Class
	2.8	Constructors: Parameterized, Multiple, Default Argument
	2.9	Dynamic Initialization of Objects, Copy Constructor, Dynamic Constructor
	2.10	Destructors
3		**Operator Overloading and Inheritance**
	3.1	Operator Overloading: Unary and Binary
	3.2	Overloading Binary Operators Using Friends
	3.3	Rules of Overloading Operators, Type Conversion
	3.4	Inheritance, Derived Classes
	3.5	Inheritance: Single, Multilevel, Multiple, Hierarchical and Hybrid
	3.6	Virtual Base Classes, Abstract Class
	3.7	Constructors In Derived Classes, Member Classes
4		**Pointer, Virtual Function and Polymorphism**
	4.1	Pointers: Pointers To Objects, This Pointer
	4.2	Pointer To Derived Classes
	4.3	Virtual Function, Pure Virtual Function
	4.4	Polymorphism: Compile Time, Run Time
	4.5	Overloading and overriding
5		**Console I/O Operations and File Handling**
	5.1	Stream Classes
	5.2	I/O Operations: Unformatted and Formatted

	5.3	Managing Output with Manipulators
	5.4	Classes For File Stream Operations
	5.5	Opening and Closing a File, Detecting End-of-File
	5.6	File Modes, File Pointers and Their Manipulations
	5.7	Sequential Input and Output Operations
	5.8	Random Access File
	5.9	Error Handling During File Operations

Text Books/ Resources:	1. E. Balagurusamy , "Object Oriented Programming with C++", Tata McGraw- Hill.
Reference Books/ Resources:	1. Herbert Schildt , "The Complete Reference" Tata McGraw-Hill 2. Robert Lafore , "Object Oriented Programming in Turbo C++" The Waite Group 3. Programming in Modern C++ NPTEL SWAYAM:https://onlinecourses.nptel.ac.in/noc 23_cs78/previw Tutorial https://www.javatpoint.com/cpp-tutorial

Master of Computer Applications (MCA) Sem I	
Course: Database Technologies	
Course Code: ODL MCA102 Credit: 04	

No.	Module Description	
1	**Introduction to Database Management System**	
	1.1	Purpose of Database Systems
	1.2	View of Data: Data Abstraction, Instances and Schemas
	1.3	Data Models: Relational Model, Entity-Relationship Model, Object- Based Data Model, Semi structured Data Model, Database Languages
	1.4	Data Storage and Querying, Database Architecture
	1.5	Database Users and Administrators
2	**Relational Data Modeling and Database Design**	
	2.1	Relational Model Concepts, Super Key, Candidate Key and Primary Key
	2.2	Constraints: Domain, Key, Entity and Referential Integrity constraints
	2.3	E.F. Codd's Rule
	2.4	Functional dependency, Armstrong's Inference rules
	2.5	Decomposition of Relations: Lossless Join and Dependency Preservation property
	2.6	Normalization: First, Second, Third, BCNF, PJNF
3	**SQL and Procedural SQL**	
	3.1.	Conditional statements and Iterative statements
	3.2.	User-defined functions
	3.3.	Stored Procedures, Parameter types: IN, OUT and INOUT
	3.4.	Triggers: Introduction, Needs, Before trigger and After trigger
4	**Transaction management and Concurrency**	
	4.1.	Transaction: Introduction, Transaction Model
	4.2.	Properties of Transactions
	4.3.	Transaction isolation, Schedules: Serial, Non-Serial Schedules

	4.4.	Serializability, Conflict Serializability
	4.5.	Concurrency Control
	4.6.	Concurrency Control Protocols: Lock based and Timestamp based
	4.7.	Deadlock Handling: Detection and Prevention
5	**Object-Oriented Database**	
	5.1.	Limitations of RDBMS
	5.2.	Introduction: OODBMS and ORDBMS
	5.3.	Storing and Accessing Objects in a Relational Database
	5.4.	Object-Oriented Database Design
	5.5.	Introduction to Object-Oriented Data Models

Text Books/ Resources:	1. Henry F. Korth, "Database System Concepts", Tata McGraw Hills Ivan Bayross, "MySQL 5.1 for Professionals", SPD
Reference Books/ Resources:	1. Elmasri and Navathe, "Fundamentals of Database Systems", Pearson Education. 2. Thomas Connolly and Carolyn Begg, "Database Systems, A Practical Approach to Design Implementation and Management", Pearson Education 3. MySQL Reference Manual - https://dev.mysql.com/doc/refman/8.0/en/ PostgreSQL Reference Manual - https://www.postgresql.org/docs/

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Master of Computer Applications (MCA) Sem I **Course: Data Structure Concepts** **Course Code: ODL MCA103 Credit: 04**		
No.	**Module Description**	
1	**Linear Data Structure**	
	1.1	Data structure concepts, Data type, Abstract data type
	1.2	Linear data structures using sequential organization, Operations
	1.3	Linear Array in data structure and its classification, Properties and representation of an array, Operation and Memory location
	1.4	Searching Algorithms: Linear, Binary
	1.5	Sorting Algorithm—Insertion, Selection, Merge sort
2	**Stack, Queue and Recursion**	
	2.1	Representation of Stacks using sequential organization, Applications
	2.2	Recursion and its Applications
	2.3	Queue, Representation of Queues using sequential organization, Dequeue, Priority Queue
3	**Linked List**	
	3.1	Linked list and its representation
	3.2	Operations on Linked list: Traversing, Searching, Insertion, Deletion
	3.3	Memory Allocation

4	**Tree and Graph**	
	4.1	Tree concepts
	4.2	Binary Tree-Representation
	4.3	Operations: Searching, Insertion, Deletion
	4.4	Algorithms: Binary Search Tree and AVL
	4.5	Graph, Graph Representation, Operations: Searching, Insertion, Deletion, Traversing
5	**Algorithm Analysis and Design**	
	5.1	The Role of Algorithm in Computing, Characteristics of algorithm, P and NP problem
	5.2	Analyzing algorithms: Time and space complexity, Execution time
	5.3	Asymptotic notations
	5.4	Algorithm design techniques: • Greedy algorithm • Divide and conquer • Dynamic programming And it's implementation.

Text Books/ Resources:	1. Seymour Lipschutz, "Data Structures", McGraw Hill Education: 2. Alfred V. Aho, John E. Hopcroft, Jeffry D. Ullaman" Data Structure and Algorithms", Pearson Education: 3. Thomas H Coreman , "Introduction to algorithms", MIT Press:
Reference Books/ Resources:	1. Michael T. Goodrich, Roberto Tamassia, David M. Mount, "Data Structure and Algorithm", John Wiley & Sons 2. G.S. Baluja, "Data Structures Through C++"

	Master of Computer Applications (MCA) Sem I **Course: Mathematical Foundation of Computer** **Course Code: ODL MCA104 Credit: 04**	
No.	**Module Description**	
1	**Set Theory, Mathematical Logic, Relation and Function**	
	1.1	Introduction to Set theory, Cartesian Product
	1.2	Statements and Notations, Logical Connectives
	1.3	Tautology, Contradiction, Logical equivalence
	1.4	Relation, Types of Binary relation, Equivalence relation
	1.5	Function, Properties of function, Composition of Functions
2	**POSETS and Lattices**	
	2.1	Introduction, Partial order relation
	2.2	Partial ordered set, HASSE diagram
	2.3.	Lattice, Sub-Lattices, Well ordered set, Complete lattice
	2.4	Distributive and Complemented lattice
3	**Boolean Algebra**	
	3.1	Basic concepts of Boolean Algebra, Boolean lattice, Boolean algebra
	3.2	Boolean functions, Disjunctive and Conjunctive normal form, Complement function, Bool's Expansion theorem
	3.3	Karnaugh map method for simplification of Boolean expressions
	3.4	Applications of Boolean Algebra in switching circuits, logic circuits

4	Graph Theory	
	4.1	Basic concepts of graph theory
	4.2	Subgraph, Walk, Paths and Circuits
	4.3	Types of graphs
	4.4	Matrix Representation of Graphs, Directed Graphs
	4.5	Tree and its properties, Rooted Tree, Binary Trees, Spanning tree, Fundamental Circuits
5	Semi Group and Monoids	
	5.1	Algebraic structure, Binary operation, Properties, Semi group, Monoid, Group theory,
	5.2	Abelian group, Cyclic group, Generators, Permutation group, Subgroup,
	5.3	Homomorphism, Isomorphism and Automorphism.
	5.4	Cosets, Langranges Theorem, Normal Subgroup and Quotient group

Text Books/ Resources:	1. H.K Pathak, J.P. Chauhan "Advanced Discrete Mathematics", Shree Shiksha Sahitya Prakashan 2. Swapan Kumar Sarkar, "Discrete Mathematics", S. Chand & Company Ltd.
Reference Books/ Resources:	1. Ralph, Gimaldi, Discrete and Combinatorial Mathematics, Pearson Education. 2. N.Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice Hall. 3. H.K Pathak, Discrete Mathematics 4. 5. Kolman, B, Busby, R.C.Ross, S.C. Discrete Mathematical Structures, Pearson Education. 6. Liu, C.L. Elements of Discrete Mathematics, Tata McGraw Hill.

Master of Computer Applications (MCA) Sem II Course: Advanced JAVA Programming Course Code: ODL MCA201 Credit: 04		
No.	**Module Description**	
1	**Object Oriented Programming Concepts and Implementations**	
	1.1	OOPS Concepts and implementation: Class, Object, Encapsulation,Polymorphism, Inheritance, Abstraction
	1.2	Package Concepts and Implementation: Defining and use of Package
	1.3	Managing Errors and Exceptions
	1.4	Multithreading: Concepts, Life Cycle, Methods
	1.5	Network Programming: Introduction, Classes and its methods
	1.6	Java Database Connectivity: Architecture, Drivers, Connectivity with database

	2		JAVA FX Technology
		1.1	Introduction to Java FX, Features, Architecture & Applications
		1.2	Java 2D Shapes, Colors, Text
		1.3	Java FX Effects
		1.4	Java FX Transformation
		1.5	Java FX Animation
		1.6	Java FX 3D Shapes
		1.7	Java FX Layout
		1.8	Java FX UI Controls
		1.9	Java FX Images
		1.10	Java FX Event Handling
	3		Servlet Technology
		3.1	J2EE Introduction and Architecture
		3.2	Java Servlet: Basic Servlet Structure
		3.3	Servlet Life Cycle
		3.4	Reading Form Data from Servlet
		3.5	Handlin the Client Request, Generating the Server Response
		3.6	Handling Cookies: Benefit of Cookies, Deleting Cookies, Sending and Receiving Cookies, Cookies Attributes
		3.7	Session Tracking: Need of Session Tracking, Session Tracking Basics, Session Tracking API,
	4		JSP Technology
		4.1	Introduction, Need and Benefit of JSP, Life Cycle of JSP
		4.2	JSP Scripting Elements : Scriptlet tag, Expression Tag, Declaration
			Tag
		4.3	Implicit Object: Request, Response, Config, Applications, Session, Page Context, Page, Exception
		4.4	Directive Elements: Page directive, include directive, taglib Directive
		4.5	Action Elements: forward, include
	5		Spring and Spring Boot Framework
		5.1	Introduction to Spring Initializing and Writing Spring Applications
		5.2	Dependency Injection: IOC Container, Dependency Injection, Constructor Injection.
		5.3	Developing web Applications: Displaying & processing information, Validating Form Input, Working with View Controller
		5.4	Working with Data: Reading and Writing data with JDBC, Working with Spring data JDBC
		5.5	Introduction to Spring Boot, Difference between Spring and Spring Boot, Spring Boot Architecture
		5.6	Project Component: Annotations, Dependency Management, Applications Properties,
		5.7	Developing Spring Boot Applications: Putting spring boot to work, using starter dependencies, using automatic configurations
		5.8	AOP (Aspect Oriented Programming) : Before, After, Around, Returning, Throwing

Text Books/ Resources:	1. E. Balagurusamy , "Programming with Java", Tata McGraw-Hill: 2. Marty Hall, Larry Brown, "Core Servlet and JavaServer Pages", PEARSON: 3. Carl Dea, Mark Heckler, Gerrit Grunwald, Jose Pereda Ph.D, Sean 4. M Philips, "Java FX 8 Introduction by Example", Apress: 5. Craig Walls, "Spring IN ACTION",Manning: Craig Walls, Andrew 6. Glover, "Spring Boot in Action",Manning:
Reference Books/ Resources:	1. Bruce Eckel, "Thinking in JAVA", Pearson 2. JDK Release Notes - https://www.oracle.com/java/technologies/javase/jdk-relnotes-index.html 3. JavaFX - https://jenkov.com/tutorials/javafx/index.html.

Master of Computer Applications (MCA) Sem II
Course: OS Concepts and Shell Programming
Course Code: ODL MCA202   Credit: 04

| No.	Module Description	
1	**Introduction to Operating System**	
	1.1	Introduction to Operating System.
	1.2	Need and Functions of Operating Systems
	1.3	Computer System Operations
	1.4	Types of OS -Batch processing, Multi-programming, Time sharing
	1.5	Operating-System Services
	1.6	System Calls.
	1.7	Operating-System Structure
	1.8	Design Goals
2	**Process Management and Synchronization**	
	2.1	Process Concepts
	2.2	Process State
	2.3	Process Control Block
	2.4	Operations on Processes
	2.5	Inter process communications
	2.6	Process Scheduling
	2.7	CPU Scheduling algorithms
	2.8	Process Threads – Overview
	2.9	Critical Section problem
	2.10	Semaphores.
	2.11	Classical problems of synchronization
	2.12	Deadlock Characterization
	2.13	Deadlock Handling: Avoidance, Detection &Prevention

3		Storage Management
	3.1.	Contiguous Memory Allocation
	3.2.	Paging Techniques: Swapping, Paging, Segmentation, Fragmentation
	3.3.	Demand Paging.
	3.4.	Page Replacement : Page Replacement Algorithm
	3.5.	Virtual Memory.
	3.6.	File Concepts, Access Methods
	3.7.	File Systems Structures
	3.8.	File System Implementation
	3.9.	Free Space Management
4		**Disk Scheduling and Distributed Systems**
	4.1.	I/O Hardware
	4.2.	Applications of I/O Interface
	4.3.	Disk Structures
	4.4.	Disk Scheduling Algorithms
	4.5.	Disk Management
	4.6.	RAID Structure
	4.7.	Distributed System Structure
	4.8.	Distributed File Systems
	4.9.	Naming and Transparency
	4.10.	Remote File Accesses
	4.11.	Stateful Versus Stateless Service
5		**Shell Programming**
	5.1.	Introduction to shell programming
	5.2.	Various types of Shells and their Comparisons
	5.3.	Command Execution
	5.4.	Command Execution Process
	5.5.	Shell programming in different shells
	5.6.	Decision Making Selections
	5.7.	Concept of Function , Parameter passing and argument
	5.8.	Filters, Basic of Shell Programming
Text books/ Resources:		1. Abraham Silberschatz, Peter B Galvin, and Gerg 2. Gagne– "Operating System Concepts", Wiley. Behrouz A. Forouzan and Richard F. Gilberg – "UNIX and Shell Programming".
Reference Books/ Resources		1. Tanenbaum A - Modern Operating Systems - Pearson Education. 2. Dhamdhere D. M. – "Operating Systems", Tata McGraw Hill. 3. Sumitabha Das – "UNIX Concepts and Applications", Tata McGraw Hill. Halder S. and Aravind A. – "Operating Systems", Pearson.
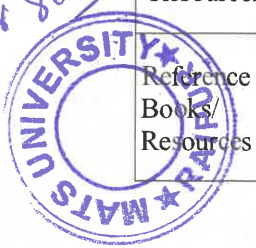
Master of Computer Applications (MCA) Sem II
Course: Advanced Networking Concepts
Concepts ODL MCA210   Credit: 04

No.	Module Description	
1	**Introduction to Networking and Physical layer**	
	1.1	Data Communication: Components like Sender, receiver, protocols etc.
	1.2	Network Models: OSI and TCP/IP , Protocol
	1.3	Addressing : Physical, Logical, Port
	1.4	Transmission Media: Wired media, Wireless media
	1.5	Multiplexing Techniques; Frequency Division, Time Division, Synchronous time division, Statistical Time Division
2	**Data link layer**	
	2.1	Type of error, redundancy, detection and correction
	2.2	Block Coding: Error Detection, Error correction , hamming distance
	2.3	Cyclic code redundancy and checksum
	2.4	Flow control and error control
	2.5	Noiseless and Noisy channels
3	**Network layer**	
	3.1	Logical addressing : IPv4 addressing, IPv6 Addressing
	3.2	IPv4: Datagram, Fragments, Checksum
	3.3	IPv6: Advantages, Packet Format, Extension
	3.4	Address Mapping, ICMP,IGMP
4	**Transport layer and Applications layer**	
	4.1.	Process To Process Delivery
	4.2.	TCP and UDP Protocol
	4.3.	Name Space, Domain Name Space
	4.4.	DNS, Resolution
	4.5	Applications layer protocols: SMTP, FTP, POP, IMAP
5	**Network Security and Cryptography**	
	5.1	Introduction to security services
	5.2	Digital signature
	5.3	Introduction to cryptography: Types
	5.4	IP Security

Text books/ Resources:	1. Forouzan B., "Data Communication and Networking", 4rd Edition, McGraw- Hill 2. Andrew S. Tanenbaum, "Computer Networks" , 5th Edition, Person Publication
Reference Books/ Resources	1. James Kurose, Keith Ross, "Computer Networking: A Top-Down Approach", 7th Edition, Pearson Publication. 2. Russ White, Ethan Banks, "Computer Networking Problems and Solutions ", 1st Edition, Cisco Press. 3. https://www.javatpoint.com/computer-network-tutorial 4. https://www.geeksforgeeks.org/computer-network-tutorials/

Master of Computer Applications (MCA) Sem II

Course: Data Warehousing and Data Mining
Course Code: ODL MCA206 Credit: 04

No.	Module Description	
1	**Introduction to Data Mining**	
	1.1	Introduction to Data Science: Data mining, Machine Learning, Deep Learning, Artificial Intelligence, Data Warehouse, Big Data
	1.2	Data Mining, Knowledge Discovery from Data (KDD) Framework
	1.3	Types of data for Data Mining
	1.4	Data Mining: Confluence of multiple disciplines
	1.5	Data Mining Applications
2	**Data Preprocessing**	
	2.1	Data types: Nominal attributes, Binary attributes, Ordinal attributes
	2.2	Statistics of data: Central tendency, dispersion of data - Range, quartiles, Variance and standard Deviation
	2.3	Covariance and correlation analysis
	2.4	Data quality, Data cleaning: Missing values, Noisy data, Data integration
	2.5	Data transformation: Normalization, Discretization
3	**Data warehousing and Online Analytical Processing**	
	3.1	Introduction to Data Warehouse
	3.2	Data Warehouses Architecture: The three-tier architecture, ETL, Enterprise data warehouse and data mart
	3.3	Data cube: a multidimensional data model
	3.4	Schemas for multidimensional data models: stars, snowflakes and fact constellations
	3.5	Concept hierarchies
	3.6	OLAP operations
4	**Association Rule Mining**	
	4.1.	Market basket analysis
	4.2.	Frequent itemset
	4.3.	Apriori algorithm: finding frequent itemset
	4.4.	Generating association rules from frequent itemset
	4.5	From association analysis to correlation analysis
5	**Classification and Cluster Analysis**	
	5.1	Introduction to Classification
	5.2	Decision tree induction
	5.3	Attribute selection measures: Information gain, Gain ratio
	5.4	Naïve Bayesian classification
	5.5	Cluster Analysis
	5.6	Partitioning methods
	5.7	k-Means: a centroid-based technique

Text books/ Resources:	1. Han, J. and Kamber, M. - Data Mining: Concepts & Techniques, 3rd Edition - Morgan Kaufmann Publishers: 2. Ian H. Witten, Eibe Frank, Mark A. Hall, Data Mining: Practical Machine Learning Tools and Techniques, Morgan Kaufmann Publications

Reference Books/ Resources	1. Mohammed J. Zaki Wagner Meira Jr - Data Mining and Machine Learning: Fundamental Concepts and Algorithms 2. Pujari, A. - Data Mining techniques - Universities Press 3. Pudi, V. and Radhakrishnan, P. - Data Mining - Oxford University Press 4. Larose, D. - Data Mining Methods & Models - Wiley-India 5. Berry, M. and Linoff, G. - Data Mining Techniques - Wiley-India

Master of Computer Applications (MCA) Sem

II Course: Elective I Software Testing
Course Code: ODL MCA205   Credit: 04

No.	Module Description
1	**Introduction to Software Testing**
1.1	Definition of Software Testing: Importance and objectives.
1.2	Software Development Life Cycle (SDLC): Role of testing in different SDLC models (Waterfall, Agile, V-Model, Spiral).
1.3	Levels of Testing: Unit testing, Integration testing, System testing, and Acceptance testing.
1.4	Types of Testing: Manual vs Automated Testing.
1.5	Error, Fault, and Failure: Understanding the differences between them
2	**Testing Process and Life Cycle**
2.1	Testing Process: Requirement analysis, Test planning, Test design, Test execution, Defect reporting, and Closure.
2.2	Test Levels: Unit testing, Integration testing, System testing, User acceptance testing (UAT).
2.3	Test Documentation: Test plan, Test case design, Test scripts, Test reports.
2.4	Defect Life Cycle: Steps from defect detection to closure.
2.5	Test Case Design: Writing effective test cases and using test case design techniques.
3	**Test Design Techniques**
3.1	Black-box Testing: Equivalence partitioning, Boundary value analysis, Decision tables, and State transition testing.
3.2	White-box Testing: Code-based testing techniques such as statement coverage, branch coverage, path coverage.
3.3	Experience-based Testing: Exploratory testing, Error guessing, and Ad-hoc testing.
3.4	Test Case Design Techniques: Writing test cases based on requirements and use cases.
4	**Types of Testing**
4.1	**Functional Testing**: Focus on the functionality of the software, ensuring the system meets specified requirements. Smoke Testing, Sanity Testing, Regression Testing, Retesting, UAT, and Interface Testing.
4.2	Non-Functional Testing, Testing non-functional aspects like performance, security, usability, etc, Performance Testing, Load Testing, Stress Testing, Scalability Testing, and Security Testing.
4.3	Regression Testing: Ensuring that new code changes do not affect the existing system.
4.4	Exploratory Testing: Simultaneously learning about the system and testing it.

5	**Automated Testing**	
	5.1	Automation Introduction: Importance, benefits, and challenges.
	5.2	Tools for Automation: Selenium, QTP, JUnit, TestNG, Appium, etc.
	5.3	Automated Test Script Design: How to design maintainable and reusable test scripts.
	5.4	Continuous Integration/Continuous Testing: Integration of automated testing in CI/CD pipelines.

Text books/ Resources:	1. Software Testing: Principles and Practices – Srinivasan Desikan, Gopalaswamy Ramesh, Pearson 2. Foundations of Software Testing – Dorothy Graham, Erik van Veenendaal, Isabel Evans, Rex Black, Cengage Learning
Reference Books/ Resources	1. Software Testing: A Craftsman's Approach – Paul C. Jorgensen, CRC Press 2. Introduction to Software Testing – Paul Ammann, Jeff Offutt, Cambridge University Press 3. Software Testing and Quality Assurance: Theory and Practice – Kshirasagar Naik, Priyadarshi Tripathy, Wiley India 4. Effective Software Testing: 50 Specific Ways to Improve Your Testing – Elisabeth Hendrickson, Addison-Wesley

Master of Computer Applications (MCA) Sem II

Course: Elective II Digital Image Processing
Course Code: ODL MCA207   Credit: 04

No.	Module Description	
1	**Introduction to Digital Image Processing**	
	1.1	Overview of Digital Image Processing
	1.2	What is Image Processing? Applications and Examples, Image Representation: Pixels, Resolution, and Color Models
	1.3	Types of Images (Gray-scale, RGB, Binary, and Multispectral)
	1.4	Basic Image Operations,Image Sampling and Quantization,Image Representation in Memory,Image File Formats (BMP, JPEG, PNG, TIFF, etc.)
	1.5	Introduction to Image Processing Tools,MATLAB/Octave, Python (OpenCV, NumPy), ImageJ
2	**Image Enhancement**	
	2.1	Point Processing Operations, Contrast Adjustment (Brightness, Histogram Equalization), Thresholding and Image Binarization
	2.2	Spatial Domain Filtering,Smoothing Filters (Mean, Gaussian Filters), Sharpening Filters (Laplacian, Sobel, Prewitt) Edge
	2.3	Frequency Domain Processing,Fourier Transform and Image Filtering, Frequency Filtering (Low-pass, High-pass filters), Image Compression (Lossless, Lossy Compression Techniques)
3	**Image Restoration**	
	3.1	Noise Models and Types

	3.2	Types of Noise (Gaussian, Salt and Pepper, Speckle), Noise Removal Techniques (Median Filtering, Wiener Filtering)
	3.3	Image Deconvolution, Degradation Models (Blur, Motion Blur),Inverse Filtering and Wiener Deconvolution .Blind Deconvolution and Regularization Techniques
4	**Thresholding Techniques**	
	4.1.	Thresholding Techniques, Global Thresholding (Otsu's Method), Adaptive Thresholding.
	4.2.	Edge-based Segmentation, Canny Edge Detection, Region Growing and Watershed Segmentation
	4.3.	Clustering-based Segmentation, k-Means Clustering, Mean-Shift Segmentation, Region-based Segmentation, Active Contours (Snakes)Graph- based Segmentation Techniques
5	**Morphological Image Processing**	
	5.1	Basic Morphological Operations, Dilation, Erosion, Opening, and Closing Hit- or-Miss Transform
	5.2	Advanced Morphological Techniques
	5.3	Applications of Morphology, Shape Analysis and Object Recognition, Noise Removal and Object Detection

Text books/ Resources:	1. Digital Image Processing – Rafael C. Gonzalez, Richard E. Woods, Pearson 2. Digital Image Processing Using MATLAB – Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, Pearson
Reference Books/ Resources	1. Fundamentals of Digital Image Processing – Anil K. Jain, Pearson 2. Digital Image Processing: An Algorithmic Introduction Using Java – Wilhelm Burger, Mark J. Burge, Springer 3. Image Processing, Analysis, and Machine Vision – Milan Sonka, Vaclav Hlavac, Roger Boyle, Cengage Learning 4. Computer Vision: Algorithms and Applications – Richard Szeliski, Springer 5. Digital Image Processing and Analysis: Human and Computer Vision Applications with CVIPtools – Scott E. Umbaugh, CRC Press 6. Practical Image and Video Processing Using MATLAB – Oge Marques, Wiley

No.	Module Description	
	Master of Computer Applications (MCA) Sem II **Course: Software Project Management** **Course Code: ODL MCA301 Credit: 04**	
No.	**Module Description**	
1	**Fundamentals of Software Project Planning and Estimation**	
	1.1	Introduction
	1.2	Tools and Techniques
	1.3	Software Project Planning
	1.4	Understand the Project Need
	1.5	Create the Project Plan
	1.6	Diagnosing Project Planning Problems
	1.7	Project Estimation
	1.8	Element of Successful Estimate
	1.9	Wideband Delphi Estimation
	1.10	Other Estimation Techniques
	1.11	Diagnosing Estimation Problems
2	**Advanced Project Scheduling and Quality Assurance Techniques**	
	2.1	Project Schedule
	2.2	Building the Project Schedules
	2.3	Managing Multiple Projects
	2.4	Use the Schedule to Manage Commitments
	2.5	Diagnosing Scheduling Problems
	2.6	Review, Inspections
	2.7	Desk checks, Walkthrough
	2.8	Code Reviews, Pair Programming
	2.9	Use Inspections to Manage Commitments
	2.10	Diagnosing Review Problems
3	**Comprehensive Software Requirements Management**	
	3.1	Software Requirements
	3.2	Requirement Elicitation
	3.3	Use Case
	3.4	Software Requirements Specification
	3.5	Change Control
	3.6	Introduce Software Requirements Carefully
	3.7	Diagnosing Software Requirement Problems
4	**Overview of Software Development Life Cycle (SDLC) Models**	
	4.1	Software Development File Cycle: Introduction, Software Process
	4.2	SDLC Life Cycle, Need of SDLC,
	4.3	SDLC Models
	4.4	Waterfall Model, RAD Model, Spiral Model
	4.5	V-Model, Incremental Model, Agile Model
	4.6	Iterative Model, Big-Bang Model, Prototype Model
5	**Advanced Software Design, Testing, and Process Improvement**	

|	5.1	Design and Programming
	5.2	Review the Design, Vision Control with Subversion
	5.3	Refactoring, Unit Testing, Use Automation, Be Careful with Existing Projects
	5.4	Diagnosing Design and Programming Problems
	5.5	Software Testing: Test Plan and Test Case, Test Execution
	5.6	Defect Tracking and Triage
	5.7	Test Environment and Performance Testing
	5.8	Smoke Test, Test Automation, Postmortem Reports
	5.9	Using Software Testing Effectively
	5.10	Diagnosing Software Testing Problem
	5.11	Understanding Change: Why Change Fails, How make Change Succeed
	5.12	Process Improvement: Life without a Software Process, Software Process Improvement
	5.13	Moving Forward

Textbooks/ Resources:	1. Andrew Stellman and Jennifer Greene, "Applied Software Project Management", O'REILLY. https://www.javatpoint.com/software-engineering-software-development-life- cycle
Reference Books /Resources	1. Jack T. Marchewka, "Information Technology Project Management", WILEY 2. Bob Hughes and Mike Cotterell, "Software Project Management", McGraw Hill

Master of Computer Applications (MCA) Sem III Course: Machine Learning Course Code: ODL MCA302 Credit: 04	

No.	Module Description	
1	**Introduction to Machine Learning Techniques**	
	1.1	Introduction and Future Scope of Machine Learning
	1.2	Techniques of Machine Learning
	1.3	Applications of Machine Learning
	1.4	Types of data in Machine Learning
	1.5	Data Preprocessing Techniques
	1.6	Continues and discrete data Dimensionality Reduction
2	**Regression**	
	2.1	Introduction to Regression
	2.2	Types of Regression model
	2.3	Simple Linear Regression
	2.4	Multiple Linear Regression
	2.5	Polynomial Regression
	2.6	Decision Tree Regression
	2.7	Random Forest Regression
	2.8	Model Building using Least squares
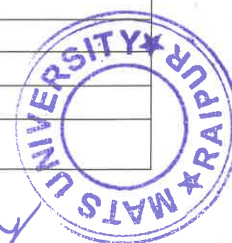
	2.9	Model Accuracy & Selection
3		**Classification**
	3.1	Introduction to Classification
	3.2	Logistic Regression
	3.3	K-Nearest Neighbors (K-NN)
	3.4	Support Vector Machine (SVM)
	3.5	Naive Bayes
	3.6	Ensemble Methods
4		**Unsupervised Learning & Association Rule Mining**
	4.1	Introduction to Unsupervised learning
	4.2	K-Means Algorithm
	4.3	K-Means – Variations
	4.4	Detecting Outliers
	4.5	Hierarchical Clustering
	4.6	Association Rule Mining
	4.7	Apriori Algorithm
	4.8	Time series Prediction
	4.9	Markov Process
	4.10	Hidden Markov Model
5		**Natural Language Processing**
	5.1	Introduction to NLP
	5.2	Applications of NLP
	5.3	Classical Vs Deep Learning Models
	5.4	Bag of words model
	5.5	Tools and techniques for NLP

Text Books/ Resources:	1. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, "Machine Learning", Pearson
Reference Books/ Resources	1. Aurelien Geron ,"Hands–On Machine Learning with Scikit–Learn and TensorFlow"(3rd Edition") Paperback, 2017. 2. Sebastian Raschka ,Vahid Mir Jalili, "Python Machine Learning", Third Edition Packt Publications, 2019. 3. Kevin P. Murph, "Machine learning: a probabilistic perspective", MIT Press, 2012.

		Master of Computer Applications (MCA) Sem III Course: Artificial Intelligence Course Code: ODL MCA304 Credit: 04
	Module Description	
1	**Introduction to Artificial Intelligence.**	
	1.1	Introduction: What Is AI?
	1.2	The Foundations of Artificial Intelligence.
	1.3	The History of Artificial Intelligence, AI Techniques, advantages, and limitations of AI, Impact and Examples of AI, Applications domains of AI.
	1.4	The State of the Art.
	1.5	Intelligent Agents: Agents and Environments.
	1.6	Good Behavior: The Concept of Rationality.
	1.7	The Nature of Environments.
	1.8	The Structure of Agents.
2	**Introduction to Algorithms in Artificial Intelligence.**	
	2.1	Introduction to Algorithms in Artificial Intelligence: Definition
	2.2	Significance of algorithms in artificial intelligence.
	2.3	Basic components of an algorithm: input, output,
	2.4	Control structures.
	2.5	Introduction to problem-solving techniques in Artificial Intelligence
	2.6	Knowledge representation.
	2.7	Reasoning.
3	**Search Algorithms**	
	3.1	Introduction to search algorithms
	3.2	Depth-first search.
	3.3	Breadth-first search
	3.4	Heuristic search techniques
	3.5	A* search
	3.6	Hill climbing, Min-Max Search, Alpha-Beta.
4	**Introduction to neural networks and Expert System**	
	4.1.	Models of neuron McCulloch – Pitts model.
	4.2.	Perceptron, Adaline model, Basic learning laws.
	4.3.	Topology of neural network architecture, Multilayer Neural Networks, Learning Methods.
	4.4	The human element in expert systems.
5	**Introduction of Fuzzy logic and Neuro Fuzzy Systems and Case Study with Artificial Intelligence**	
	5.1	Fuzzy sets, Fuzzy model, Fuzzy rule generation Fuzzy inference system.
	5.2	Integrating Artificial Intelligence in Yoga Applications.
	5.3	Personalized yoga routines based on user preferences and goals.
	5.4	AI-powered progress tracking and performance analytics.
	5.5	Design considerations for AI-enhanced yoga Applications.

Text books/ Resources:	1. "Artificial Intelligence" by Stuart Russell and Peter Norvig, Third Edition 2010, Pearson Education, Inc. 2. "Artificial Intelligence: Foundations of Computational Agents" by David L. Poole and Alan K. Mackworth. 3. "Introduction to Artificial Intelligence and Expert Systems" by Dan W. 4. Patterson, Publisher. Pearson Education India, 2015, Pages 464. 5. Introduction to Neural Network Using MatLab 6.0 by Dr. S N Sivanandam. 6. Neural Network Design by Martin T. Hagan.
Reference Books/ Resources	1. "Artificial Intelligence" by Rich, E., Knight, K., & Nair, S. (2009), Tata McGraw 2. Hill. 3. " AI Algorithms Lab: Hands-On Exercises in Artificial Intelligence" By John Smith (Year: 2023). 4. SWAYAM NPTEL/MOOCs: 5. https://onlinecourses.nptel.ac.in/noc22_cs56/preview 6. https://onlinecourses.nptel.ac.in/noc23_cs18/preview 7. GitHub Links: 1. https://github.com/topics/artificial-intelligence.

Master of Computer Applications (MCA) Sem III
Course: Internet of Things
Course Code: ODL MCA310 Credit: 02

No.		Module Description
1		**Fundamentals of IoT**
	1.1	Introduction, Definitions & Characteristics, Challenges of IoT.
	1.2	IoT Architectures, Physical & Logical Design of IoT, Enabling Technologies in IoT.
	1.3	History of IoT, About Things in IoT.
	1.4	The Identifiers in IoT, About the Internet in IoT
	1.5	IoT frameworks, IoT and M2M.
2		**Sensors Networks**
	2.1	Definition, Types of Sensors, Types of Actuators, Examples and Working,
	2.2	IoT Development Boards: Arduino IDE and Board Types, Raspberri Pi Development Kit
	2.3	RFID Principles and components,
	2.4	History and Context
	2.5	The node, Connecting nodes, Networking Nodes, WSN and IoT.
3		**Applications of IoT**
	3.1	Home Automation, Smart Cities, Energy, Retail Management, Logistics, Agriculture, Health and Lifestyle, Industrial IoT
	3.2	Legal challenges, IoT design Ethics
	3.3	IoT in Environmental Protection.

Text Books/ Resources:	1. CunoPfister, "getting started with the Internet of Things : Connecting Sensors and MicroController to the Cloud"kindle2011 : TB#1
	2. ArsheepBagha ,Vijay Madisetti,"Internet of Things":A Hands On
Reference Books/ Resources: .	1. https://github.com/jollyvjacob/Books/blob/master/book/Internet%20of%20 Things%20wit h%20ESP8266.pdf
	2. https://youtu.be/WUYAjxnwjU4?si=e2svqjWRREf9SZL9

	Master of Computer Applications (MCA) Sem III **Course: Cloud Computing** **Course Code: MCA 307 Credit: 02**	
No.	**Module Description**	
1	**Cloud Computing Basics**	
	1.1	Cloud Computing Overview, Advantages, Disadvantages
	1.2	How it works, cloud computing architecture and its components
	1.3	Cloud deployment models, Applications
	1.4	IAAS (infrastructure as a service)
	1.5	SAAS (Software as a service)
	1.6	PAAS (Platform as a service)
2	**Virtualization and Abstraction**	
	2.1	Overview of virtualization, Type of virtualization, uses of virtualization.
	2.2	How abstraction is provided in cloud, advantages, disadvantages
	2.3	Hypervisor, Type of hypervisor
	2.4	Load balancing, cloud security tools and technologies
	2.5	Security concerns, legal issues and aspects, multitenancy issues
3	**Introduction to Simulator**	
	3.1	Overview of simulator
	3.2	Understanding of Cloud sim simulator
	3.3	Cloud sim architecture (user code, Cloud Sim, Grid Sim, Sim java)
	3.4	Working Platform of Clod Sim
	3.5	Introduction to Green Cloud
4	**Introduction to AWS**	
	4.1	Introduction to AWS, AWS free tier account setup
	4.2	Amazon web services ecosystem
	4.3	Compute services, Storage services
	4.4	AWS networking services
	4.5	Aws glacier, Terminology, Amazon glacier vs Amazon S3
Text Books/ Resources:	1. Cloud Computing: Web based Applications that change the way you work and collaborate online -Michael Miller.	
	2. Link of Book: https://books.google.co.in/books?id=mfoLMXve2gEC&printsec=front cover#v=onepage&q&f=false	
Reference Books/ Resources:	1. Sandeep Bhowmik, "Cloud Computing" CAMBRIDGE	
	2. https://www.javatpoint.com/cloud-computing	
	3. https://www.geeksforgeeks.org/what-is-cloudsim/	
	4. https://www.tutorialspoint.com/green-cloud-computing-and-its-strategies	

Master of Computer Applications (MCA) Sem IV	
Course: Organizational Behavior and Professional Ethics	
Course Code: ODL MCA402 Credit: 02	

No.	Module Description	
1	**Introduction to Organizational Behavior**	
	1.1	Definition and Importance of Organizational Behavior (OB)
	1.2	Foundations of OB: Psychological, Social, and Cultural Influences
	1.3	Key Concepts in OB: Motivation, Leadership, Communication, Teamwork, etc.
	1.4	Levels of Analysis: Individual.
	1.5	Group, and Organizational
2	**Individual Behavior in Organizations**	
	2.1	Personality and its Impact on Work Behavior,Types of Personality Models (Big Five, MBTI)
	2.2	Perception and Decision Making,Process of Perception,Biases in Decision Making
	2.3	Attitudes: Job Satisfaction, Organizational Commitment and Engagement
	2.4	Emotions in the Workplace
	2.5	Type of emotions
3	**Entrepreneurship and Motivation Theories**	
	3.1.	Classical Motivation Theories, Maslow's Hierarchy of Needs Herzberg's Two-Factor Theory, McGregor's Theory X and Y
	3.2.	Entrepreneurship Small Business Entrepreneurship, Scalable Start-up Entrepreneurship, Social Entrepreneurship and Large Company Entrepreneurship.
	3.3.	Goal Setting Theory (Locke & Latham),
	3.4.	Equity Theory (Adams Self-Determination Theory
	3.5	Motivational Techniques in Organizations
4	**Group Behavior and Team Dynamics**	
	4.1.	Types of Groups: Formal and Informal Groups
	4.2.	Group Development Stages (Tuckman's Model)
	4.3.	Teamwork and Team Effectiveness
	4.4.	Conflict in Groups and Conflict Resolution Strategies
5	**Leadership and Power in Organizations**	
	5.1.	Leadership Theories, Trait Theory, Behavioral Theories,and Contingency Models (e.g., Fiedler's Contingency Theory), Transformational and Transactional Leadership, Servant Leadership
	5.2.	Power and Politics in Organizations
	5.3.	Sources of Power, Organizational Politics and Influence Tactics
	5.4.	Ethical Leadership

Textbooks/ Resources:	1. "Organizational Behavior" by Stephen P. Robbins and Timothy A. Judge 2. "Organizational Behavior: A Practical, Problem-Solving Approach" by Debra L: Nelson and James Campbell Quick 3. "Essentials of Organizational Behavior" by Stephen P. Robbins and Timothy A. Judge
Reference Books/ Resources	1. "The Moral Compass of the Corporation: Business Ethics and the Path to Corporate Social Responsibility" by Denise Rousseau. 2. "Ethics in the Workplace: Tools and Tactics for Organizational Transformation" by Craig E. Johnson