

**DR. RAMMANOHAR LOHIA AVADH UNIVERSITY  
AYODHYA U.P.**



**Evaluation Scheme & Syllabus**

**for**

**Master of Computer Application**

**of Third Year**

**On**

**Choice Based Credit System**

**(Effective from the Session: 2020-21)**

**Dr. RamManohar Lohia Avadh University, Ayodhya**  
**Study and Evaluation Scheme**  
**MCA (Master of Computer Applications)**  
**(Effective From Session 2019-20)**  
**Year – III Semester – V**

Sl. No.	Subject Code	Subject Name	Periods			Evaluation Scheme					Credit
			L	T	P	Sessional Exams			ESE	Subject	
						CT	TA	Total		Total	
THEORY SUBJECT											
1	MCA 501	Computer Network	3	1	0	30	20	50	100	150	04
2	MCA 502	Dot Net Framework & C#	3	1	0	30	20	50	100	150	04
3	MCA 503	Software Engineering	3	1	0	30	20	50	100	150	04
4	MCA 504 (i)-(v)	Elective - I	3	1	0	20	10	30	70	100	04
5	MCA 505	Python Programming	3	1	0	30	20	50	100	150	04
6	MCA 506	Embedded System	3	1	0	20	10	30	70	100	04
Practical											
7	MCA 507	Computer Network Lab	0	0	3	10	10	20	30	50	02
8	MCA 508	Dot Net Framework & C# Lab	0	0	3	10	10	20	30	50	02
9	MCA 509	Software Engineering Lab	0	0	3	10	10	20	30	50	02
10	MCA 510	Python Programming Lab	0	0	3	10	10	20	30	50	02
		Total	18	6	12	-	-	-	-	1000	32

**Elective - I**

MCA 504-(i)	Computer Graphics and Animation
MCA 504-(ii)	Android Programming
MCA 504-(iii)	Multimedia
MCA 504-(iv)	ERP System
MCA 504-(v)	<b>Client Server Computing</b>

## PAPER—I

### MCA-501: COMPUTER NETWORK

L	T	P	MM
3	1	0	100

#### Unit -I

Introduction Concepts: Goals and Applications of Networks, Network structure and architecture, The OSI reference model, services, Network Topology Design - Delay Analysis, Back Bone Design, Local Access Network Design, Physical Layer Transmission Media, Switching methods, ISDN, Terminal Handling.

#### Unit-II

Medium Access sub layer: Medium Access sub layer - Channel Allocations, LAN protocols - ALOHA protocols - Overview of IEEE standards - FDDI. Data Link Layer - Elementary Data Link Protocols, Sliding Window protocols, Error Handling.

#### Unit - III

Network Layer: Network Layer - Point - to Pont Networks, routing, Congestion control Internetworking - TCP / IP, IP packet, IP address, IPv6.

#### Unit - IV

Transport Layer: Transport Layer - Design issues, connection management, session Layer-Design issues, remote procedure call. Presentation Layer-Design issues, Data compression techniques, cryptography - TCP - Window Management.

#### Unit-V

Application Layer: Application Layer: File Transfer, Access and Management, Electronic mail, Virtual Terminals, Other application. Example Networks - Internet and Public Networks.

#### Text Books :

- (i) Forouzen, "Data Communication and Networking", TMH
- (ii) A.S. Tanenbaum, Computer Networks, Pearson Education
- (iii) W. Stallings, Data and Computer Communication, Macmillan Press

#### References :

- 1. Anuranjan Misra, "Computer Networks", Acme Learning
- 2. G. Shanmugarathinam, "Essential of TCP/ IP", Firewall Media

## PAPER—II

L	T	P	MM
3	1	0	100

### MCA 502: Dot Net Framework and C#

**Unit-1** The .Net framework: Introduction, The Origin of .Net Technology, Common Language Runtime (CLR), Common Type System (CTS), Common Language Specification (CLS), Microsoft Intermediate Language (MSIL), Just-In –Time Compilation, Framework Base Classes.

**Unit-II** C -Sharp Language (C#): Introduction, Data Types, Identifiers, Variables, Constants, Literals, Array and Strings, Object and Classes, Inheritance and Polymorphism, Operator Overloading, Interfaces, Delegates and Events. Type conversion.

**Unit-III** C# Using Libraries: Namespace- System, Input-Output, Multi-Threading, Networking and sockets, Managing Console I/O Operations, Windows Forms, Error Handling.

**Unit-IV** Advanced Features Using C#: Web Services, Window Services, Asp.net Web Form Controls, ADO.Net. Distributed Application in C#, Unsafe Mode, Graphical Device interface with C#.

**Unit-V** .Net Assemblies and Attribute: .Net Assemblies features and structure, private and share assemblies, Built-In attribute and custom attribute. Introduction about generic.

### References:

1. Wiley, "Beginning Visual C# 2008", Wrox
2. Fergal Grimes, "Microsoft .Net for Programmers". (SPI)
3. Balagurusamy, "Programming with C#", (TMH)
4. Mark Michaelis, "Essential C# 3.0: For .NET Framework 3.5, 2/e, Pearson Education
5. ShibiParikkar, "C# with .Net Frame Work", Firewall Media.

## PAPER—III

L	T	P	MM
3	1	0	100

### MCA 503: SOFTWARE ENGINEERING

**Unit-I:** Introduction Introduction to Software Engineering, Software Components, Software Characteristics, Software Crisis, Software Engineering Processes, Similarity and Differences from Conventional Engineering Processes, Software Quality Attributes. Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models.

**Unit-II:** Software Requirement Specifications (SRS) Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, Information Modeling, Data Flow Diagrams, Entity Relationship Diagrams, Decision Tables, SRS Document, IEEE Standards for SRS. Software Quality Assurance (SQA): Verification and Validation, SQA Plans, Software Quality Frameworks, ISO 9000 Models, SEI-CMM Model.

**Unit-III:** Software Design Basic Concept of Software Design, Architectural Design, Low Level Design: Modularization, Design Structure Charts, Pseudo Codes, Flow Charts, Coupling and Cohesion Measures, Design Strategies: Function Oriented Design, Object Oriented Design, Top-Down and Bottom-Up Design. Software Measurement and Metrics: Various Size Oriented Measures: Halstead's Software Science, Function Point (FP) Based Measures, Cyclomatic Complexity Measures: Control Flow Graphs.

**Unit-IV:** Software Testing Testing Objectives, Unit Testing, Integration Testing, Acceptance Testing, Regression Testing, Testing for Functionality and Testing for Performance, Top-Down and Bottom-Up Testing Strategies: Test Drivers and Test Stubs, Structural Testing (White Box Testing), Functional Testing (Black Box Testing), Test Data Suit Preparation, Alpha and Beta Testing of Products. Static Testing Strategies: Formal Technical Reviews (Peer Reviews), Walk Through, Code Inspection, Compliance with Design and Coding Standards.

**Unit-V:** Software Maintenance and Software Project Management Software as an Evolutionary Entity, Need for Maintenance, Categories of Maintenance: Preventive, Corrective and Perfective Maintenance, Cost of Maintenance, Software Re- Engineering, Reverse Engineering. Software Configuration Management Activities, Change Control Process, Software Version Control, An Overview of CASE Tools. Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration, Constructive Cost Models (COCOMO), Resource Allocation Models, Software Risk Analysis and Management.

### References:

1. R. S. Pressman, Software Engineering: A Practitioners Approach, McGraw Hill.
2. Rajib Mall, Fundamentals of Software Engineering, PHI Publication.
3. K. K. Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers.
4. Pankaj Jalote, Software Engineering, Wiley
5. Carlo Ghezzi, M. Jarayeri, D. Manodrioli, Fundamentals of Software Engineering, PHI Publication.
6. Ian Sommerville, Software Engineering, Addison Wesley.
7. KassemSaleh, "Software Engineering", Cengage Learning.
8. Pfleeger, Software Engineering, Macmillan Publication.

L	T	P	MM
3	1	0	70

**ELECTIVE I****MCA 504-(i) COMPUTER GRAPHICS AND ANIMATION**

**Unit – I** Introduction and Line Generation: Types of computer graphics, Graphic Displays- Random scan displays, Raster scan displays, Frame buffer and video controller, Points and lines, Line drawing algorithms, Circle generating algorithms, Mid point circle generating algorithm, and parallel version of these algorithms.

**Unit – II** Transformations: Basic transformation, Matrix representations and homogenous coordinates, Composite transformations, Reflections and shearing. Windowing and Clipping: Viewing pipeline, Viewing transformations, 2-D Clipping algorithms- Line clipping algorithms such as Cohen Sutherland line clipping algorithm, Liang Barsky algorithm, Line clipping against non rectangular clip windows; Polygon clipping – Sutherland Hodgeman polygon clipping, Weiler and Atherton polygon clipping, Curve clipping, Text clipping.

**Unit – III** Three Dimensional: 3-D geometric primitives, 3-D Object representation, 3-D Transformation, 3-D viewing, projections, 3-D Clipping.

**Unit – IV** Curves and Surfaces: Quadric surfaces, Spheres, Ellipsoid, Blobby objects, Introductory concepts of Spline, Bspline and Bezier curves and surfaces. Hidden Lines and Surfaces: Back Face Detection algorithm, Depth buffer method, A- buffer method, Scan line method, basic illumination models – Ambient light, Diffuse reflection, Specular reflection and Phong model, Combined approach, Warn model, Intensity Attenuation, Color consideration, Transparency and Shadows.

**Unit – V** Computer Animations : Conventional and computer assisted animation, design of animation sequences, interpolation, simple animation effects, animation languages ( Key Frame System, Parameterized systems), motion specifications, methods of controlling animation.

**References:**

1. Donald Hearn and M Pauline Baker, “Computer Graphics C Version”, Pearson Education
2. Amrendra N Sinha and Arun D Udai,” Computer Graphics”, TMH
3. Donald Hearn and M Pauline Baker, “ Computer Graphics with OpenGL”, Pearson education
4. Steven Harrington, “Computer Graphics: A Programming Approach”, PHI or TMH
5. James D Foley, A V Dam, S K Feiner and John f Hughes, “Computer Graphics Principles and Practice” Second Edition in C.

L	T	P	MM
3	1	0	70

**ELECTIVE I****MCA 504-(ii)      Android Programming****UNIT I**

Introducing the android computing platform, History of android, android software stack, Developing end user application using android SDK, android java packages, Setting up the development environment, Installing android development tools (ADT), Fundamental components, Android virtual devices, Running on real device, Structure of android application, Application life cycle.

**UNIT II**

Understanding android resources - String resources, Layout resources, Resource reference syntax, Defining own resource IDs - Enumerating key android resources, string arrays, plurals, Colour resources, dimension resources, image resources, Understanding content providers - android built in providers, exploring databases on emulator, architecture of content providers, structure of android content URIs, reading data using URIs, using android cursor, working with where clause, inserting updates and deletes, implementing content, Understanding intents – basics of intents, available intents, exploring intent composition, Rules for Resolving Intents to Their Components, ACTION PICK, GET CONTENT, pending intents

**UNIT III**

User interfaces development in android - building UI completely in code, UI using XML, UI in XML with code, Android's common controls - Text controls, button controls, checkbox control, radio button controls, image view, date and time controls, map view control, understanding adapters, adapter views, list view, grid view, spinner control, gallery control, styles and themes, Understanding layout managers - linear layout manager, table layout manager, relative layout manager, frame layout manager, grid layout manager.

**UNIT IV**

Android menus - creating menus, working with menu groups, responding to menu items, icon menu, sub menu, context menu, dynamic menus, loading menu through XML, popup menus, Fragments in android - structure of fragment, fragment life cycle, fragment transaction and back stack, fragment manager, saving fragment state, persistence of fragments, communications with fragments, startActivity() and setTargetFragment(), using dialogs in android, dialog fragments, working with toast, Implementing action bar - tabbed navigation action bar activity, implementing base activity classes, tabbed action bar and tabbed listener, debug text view layout, action bar and menu interaction, list navigation action bar activity, spinner adapter, list listener, list action bar, standard navigation action bar activity, action bar and search view, action bar and fragments.

**UNIT V**

Persisting data - Files, saving state and preferences - saving application data, creating, saving and retrieving shared preferences, preference framework and preference activity, preference layout in XML, native preference controls, preference fragments, preference activity, persisting the application state, including static files as resources, Working with file system, SQLite - SQLite types, database manipulation using SQLite, SQL and database centric data model for android, android database classes.

**References:**

1. *Pro Android 4*, Satya Komatineni & Dave MacLean, Apress.
2. *Professional Android 4 Application Development*, Retomeier, Wrox.
3. *Programming Android*, Zigurd

L	T	P	MM
3	1	0	70

**ELECTIVE I****MCA 504-(iii) MULTIMEDIA SYSTEM****UNIT I**

Evolution of Multimedia and its objects, Scope of multimedia in business & work, Production and planning of Multimedia applications. Multimedia hardware, Memory & Storage Devices, Communication Devices, Multimedia Software, Presentation and object generation tools, Video, sound, Image capturing, Authoring Tools, Card & Page Based Authoring Tools.

**UNIT II**

Production and Planning of Multimedia building blocks, Text, sound (MIDI), Digital Audio, Audio File Formats, MIDI under Windows environment, Audio & Video Capture.

**UNIT III**

Macromedia products, Basic drawing techniques, Advance animation techniques, Creating multi layer combining interactivity and multiple scenes, Creating transparency effects using text in Flash, Flash animation.

**UNIT IV**

Digital Audio Concepts, Sampling variables, Loss Less compression of sound, Lossy compression & Silence compression.

**UNIT V**

Multimedia monitor bitmaps, Vector drawing, Lossy graphic compression, Image file formatic animations Image standards, J P E G compression, Zig Zag coding, Video representation, colors, video compression, MPEG standards, MHEG standard, recent development in multimedia, Multimedia Application Planning, Costing, Proposal preparation, and Financing-Case study of a typical industry.

***References:***

1. Andreas Halzinger, "Multimedia Basics", Vol-I to Vol-III, Firewall Media, New Delhi.
2. Tay Vaughan, "Multimedia Making It work", Tata McGraw Hill.
3. Buford, "Multimedia Systems", Addison Wesley.
4. Agarwal and Tiwari, "Multimedia Systems", Excel.
5. Rosch, "Multimedia Bible", Sams Publishing
6. Sleinreitz, "Multimedia Systems", Addison Wesley
7. Ken Milburn, John Croteau, "Flash 4 web special Effects, Animation & Design Handbook", Dreamtech Press.
8. John Villamil-Casanova & Louis Molina, "Multimedia-Production, Planning & Delivery", PHI



L	T	P	MM
3	1	0	70

**ELECTIVE I****MCA 504-(iv) ERP SYSTEMS**

**UNIT - I** ERP Introduction, Benefits, Origin, Evolution and Structure : Conceptual Model of ERP, The Evolution of ERP, The Structure of ERP.

**UNIT - II** Business Process Reengineering, Data ware Housing, Data Mining, Online Analytic Processing(OLAP), Product Life Cycle Management(PLM),LAP, Supply chain Management.

**UNIT - III** ERP Marketplace and Marketplace Dynamics : Market Overview, Marketplace Dynamics, The Changing ERP Market.

ERP- Functional Modules: Introduction, Functional Modules of ERP Software, Integration of ERP, Supply chain and Customer Relationship Applications.

**UNIT - IV** ERP Implementation Basics, ERP Implementation Life Cycle, Role of SDLC/SSAD, Object Oriented Architecture, Consultants, Vendors and Employees,

**UNIT - V** ERP & E-Commerce, Future Directives- in ERP, ERP and Internet, Critical success and failure factors, Integrating ERP into organizational culture. Using ERP tool: either SAP or ORACLE format to case study

**References:**

1. Alexis Leon, “ERP Demystified”, Tata McGraw Hill
2. Rahul V. Altekhar “Enterprisewide Resource Planning”, Tata McGraw Hill,
3. Vinod Kumar Garg and Venkitakrishnan N K, “Enterprise Resource Planning – Concepts and Practice”, PHI
4. Joseph A Brady, Ellen F Monk, Bret Wagner, “Concepts in Enterprise Resource Planning”, Thompson Course Technology
5. Mary Summer, “Enterprise Resource Planning”- Pearson Education

L	T	P	MM
3	1	0	70

## ELECTIVE I

## MCA 504-(v) CLIENT SERVER COMPUTING

## UNIT I

**Client/Server Computing:** DBMS concept and architecture, Single system image, Client Server architecture, mainframe-centric client server computing, downsizing and client server computing, preserving mainframe applications investment through porting, client server development tools, advantages of client server computing.

## UNIT II

**Components of Client/Server application:** The client: services, request for services, RPC, windows services, fax, print services, remote boot services, other remote services, Utility Services & Other Services, Dynamic Data Exchange (DDE), Object Linking and Embedding (OLE), Common Object Request Broker Architecture (CORBA).

The server: Detailed server functionality, the network operating system, available platforms, the network operating system, available platform, the server operating system.

## UNIT III

**Client/Server Network:** connectivity, communication interface technology, Interposes communication, wide area network technologies, network topologies (Token Ring, Ethernet, FDDI, CDDI) network management, Client-server system development: Software, Client–Server System Hardware: Network Acquisition, PC-level processing unit, Macintosh, notebooks, pen, UNIX workstation, x-terminals, server hardware.

## UNIT IV

**Data Storage:** magnetic disk, magnetic tape, CD-ROM, WORM, Optical disk, mirrored disk, fault tolerance, RAID, RAID-Disk network interface cards. Network protection devices, Power Protection Devices, UPS, Surge protectors.

**Client Server Systems Development:** Services and Support, system administration, Availability, Reliability, Serviceability, Software Distribution, Performance, Network management, Help Disk, Remote Systems Management Security, LAN and Network Management issues.

## UNIT V

**Client/Server System Development:** Training, Training advantages of GUI Application, System Administrator training, Database Administrator training, End-user training. The future of client server Computing Enabling Technologies, The transformational system.

## References:

1. Patrick Smith & Steave Guengerich, “Client / Server Computing”, PHI
2. Dawna Travis Dewire, “Client/Server Computing”, TMH
3. Majumdar & Bhattacharya, “Database management System”, TMH
4. Korth, Silberchatz, Sudarshan, “Database Concepts”, McGraw Hill
5. Elmasri, Navathe, S.B, “Fundamentals of Data Base System”, Addison Wesley

L	T	P	MM
3	1	0	100

## MCA 505: PYTHON PROGRAMMING

### UNIT I

**Introduction:** History, Features, Setting up path, working with Python, Basic Syntax, Variable and Data Types, Operator,

**Conditional Statements:** If, If- else, Nested if-else

**Looping:** For, While, Nested loops

### UNIT II

**Control Statements:** Break, Continue, Pass, String Manipulation, Accessing Strings, Basic Operations, String slices, Function and Methods

**Lists:** Introduction, Accessing list, Operations, Working with lists, Function and Methods

**Tuple:** Introduction, Accessing tuples, Operations, Working, Functions and Methods

### UNIT III

**Dictionaries:** Introduction, Accessing values in dictionaries, working with dictionaries, Properties, Functions

**Functions:** Defining a function, calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables

**UNITs:** Importing UNIT, Math UNIT, Random UNIT, Packages, Composition,

### UNIT IV

**Input-Output:** Printing on screen, Reading data from keyboard, Opening and closing file , Reading and writing files, Functions

**Exception Handling:** Exception, Exception Handling, Except clause, Try ? Finally clause, User Defined Exceptions

### UNIT V

**Advanced Python:** Classes Objects, Reg Expressions, CGI Programming, Database Access, Networking, Sending Email, Multithreading, XML Processing, GUI Programming, Further Extensions

### References:

1. Programming With Python Book,Himalaya Publishing House Pvt. Ltd.
2. Python for Data Analysis by Wes McKinney
3. Python for Data Analysis by O'Reilly
4. Python Programming: An Introduction to Computer Science by Jhon Zelly
5. Learn Python in one day and learn it well Jamie Chan

L	T	P	MM
3	1	0	70

## **MCA 506: EMBEDDED SYSTEMS**

### **UNIT-I**

Introduction to embedded systems: Classification, Characteristics and requirements, Applications

### **UNIT-II**

Timing and clocks in Embedded systems, Task Modeling and management, Real time operating system issues.

### **UNIT-III**

Signals, frequency spectrum and sampling, digitization (ADC, DAC), Signal Conditioning and Processing. Modeling and Characterization of Embedded Computation System.

### **UNIT-IV**

Embedded Control and Control Hierarchy, Communication strategies for embedded systems: Encoding and Flow control.

### **UNIT-V**

Fault-Tolerance, Formal Verification, Trends in Embedded Processor, OS, Development Language

### **References:**

1. Prasad, Embedded /Real Time System, Concept, Design and Programming Black Book, Wiley India
2. R. Gupta, "Co-synthesis of Hardware and Software for Embedded Systems", Kluwer
3. Shibu K.V., "Introduction to Embedded Systems", TMH
4. Marwedel, "Embedded System Design", Springer

## MCA 507: Computer Networks Lab

L	T	P	MM
0	0	3	50

1. Programs using TCP Sockets (like date and time server & client, echo server & client, etc.)
2. Programs using UDP Sockets (like simple DNS)
3. Programs using Raw sockets (like packet capturing and filtering)
4. Programs using RPC
5. Simulation of sliding window protocols
6. Fundamental of NS2 programming
6. Fundamental of NS3 programming

## MCA 508: Net Frame Work & C# Lab

L	T	P	MM
0	0	3	50

Write programs in C# illustrating

1. The use of sequence, conditional and iteration construct.
2. Various operators like logical, arithmetical, relational, etc.
3. Overloading of various operators.
4. Use of Fried, Inline, and Static Member functions, default arguments.
5. Use of destructor and various types of constructor.
6. Various forms of Inheritance.
7. Use of virtual functions, virtual Base Class, delegates.
8. File operation.
9. Simple web application using ASP Net.
10. Use of Active X controls.

Note : Students are advised to develop a small project illustrating the handling of database and screens in order to fully understand the C#.

## MCA 509: Software Engineering Lab

L	T	P	MM
0	0	3	50

1. Program for Configuration Management.
2. Perform SA/SD for the following software.
  - Hotel Automation System
  - Book Shop Automation Software.
  - Word processing Software.
  - Software Component Cataloguing Software.
3. Design and development of test cases for testing.
4. Writing program in Java for Computing Cyclomatic complexity.
5. Development of Software tool for Halstead Analysis.
6. Perform Cost/Benefit analysis.
7. Illustration of various activities of Software development using MS Project 2000.
8. Lab exercise involving development of various practical applications using software like VJ++VB, SYBASE, JDK. Students are to be given a major assignment to be completed using one or more of these tools. Student's exposure to any CASE tool is desirable.
9. Case studies : Payroll System, Banking System, Purchase Order System, Library management System, Railway Reservation System, Bill Tracking System, College Admission System, Sales Management System.

L	T	P	MM
0	0	3	50

## MCA 510: PYTHON Lab

1. Python Basic: Python Data Types - String , List , Dictionary, Tuple, Sets
2. Python Array
3. Python Conditional statements and loops
4. Python functions
5. Python Data Structures and Algorithms
6. Data Structure
7. Search and Sorting
8. Recursion
9. Python Date Time
10. Python Class
11. Python Math
12. Python File Input Output
13. Python Regular Expression
14. Python NumPy :Python NumPy arrays, Python NumPy Random, Python NumPy Math, Statistics, Trigonometry and Linear algebra , Python NumPy DateTime
15. Python Pandas : Python Pandas - DataFrame and Series
16. Python Web Scraping : Python Web Scraping

# Dr. RamManohar Lohia Avadh University, Ayodhya U.P.

## Study and Evaluation Scheme

MCA (Master of Computer Applications)

(Effective From Session 2020-21)

Year – III Semester – VI

Sl. No.	Subject Code	Subject Name	Periods			Evaluation Scheme					Credit
			L	T	P	Sessional Exams			ESE	Subject Total	
						CT	TA	Total			
	THEORY SUBJECT										
1	MCA 601	Big Data	3	1	0	30	20	50	50	150	04
2	MCA 602	Data Science	3	1	0	30	20	50	50	150	04
3	MCA 603	Machine Learning	3	1	0	30	20	50	50	150	04
4	MCA 604	Data Mining and warehousing	3	1	0	30	20	50	50	150	04
	Practical										
5	MCA 605	Big Data Lab	0	0	3	10	10	20	30	50	02
6	MCA 406	Data Science Lab	0	0	3	10	10	20	30	50	02
7	MCA 607	Machine Learning Lab	0	0	3	10	10	20	30	50	02
8	MCA 608	Data Mining and warehousing Lab	0	0	3	10	10	20	30	50	02
9	MCA 609	Project / Dissertation*	0	0	3	50	50	50	150	200	02
		Total	12	4	18	-	-	-	-	1000	26

Students make a project thesis in specific topic on Research area / Specialization based on latest technology. Maximum Two Students may be participated in one Project. After developing Project thesis student presenting an explanation on a specified concept may include seminar in it. Students develop project under the guidance of faculty members. Students must publish at least one paper in UGC care list / SCI index / Scopus index / Web science.

**Prepare Project Thesis according MCA Thesis Guideline 2020**

L	T	P	MM
3	1	0	100

**MCA 601: BIG DATA****UNIT I UNDERSTANDING:**

What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics

**UNIT II NOSQL DATA MANAGEMENT**

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models, sharding, master-slave replication, peer-peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations

**UNIT III BASICS OF HADOOP**

Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro file-based data structures

**UNIT IV MAP REDUCE APPLICATIONS**

Map Reduce workflows, unit tests with MRUnit, test data and local tests – anatomy of Map Reduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats

**UNIT V HADOOP RELATED TOOLS**

Hbase, data model and implementations, Hbase clients, Hbase examples – praxis. Cassandra, cassandra data model, cassandra examples, cassandra clients, Hadoop integration. Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation – HiveQL queries

**Text Books:**

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
3. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
4. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
5. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
6. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
7. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
8. Alan Gates, "Programming Pig", O'Reilley, 2011.



L	T	P	MM
3	1	0	100

## **MCA 602: DATA SCIENCE**

**Unit I INTRODUCTION TO DATA SCIENCE:** Introduction to Data Science and its importance, Data Science and Big data, The life cycle of Data Science, The Art of Data Science, Work with data, Types of Data, Data privacy, Data Security and ethics, Tools for Data Science, Data Cleaning, Data Munging, Data manipulation. Establishing computational environments for data scientists using Python with IPython and Jupyter Notebook.

**Unit II PYTHON FOR DATA SCIENCE-**Basic Python concepts, Python Data structures, String Manipulation, Functions, Class, Object, Overloading, Overriding, Inheritance, Information hiding, Modules, Packages and File handling

**NUMPY:** The Basics of NumPy Arrays - Computation on NumPy Arrays: Universal Functions - Aggregations: Min, Max, and Everything in Between Computation on Arrays: Broadcasting-Comparisons, Masks, and Boolean Logic Fancy Indexing-Sorting Arrays

**Unit III DATA MANIPULATION USING PANDAS:** Installing and Using Pandas, Introducing Pandas Objects, Data Indexing and Selection. Operating on Data in Pandas, Handling Missing Data, Hierarchical Indexing Combining Datasets: Concat and Append, Combining Datasets: Merge and Join. Aggregation and Grouping, Pivot Tables, Vectorized String Operations, Working with Time Series.

**INTRODUCTION TO DATABASES AND BASIC SQL:** Introduction to Databases, how to create a Database instance, Relational Database Concepts, CREATE Table Statement, SELECT Statement, COUNT, DISTINCT, LIMIT, INSERT Statement, UPDATE and DELETE Statements.

**ADVANCED SQL-** Using String Patterns, Ranges, Sorting Result Sets, Grouping Result Sets, Built-in database Functions, Date and Time Built-in Functions, Sub-Queries and Nested Selects, Working with Multiple Tables, Types of Joins with Examples

## **Unit IV DATA VISUALIZATION WITH MATPLOTLIB**

General Matplotlib Tips, Simple Line Plots, Simple Scatter Plots, Visualizing Errors Density and Contour Plots, Histograms, Binning and Density, Customizing Plot Legends Customizing Color bars, Multiple Subplots, Text and Annotation, Customizing Ticks Customizing Matplotlib: Configurations and Stylesheets, Geographic Data with Basemap.

**Unit V MACHINE LEARNING USING PYTHON:** Intro Machine Learning, Categories of Machine Learning algorithms, Dimensionality Reduction, Introducing Scikit-Application: Exploring Hand-written Digits. Feature Engineering- Naive Bayes Classification, Linear Regression, K-Nearest Neighbors (k-NN), SVM, k-Means Clustering, Decision Tree, Building Pipelines, Training Model, Saving Model, Loading Model, Writing API for Model using Flask, Deployment of Model

### **Text Book:**

1. Python Data Science Handbook-Essential Tools for Working with Data, Jake Vander Plas, O'Reilly Media, 2016.
2. Data Science from Scratch: First Principles with Python, Joel Grus, O'Reilly, 2015.
3. SQL Cookbook, 2nd Edition, O'Reilly, 2020
4. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, O'Reilly, 2020

### **Reference Book:**

1. Python for Data Analysis, Wes McKinney, O'Reilly Media, 2013.
2. Field Cady, "Data Science Hand Book", John Wiley & Sons, 2017.
3. Fundamentals of Data Science, Samuel Burns, Amazon KDP printing and Publishing, 2019.
4. Doing Data Science, Straight Talk from The Frontline, Cathy O'Neil and Rachel Schutt. O'Reilly. 2014.
5. Tony Ojeda, Sean Patrick Murphy, Benjamin Bengfort, Abhijit Dasgupta, "Practical Data Science Cookbook", Packt Publishing Ltd., 2014.
6. Nathan Yau, "Visualize This: The Flowing Data Guide to Design, Visualization, and Statistics", Wiley, 2011.
7. Shai Vaingast, "Beginning Python Visualization Crafting Visual Transformation Scripts", Apress, 2nd edition, 2014.

## PAPER—III

L	T	P	MM
3	1	0	100

### MCA 603: MACHINE LEARNING

#### UNIT I INTRODUCTION

Machine Learning, Machine Learning Fundamentals – applications, Types of machine learning, basic concepts in machine learning , Examples of Machine Learning

#### UNIT II SUPERVISED LEARNING

Linear Models for Regression , Linear Basis Function Models , The Bias, Variance Decomposition , Bayesian Linear Regression , Bayesian Model Comparison , Linear Models for Classification , Discriminant Functions , Probabilistic Generative Models , Probabilistic Discriminative Models , Bayesian Logistic Regression. Decision Trees, Classification Trees, Regression Trees, Pruning. Neural Networks, Feed, forward Network Functions, Back, propagation

#### UNIT III UNSUPERVISED LEARNING

Clustering, K, means , EM , Mixtures of Gaussians , The EM Algorithm in General , Model selection for latent variable models , high dimensional spaces , The Curse of Dimensionality , Dimensionality Reduction , Factor analysis , Principal Component Analysis , Probabilistic PCA, Independent components analysis

#### UNIT IV PROBABILISTIC GRAPHICAL MODELS- I

Directed Graphical Models , Bayesian Networks , Exploiting Independence Properties , From Distributions to Graphs , Examples , Markov Random Fields , Inference in Graphical Models , Learning–Naive Bayes classifiers, Markov Models – Hidden Markov Models – Inference – Learning, Generalization

#### UNIT V PROBABILISTIC GRAPHICAL MODELS- II

Undirected graphical models, Markov random fields, Conditional independence properties , Parameterization of MRFs , Examples , Learning , Conditional random fields (CRFs) , Structural SVMs

Sampling – Basic sampling methods – Monte Carlo Reinforcement Learning, K, Armed Bandit, Elements , Model, Based Learning, Value Iteration, Policy Iteration.

#### TEXT BOOKS:

1. Christopher Bishop, —Pattern Recognition and Machine Learning| Springer, 2006
2. Kevin P. Murphy, —Machine Learning: A Probabilistic Perspective|, MIT Press, 2012
3. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.(latest edition)

#### REFERENCE BOOKS

1. Ethem Alpaydin, —Introduction to Machine Learning|, Prentice Hall of India, 2005
2. Hastie, Tibshirani, Friedman, —The Elements of Statistical Learning| (2nd ed)., Springer, 2008
3. Stephen Marsland, —Machine Learning –An Algorithmic Perspective|, CRC Press, 2009.

L	T	P	MM
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**MCA 604: DATA MINING & WAREHOUSING**

**Unit – I**

Dss-Uses, definition, Operational Database. Introduction to DATA Warehousing. Data-Mart, Concept of Data-Warehousing, Multi Dimensional Database Structures. Client/Server Computing Model & Data Warehousing. Parallel Processors & Cluster Systems. Distributed DBMS implementations.

**Unit – II**

DATA Warehousing. Data Warehousing Components. Building a Data Warehouse. Warehouse Database. Mapping the Data Warehouse to a Multiprocessor Architecture. DBMS Schemas for Decision Support. Data Extraction, Cleanup & Transformation Tools. Metadata.

**Unit – III**

Business Analysis. Reporting & Query Tools & Applications. On line Analytical Processing(OLAP).Patterns & Models. Statistics. Artificial Intelligence.

**Unit – IV**

Knowledge Discovery, Data Mining. Introduction to Data-Mining. Techniques of Data-Mining. Decision Trees. Neural Networks. Nearest Neighbor & Clustering. Genetic Algorithms. Rule Introduction. Selecting & Using the Right Technique.

**Unit – V**

Multimedia Data-Mining, Multimedia-Databases, Mining Multimedia Data, Data-Mining and the World Wide Web, Web Data-Mining, Mining and Meta-Data. Data Visualization & Overall Perspective. Data Visualization. Applications of Data-Mining.

**References:**

1. Berson, “Data Warehousing, Data-Mining & OLAP”, TMH
2. Mallach, “Decision Support and Data Warehousing System”, TMH
3. Bhavani Thura-is-ingham, “Data-Mining Technologies, Techniques Tools & Trends”, CRC Press
4. Navathe, “Fundamental of Database System”, Pearson Education
5. Margaret H. Dunham, “Data-Mining. Introductory & Advanced Topics”, Pearson Education
6. Pieter Adriaans, Dolf Zantinge, “Data-Mining”, Pearson Education

## MCA 601: BIG DATA LAB

L	T	P	MM
0	0	3	50

1. Implement the following Data structures in Java
  - a) Linked Lists
  - b) Stacks
  - c) Queues
  - d) Set
  - e) Map
2. (i) Perform setting up and Installing Hadoop in its three operating modes:
  - Standalone,
  - Pseudo distributed,
  - Fully distributed

(ii) Use web-based tools to monitor your Hadoop setup.
3. Implement the following file management tasks in Hadoop:
  - Adding files and directories
  - Retrieving files
  - Deleting files

Hint: A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities.

4. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
5. Write a Map Reduce program that mines weather data.

Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with Map Reduce, since it is semi structured and record-oriented.
6. Implement Matrix Multiplication with Hadoop Map Reduce
7. Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data.
8. Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes
9. Creating the HDFS tables and loading them in Hive and learn joining of tables in Hive
10. Basic CRUD operations in Apache Cassandra
11. Develop a system which can use of Web search, web crawlers and web information retrieval to store the Data into Cassandra Database.
12. Analyze and implement a system with Web graph mining.
13. Implement and Subscribe RSS News feeds to get latest news in India.
14. Installation of Apache Spark, Exploring RDDs using Spark Shell, Process Data Files with Apache Spark, Use Pair RDDs to Join Two Datasets
15. Write and Run an Apache Spark Application, Configure an Apache Spark Application
16. View Jobs and Stages in the Spark Application UI, Persist an RDD and Implement an Iterative Algorithm with Apache Spark
17. Use Apache Spark SQL for ETL
18. Write an Apache Spark Streaming Application
19. Process Multiple Batches with Apache Spark Streaming

L	T	P	MM
0	0	3	50

1. Interactive commands in Python, data operations, simple programs for writing into files and reading from files.
2. Data file manipulations programs.
3. Familiarization with IDE (PyCharm /Spyder) in Python.
4. Writing programs for standard algorithms of sorting and searching in Python.
5. Introduction to Python Libraries- NumPy, Pandas, Matplotlib, Scikit
6. Perform Data exploration and preprocessing in Python
7. Perform CRUD operation using SQL
8. Perform Joining Multiple Tables Data using difference type of SQL Joins
9. Perform Data exploration and preprocessing Using SQL
10. Plotting the data using X-Y graph, Bar- chart, and using other plotting techniques.
11. Write programs to perform exploratory data analysis: variance, standard derivation, summarization, distribution, and statistical inference.
12. Plotting the various distributions for given data sets.
13. Implement Linear regression
14. Implement logistic regression
15. Implement Naive Bayes classifier for dataset stored as CSV file.
16. Build models using Decision trees
17. Build model using SVM with different kernels
18. Classifying and presentation of data using support vector machine.
19. Implement K-NN algorithm to classify a dataset.
20. Build models using different Ensembling techniques
21. Writing Flask API for models
22. Deployment of models on clouds(AWS/Azure/GCP)

## MCA 603: MACHINE LEARNING LAB

L	T	P	MM
0	0	3	50

1. Study and Implement the Naive Bayes learner using Sklearn. (The datasets taken can be: Breast Cancer data file or Reuters data set).
2. Study and Implement the Decision Tree learners using Sklearn. (The datasets taken can be: Breast Cancer data file or Reuter's data set).
3. Estimate the accuracy of decision classifier on breast cancer dataset using 5-fold cross-validation. (You need to choose the appropriate options for missing values).
4. Estimate the precision, recall, accuracy, and F-measure of the decision tree classifier on the text classification task for each of the 10 categories using 10-fold cross-validation.
5. Write a program to develop a machine learning method to classifying your incoming mail using Sklearn.
6. Write a program to develop a machine learning method to Predict stock prices based on past price variation using Sklearn.
7. Write a program to develop a machine learning method to predict how people would rate movies, books, etc. using Sklearn.
8. Write a program to develop a machine learning method to Cluster gene expression data, how to modify existing methods to solve the problem better
9. Select two datasets. Each dataset should contain examples from multiple classes. For training purposes assume that the class label of each example is unknown (if it is known, ignore it). Implement the K-means algorithm and apply it to the data you selected. Evaluate performance by measuring the sum of Euclidean distance of each example from its class center. Test the performance of the algorithm as a function of the parameter k.
10. Suggest and test a method for automatically determining the number of clusters.
11. Using a dataset with known class labels compare the labeling error of the K-means and EM algorithms. Measure the error by assigning a class label to each example. Assume that the number of clusters is known.
12. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
13. Build an Artificial Neural Network by implementing CNN algorithm and test the same using appropriate data sets.

## MCA 604: DATA MINING & WAREHOUSING LAB

L	T	P	MM
0	0	3	50

1. Create an Employee Table with the help of Data Mining Tool WEKA.
2. Create a Weather Table with the help of Data Mining Tool WEKA.
3. Apply Pre-Processing techniques to the training data set of Weather Table
4. Apply Pre-Processing techniques to the training data set of Employee Table
5. Normalize Weather Table data using Knowledge Flow.
6. Normalize Employee Table data using Knowledge Flow.
7. Finding Association Rules for Buying data.
8. Finding Association Rules for Banking data
9. Finding Association Rules for Employee data.
10. To Construct Decision Tree for Weather data and classify it.
11. To Construct Decision Tree for Customer data and classify it.
12. To Construct Decision Tree for Location data and classify it.
13. Write a procedure for Visualization for Weather Table.
14. Write a procedure for Visualization of Banking Table.
15. Write a procedure for cross-validation using J48 Algorithm for weather table
16. Write a procedure for Clustering Buying data using Cobweb Algorithm
17. Write a procedure for Clustering Weather data using EM Algorithm.
18. Write a procedure for Banking data using Farthest First Algorithm.
19. Write a procedure for Employee data using Make Density Based Cluster Algorithm.
20. Write a procedure for Clustering Customer data using Simple KMeans Algorithm
21. List all the categorical (or nominal) attributes and the real-valued attributes separately.
22. What attributes do you think might be crucial in making the credit assessment? Come up with some simple rules in plain English using your selected attributes.
23. \*What attributes do you think might be crucial in making the bank assessment?
24. One type of model that you can create is a Decision Tree -train a Decision Tree using the complete dataset as the training data. Report the model obtained after training.
25. Suppose you use your above model trained on the complete dataset, and classify credit good/bad for each of the examples in the dataset. What % of examples can you classify correctly? (This is also called testing on the training set) Why do you think you cannot get 100 % training accuracy?
26. \*Find out the correctly classified instances, root mean squared error, kappa statistics, and mean absolute error for weather data set?