Department of Computer Science & Information Technology
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)
SYLLABUS FOR MCA 2 YEAR DEGREE COURSE

Effective from Session 2020-21

Semester 1

Sl.no	Subject Code	Title	Credit L	P	Marks Internal	External	Credits
1	MCA-101	Operating System	4		40	60	4
2	MCA-102	Artificial Intelligence	4		40	60	4
3	MCA-103	Relational Data Base Management Systems	4		40	60	4
4	MCA-104	Elective I	4		40	60	4
5	MCA-105	Elective II	4		40	60	4
6	MCA-106	RDBMS LAB		2		100	2
7	MCA-107	LAB based on Elective –I / II		2		100	2
		Total	20	04	200	500	26

Semester 2

Sno	Subject Code	Title	Credit L	P	Marks Internal	External	Credits
1	MCA-201	Design and Analysis of Algorithm	4		40	60	4
2	MCA-202	Software Engineering	4		40	60	4
3	MCA-203	Optimization Techniques	4		40	60	4
	MCA-204	Elective III	4		40	60	4
	MCA-205	Elective IV	4		40	60	4
6	MCA-206	LAB based on III / IV		2		100	2
7	MCA-207	Minor Project		2		100	2
		Total	20	04	200	500	26

Semester 3

Sl.no	Subject Code	Title	Credit		Marks		Credits
			L	P	Internal	External	
1	MCA-301	Machine Learning	4		40	60	4
2	MCA-302	Computer Graphics and Multimedia	4		40	60	4
3	MCA-303	Data Mining and Data Warehousing	4		40	60	4
4	MCA-304	Elective V	4		40	60	4
5	MCA-305	Elective VI	4		40	60	4
6	MCA-306	Lab based on V / VI		2			2
7	MCA-307	Minor Project		2		100	2
		Total	20	04	200	500	26

Semester 4

Sl.no	Subject Code	Title	Credit		Marks		Credits
			L	P	Internal	External	
1	MCA-401	Major Project	-	-	-	500	22
		Total	-	-	-	-	22

Electives

Sl.No	Paper Code	(1)	(2)	(3)
1	MCA-104(Elective-I)	Advanced JAVA Programming	Probability and Statistics	Linux Operating System and Shell Programming
2	MCA-105(Elective-II)	Computer Network	Mobile Application Programming	V.B.Net Programming
3	MCA-204(Elective-III)	E-Commerce	Cloud Computing	Neural networks and Deep Learning
4	MCA-205(Elective-IV)	Web Technology	Image Processing	Pattern Recognition
5	MCA-304(Elective-V)	Big Data Analytics	Advanced Operating System	Data Science using Python
6	MCA-305(Elective-VI)	Compiler Design	Network Security	Parallel processing

Bridge Course: (Non Credit Course to be completed within maximum allowable duration for completing MCA course).

List of subjects:

1) Fundamentals of Computer Science
2) C programming

Total Course Credits-100
Note: electives to be decided at the start of the respective semester.

* The syllabus is subjected to change as per the requirement.

MCA-101

Principles of Operating System

1. **Introduction**: Definition, Design Goals, Types, Batch processing, Multi-programming, Real time, Time sharing; Functions of Operating System.

2. **Process Management**: Process states, Process Control block, Schedulers, CPU Scheduling algorithms

3. **Inter process synchronization and communication:** need, Mutual exclusion, semaphore, classical problems in concurrent programming, critical region and conditional critical region, Deadlock Characteristics, prevention, resource allocation graphs.

4. **Memory Management**: Address Binding, Dynamic Loading and Linking Concepts, Logical and Physical Addresses, Contiguous Allocation, Fragmentation, Paging, Segmentation, Virtual Memory, Demand Paging, Page fault, Page replacement algorithms, Global Vs Local Allocation, Thrashing,

5. **File and Secondary Storage Management**: File Attributes, File Types, File Access Methods, Directory Structure, File System Organization, Allocation Methods, Free Space management; Disk Structure, Logical and Physical View, Disk Head Scheduling, Formatting, Swap Management.
   UNIX/ LINUX/ WINDOWS/Android as an example of Operating systems

   Readings:

1. Operating System Concepts 6/ed By Silberschatz and Galvin, Addison Wesley.
2. Operating Systems: Internals and Design Principles 5/ed By William Stalling, PHI.
3. Modern operating Systems By Tanenbaum, PHI.
4. Operating System Concepts By Peterson and Silberschatz, Addison Wesley.
5. Operating System Principles By P. B. Hansen, PHI.
6. The UNIX Operating System By K. Christian, John Wiley.

MCA -102

Artificial Intelligence

1. **Introduction:** Definitions and approaches, Foundation of A.I. , Challenges in AI, Area and Applications of A.I., Intelligent Agents: meaning, types, environments, examples.

2. **Problem Solving:** Problem solving as state space search, production system, writing production system and solution for a Water jug problem; some AI classical problems (statements only) cannibal missionaries, tower of Hanoi, tic tac toe, 8-puzzle, Search techniques: Breadth First, and Depth-first, Best-First Search, Hill-climbing, Heuristics, A* algorithm, local and global maxima(minima),

3. **Knowledge Representation and Reasoning**: Predicate and prepositional logic, conversion of sentences to wffs of predicate logic, Resolution, clause form, Skolem functions, Unification, Resolution in Propositional and predicate logic, Semantic Nets.

4. **Pattern Recognition:** Meaning of pattern, Pattern Recognition, Classification, Supervised & Unsupervised Learning of classifiers, K-NN, K-MEANS algorithms.

5. **Expert Systems:** Introduction, Advantages, components and participants in an expert system, Application

Readings:

1. Artificial Intelligence: E. Rich and K. Knight, Tata McGraw Hill.
2. Artificial Intelligence: A New Synthesis By Nilsson, Morgan Kaufmann.
3. Pattern Classification 2nd Edition By R.O. Duda, Hart, Stork (2001) ,John wiley, New York.
4. Pattern Recognition : Technique and Applications By Shinghal (2006) ,Oxford University Press,New Delhi.

MCA - 103

Relational Data Base Management System

1. **Overview of Database Management** :Data, Information and knowledge, Increasing use of data as a corporate resource, data processing verses data management, file oriented approach verses database oriented approach to data management; data independence, database administration roles, DBMS architecture, different kinds of DBMS users, importance of data dictionary, contents of data dictionary, types of database languages. Data models: network, hierarchical, relational. Introduction to distributed databases.

2. **Relational Model :** Entity - Relationship model as a tool for conceptual design-entities attributes and relationships. ER diagrams; Concept of keys: candidate key, primary key, alternate key, foreign key; Strong and weak entities, Case studies of ER modeling Generalization; specialization and aggregation. Converting an ER model into relational Schema. Extended ER features.

3. **Structured Query Language :**Relational Algebra: select, project, cross product different types of joins (inner join, outer joins, self join); set operations, Tuple relational calculus, Domain relational calculus, Simple and complex queries using relational algebra, stand alone and embedded query languages, Introduction to SQL constructs (SELECT…FROM, WHERE… GROUP BY… HAVING… ORDERBY….), INSERT, DELETE, UPDATE, VIEW definition and use, Temporary tables, Nested queries, and correlated nested queries, Integrity constraints: Not null, unique, check, primary key, foreign key, references, Triggers. Embedded SQL and Application Programming Interfaces.

4. **Relational Database Design :**Normalization concept in logical model; Pitfalls in database design,

   update anomalies: Functional dependencies, Join dependencies, Normal forms (1NF, 2NF, 3NF). Boyce Codd Normal form, Decomposition, Multi-Valued Dependencies, 4NF, 5NF. Issues in physical design; Concepts of indexes, File organization for relational tables, De-normalization.

5. **Introduction to Query Processing and Protecting the Database & Data Organizations :** Parsing, translation, optimization, evaluation and overview of Query Processing. Protecting the Data Base - Integrity, Security and Recovery. Domain Constraints, Referential Integrity, Assertion, Triggers, Security & Authorization in SQL.

   Readings:

1. Database system concept By H. Korth and A. Silberschatz, TMH.
2. Data Base Management System By Alexies & Mathews , Vikas publication.
3. Data Base Management System By C. J. Date ,Narosha Pub.
4. Data Base Management System By James Matin .
5. Principles of Database System By Ullman.
6. An Introduction to database systems By Bipin Desai, 2011 ed.,Galgotia Publication.
7. Database Management System By A. K. Majumdar & P.Bhattacharya, TMH

MCA-104   **ELECTIVE-I**   **(1)**

Advanced Java Programming

1. **Basics of Core JAVA:** class, interface, exception handling.**Collections :** Collection Interfaces, Concrete
Collections, The Collections Framework **Multithreading :** Creating thread and running it, Multiple Thread acting on single object,Synchronization, Thread communication, Thread group, Thread priorities, Daemon Thread, Life Cycle of Thread.

2. **Networking:**Internet Addressing, InetAddress, Factory Methods, Instance Methods, TCP/IP Client Sockets, URL, URL Connection, TCP/IP Server Sockets, Datagrams.**Java Database Connectivity (JDBC):** Merging Data from Multiple Tables: Joining, Manipulating, Databases with JDBC, Prepared Statements, Transaction Processing, Stored Procedures.

3. **Servlets:** Servlet Overview and Architecture, Interface Servlet and the Servlet Life Cycle, HandlingHTTP get Requests, Handling HTTP post Requests, Redirecting Requests to Other Resources, Session Tracking, Cookies, Session Tracking with HttpSession

4. **Java Server Pages (JSP):** Introduction, JavaServer Pages Overview, A First JavaServer Page Example, Implicit Objects, Scripting, Standard Actions, Directives, Custom Tag Libraries, **Enterprise Java Bean:** Preparing a Class to be a JavaBean, Creating a JavaBean, JavaBean Properties,Types of beans, Stateful Session bean, Stateless Session bean, Entity bean

5. **Remote Method Invocation:** Defining the Remote Interface, Implementing the Remote Interface, Compiling and Executing the Server and the Client, **Struts:** Basics of Struts,Struts : What and Why?

   ,Model1 vs Model2 ,Struts2 Features, Steps to create Struts application ,Understanding Action class ,Understanding struts.xml file

Readings:

1. "Advanced Java 2 Platform HOW TO PROGRAM" by H. M.Deitel, P. J. Deitel, S. E. Santry – Prentice Hall
2. "Beginning Java™ EE 6 Platform with GlassFish 3 From Novice to Professional" by Antonio Goncalves
   – Apress publication

MCA-104   ELECTIVE-I   (2)

Probability and Statistics

1. **Descriptive measures** : Frequency distribution, mean, median, mode, standard deviation, moments, skewness and kurtosis, **Probability:** Definitions of Probability, Addition Theorem, Conditional
   Probability, Multiplication Theorem, Bayes'' Theorem of Probability.

2. **Random Variables and their Properties:** Discrete Random Variable, Continuous Random Variable, Probability Distribution, Joint Probability Distributions Their Properties, Transformation Variables, Mathematical Expectations, Covariance.

3. **Probability Distributions:** Discrete Distributions: Binomial, Poisson Negative Binominal Distributions
   and their Properties; Continuous Distributions : Uniform, Normal, Exponential Distributions and their Properties.

4. **Multivariate Analysis and Curve Fitting**: Correlation, Correlation Coefficient, Rank Correlation, Linear Regression, Multiple Regression, Principles of Least Squares and Curve Fitting

5. **Estimation and testing of hypothesis**: Sample, Populations, Statistic, Parameter, Sampling Distribution, Standard Error, Un-Biasedness, Efficiency, Maximum Likelihood Estimator, Notion & Interval Estimation. Small Sample Tests. Large Sample Tests.

Readings:

1. Fundamentals of Mathematical Statistics, S. C. Gupta and V. K. Kapoor, Sultan Chand & Sons, 2002
2. Probability & Statistics for Engineers and Scientists, Walpole, Myers, Myers, Ye. Pearson Education.
3. Probability, Statistics and Random Processes, T.Veerarajan Tata McGraw – Hill
4. Probability & Statistics with Reliability, Queuing and Computer Applications, Kishor S. Trivedi, Prentice Hall of India ,1999

MCA-104   ELECTIVE-I   (3)

Linux operating System and Shell Programming

1. **INTRODUCTION TO LINUX:** History, The Linux Architecture, Features of Linux, Internal and External Commands, Command Structure, difference between Linux and Unix, various Linux distributions, basic commands.**UTILITIES:** file handling utilities, security by file permissions, process utilities, disk utilities, networking commands, Text processing utilities and backup utilities, Security commands. The vi editor, security by file Permissions.

2. **INTRODUCTION TO SHELLS:** Session, Standard Streams, Redirection, Pipes, Tee Command, Command Execution, Command-Line Editing, Quotes, Command Substitution, Job Control, Aliases, Variables, Predefined Variables, Options, Shell Edition Environment Customization. Filters. **GREP:** Operation, grep Family, Searching for File Content. **SED:** Scripts, Operation, Addresses, commands, Applications. **AWK:** Execution, Fields and Records, Scripts, Operations, Patterns, Actions, Associative Arrays, String Functions, String Functions, Mathematical Functions, User – Defined Functions, Using System commands in awk, Applications.

3. **INTERACTIVE KORN SHELL:** Korn Shell Features, Two Special Files, Variables, Output, Input, Exit Status of a Command, eval Command, Environmental Variables, Options, Startup Scripts, Command History, Command Execution Process. **KORN SHELL PROGRAMMING:** Basic Script concepts, Expressions, Decisions Making Selections, Repetition, special Parameters and Variables, changing Positional Parameters, Argument Validation, Debugging Scripts, Script Examples.

4. **INTERACTIVE C SHELL:** C shell features, Two Special Files, Variables, Output, Input, Exit Status of a Command, eval Command, Environmental Variables, On-Off Variables, Startup and Shutdown Scripts, Command History, Command Execution Scripts. **C SHELL PROGRAMMING:** Basic Script concepts, Expressions, Decisions: Making Selections, Repetition, special Parameters and Variables, changing Positional Parameters, Argument Validation, Debugging Scripts, Script Examples.

5. **FILE MANAGEMENT:** File Structures, System Calls for File Management – create, open, close, read, write, lseek, link, symlink, unlink, stat, fstat, lstat, chmod, chown, Directory API – opendir, readdir, closedir, mkdir, rmdir, umask.

Readings:

1. Sumitabha Das, "Unix Concepts and Applications", 4thEdition. TMH, 2006. (1, 2 units)
2. Behrouz A. Forouzan, Richard F. Gilbery, "Unix and shell Programming", 1stEdition, Cengage Learning India, 2003.
3. Beginning Linux Programming, 4th Edition, N.Matthew, R.Stones,Wrox, Wiley India Edition.
4. Graham Glass, King Ables, "Unix for programmers and users", 3rd Edition, Pearson Education, 2009.
5. N.B Venkateswarlu, "Advanced Unix programming", 2ndEdition, BS Publications, 2010.
6. Yashwanth Kanitkar," Unix Shell programming", 1stEdition, BPB Publisher, 2010.
7. Linux: Complete Reference, 6th Edition, Richard Petersen, Tata McGraw-Hill

MCA-105   ELECTIVE-II   (1)

Computer Networks

1. **Introduction and Physical Layer :Introduction:** Goal and application Network Hardware and Software, Protocol Hierarchies, Design Issue of the layers, Interfaces and services, Connection oriented and connection less services, Service Primitives, Reference Models – The OSI Reference model, The TCP/IP Model ,Types of computer Network :LAN,MAN,WAN, Topologies, Transmission mode .

   Physical Layer :Data and signal, Analog and digital Communication, Transmission Media ,Concept of data transmission, Switching Techniques ,Communication Satellites – Geosynchronous Satellite – VSAT, Low Orbit Satellites, ISDN and ATM.

2. **Data Link Layer :** Data Link Layer design issues Data link control:Framing, Flow control. Error Detection and Correction. DLC protocol :Stop and Wait Protocol, Sliding window protocol, A Simplex protocol for noisy channel, Medium access sublayer: Channel allocation :static and dynamic ,Multiple access protocol FDDI, Data Link Layer in the Internet : SLIP,PPP. Wired and Wireless LAN protocol.

3. **Network Layer :** The Network   Layer Design Issue, IP   addressing, Address mapping, Error reporting ,Multicasting ,Delivery, Forwarding and Routing. The Network Layer in the Internet : The IP Protocol. subnets, Internet control protocols ,internet multicasting.

4. **Transport Layer :**The Transport layer services, The   concept of client and server in terms of socket addressing Quality of service, Transport service primitives and buffering, Multiplexing, Crash Recovery. The Internet Transport Protocols (TCP/IP) – The TCP Service Model, The TCP protocol, The TCP segment header, TCP connection management, TCP transmission policy, TCP congestion control, TCP timer management, UDP.

5. **Presentation and Application   Layer :** Network   Security, Traditional Cryptography, Private key cryptography and public key cryptography, Authentication protocols, DNS ,SNMP,E-mail, application layer protocols.

   Readings:

   1. Data Communications and Networking By Forouzan, Tata McGraw Hill Company.
   2. Computer Networks By A.S. Tanenbaum
   3. Computer Network By S.S.Shinde ,New Age International Publisher.
   4. Data and computer Communication by Shashi banzal ,Firewall media
   5. Internetworking with TCP/IP :Principles,protocols,and Architecture Vol 1 5th Edition ,PHI publication
   6. Data Communications and Computer Network by Prakash C Gupta, PHI Publication.

MCA-105   ELECTIVE-II   (2)

Mobile Application Programming

1. **Introduction of Mobile Application:** Fundamentals of mobile applications, mobile Application environment and mobile operating Systems, IDEs and various Tools.

2. **Introduction of Mobility and Building blocks of Mobile Application.**: Mobile Application development Activity life cycle, Mobile Landscape, Mobile Platforms, overview of various Mobile application tools.

3. **Mobile Operating Systems:** Android library and its characteristic, iOS library and its characteristic, Windows Phone 7 library and its characteristic

4. **App functionality based User interface and Mobile functions:** Application user Interface designing, User Interface Element, Menu, interaction among the activities. Threads, Asynchronous task, Service – states and life cycles, Notifications, Broadcast receivers, Telephony and SMS API, Animation API multimedia –Audio/Video playback and record, location aware etc.

5. **Mobile Application development in Android:** Android Architecture -Android Stack –Linux Kernel, Android Runtime Environment Dalvik virtual Machine, Android Emulator. Basics Application creation and deployment in Android, Introduction of mobile application database SQLite.

Readings:

1. Professional Mobile Application Development, Jeff Mcwherter, Scott Gowell, Wrox Publisher, 1st Ed. 2012
2. Sams Teach Yourself Android Application Development in 24 Hrs, Lauren Darcy and Shane Conder, 1sted.
3:-Android Programming, Bill Philips and Brain Hardy.
4:Android Recipes : A problem-Solution Approach ,Dave Smith and Jeff friesen.

MCA-105   ELECTIVE-II   (3)

VB.NET Programming

1. **.Net framework and VB.Net:** Evolution of the .NET Framework – Overview of the .Net Framework – VB.NET – Simple VB.Net Program. VARIABLES, CONSTANTS AND EXPRESSIONS: Value Types and Reference Types – Variable Declarations and Initializations – Value Data Types – Reference Data Types – Boxing and Unboxing – Arithmetic Operators – Textbox Control – Label Control – Button Control.

2. **Control Statements:** If Statements – Radio Button Control – Check Box Control – Group Box Control – Listbox Control – Checked List Box Control – Combo box Control – Select Case Statement – While Statement – Do Statement – For Statement. METHODS AND ARRAYS: Types of Methods – One Dimensional Array – Multi Dimensional Arrays – Jagged Arrays. CLASSES: Definition And Usage of a Class – Constructor Overloading – Copy Constructor – Instance and Shared Class Members – Shared Constructors.

3. **Inheritance and Polymorphism**: Virtual Methods – Abstract Class and Abstract Methods – Sealed Classes. INTERFACES, NAMESPACES AND COMPONENTS: Definition of Interfaces – Multiple Implementations of Interfaces – Interface Inheritance – Namespaces – Components – Access Modifiers. DELEGATES, EVENTS AND ATTRIBUTES: Delegates – Events – Attributes – Reflection.

4. **Exception Handling**: Default Exception Handling Mechanism – User Defined Exception Handling Mechanism – Throw Statement – Custom Exception. MULTITHREADING: Usage Of Threads – Thread Class – Start(), Abort(), Join(), and Sleep() Methods – Suspend() And Resume() Methods – Thread Priority – Synchronization. I/O STREAMS: Binary Data Files – Text Files - Data Files – FileInfo and DirectoryInfo Classes.

5. **Additional Controls**: Timer – ProgressBar – LinkLabel – Panel – TreeView – Splitter – Menu – SDI & MDI – Dialog Boxes – Toolbar – StatusBar. DATABASE CONNECTIVITY: Advantages Of ADO.NET – Managed Data Providers – Developing a Simple ADO.NET Based Application – Creation of Data Table – Retrieving Data From Tables – Table Updating – Disconnected Data Access Through Dataset Objects.

Readings:

1. Muthu C. (2008), ”Visual Basic.NET”, 2nd Ed., Vijay Nicole Imprints Pvt.Ltd.,.
2. Jeffrey R.Shaprio (2002), "Visual Basic .NET The Complete Reference", Mac Graw Hill
3. Michael Halvorson (2010), "Visual Basic 2010 Step by Step", Microsoft Press.
4. Harold Davis (2002), "Visual Basic.NET Programming", Sybex.

MCA 201

Analysis & Design of Algorithm

1. **Introduction:** Algorithm, Performance Analysis-Space complexity, Time complexity, Asymptotic Notation-Big oh notation, Omega notation, Theta notation and Little oh and omega notation, recurrence relation: Substitution method, Master method

   Deterministic Algorithms
2. **Divide and conquer**: General method, applications-Binary search, Quick sort, Merge sort.

   Greedy method: General method, Greedy knapsack problem, Minimum cost spanning trees: prim's and kruskal"s algorithm, Single source shortest path problem: Dijkstra's Shortest Path Algorithm, Huffman coding.

3. **Dynamic Programming**: General method, applications-Matrix chain multiplication, Optimal binary search trees, , Longest Common Sub sequence Problem. **Back Tracking**: 8-quen problem, Graph Coloring, Hamiltonian Cycle, **Branch and Bound:** 0/1knapsack problem, travelling sales person problem

   Non Deterministic Algorithms
4. **Interactable problems**: Basic concepts , non deterministic algorithms, NP-Hard and NP-Complete problems, Classes P and NP, Reducibility, Satisfiability Problem, Cook"s theorem.

   Approximation: Graph Coloring, Task scheduling, bin packing, **Probabilistic algorithm :** Numerical integration, primality testing, **Graph Algorithms:** BFS and DFS and its applications.

5. **Evaluation of Algorithm**
   Lower bound Techniques: Lower bound techniques, Comparison Techniques, reduction.

Readings:

1. The Design and Analysis of Computer Algorithms , A.Aho, J. Hopcroft and J.Ullman, Addison Wesley.
2. Fundamentals of Computer Algorithms , E. Horowitz and S. Sahani, Galgotia, New Delhi.
3. Introduction to the Design and Analysis of Algorithms , S.E.Goodman and S.T.Hedetniemi, McGraw Hill.
4. Design Methods and Analysis of Algorithmics , G.Brassard and P.Bratley, PHI.
5. Design Methods and Analysis of Algorithms, S.K.Basu, PHI, 2005.
6. Introduction To Algorithms , Thomas H Cormen, Charles E Leiserson, Ronald L Rivest, Clifford Stein ,MIT Press
7. Rosen, Kenneth , Discrete Mathematics and Its Applications , McGraw-Hill Science
8. W. W. Rouse Ball (1960) The Eight Queens Problem, in Mathematical Recreations and Essays, Macmillan, New York, pp 165-171.

MCA 202

SOFTWARE ENGINEERING

1. .**Introduction**
The Evolving Role of Software, Software Characteristics, Changing Nature of Software, Software Engineering as a Layered Technology, Software Process Framework, Framework and Umbrella Activities, s. Process models: The waterfall model, Incremental process models, Evolutionary process models, specialized process models, The Unified process.Models, Capability Maturity Model Integration (CMMI).

2. **Requirement Analysis**
Functional and non-functional requirements, User requirements, System requirements,
Software Requirement Analysis, Initiating Requirement Engineering Process, Requirement Analysis and Modeling Techniques, Flow Oriented Modeling, Need for SRS, Characteristics and Components of SRS.

3. **Software Project Management**
 Estimation in Project Planning Process, Project Scheduling.

4. 4.**Risk Management**
Software Risks, Risk Identification, Risk Projection and Risk Refinement, RMMM Plan. Quality Management . Quality Concepts, Software Quality Assurance, Software Reviews, Metrics for Process and Projects.

5. **Design Engineering**
Design Concepts, Architectural Design Elements, Software Architecture, Data Design at the Architectural Level and Component Level, Mapping of Data Flow into Software Architecture, Modeling Component Level Design.
Software Measurement and Metrics: Various Size Oriented Measures: Hallstead's Software Science, Function Point (FP) Based
Measures, Cyclomatic Complexity

6. **Testing Strategies & Tactics**
Software Testing Fundamentals, Strategic Approach to Software Testing, Test Strategies for Conventional Software, Validation Testing, System testing, Black-Box Testing, White-Box Testing and their type, Basis Path Testing.

Recommended Books:
1. R.S. Pressman, Software Engineering: A Practitioner_s Approach (7th Edition), McGraw- Hill, 2009. 2. P. Jalote, An Integrated Approach to Software Engineering (2 nd Edition), Narosa

7. Publishing House, 2003. K.K. Aggarwal and Y. Singh, Software Engineering (2nd Edition), New Age International Publishers, 2008. 4. I. Sommerville, Software Engineering (8 th edition), Addison Wesley, 2006. 5. D. Bell, Software Engineering for Students (4th Edition), Addison-Wesley, 2005. 6. R. Mall, Fundamentals of Software Engineering (2 nd Edition), Prentice-Hall of India, 2004.

MCA-203

Optimization Techniques

1. Introduction to OR, The Nature and Meaning of OR, History, Management Applications of OR , Principles, Characteristics, Scope of OR.

2. **Linear Programming**-Introduction and Applications of LP, Limitations of LP Formulation of a LP Model,Graphical Solution of a LPP, Simplex Method, Two Phase Method, Big-M Method, duality in LPP.

3. **Transportation Problem** – Introduction, Mathematical Formulation, Feasible Solution and Optimum Solution(simple case only).

4. **Assignment Problem** – Introduction, Mathematical Formulation, Traveling Salesman Problem, elementary Problems, Replacement Problems-Types, Simple Replacement Problems.

5. **Project Management by PERT-CPM** – Introduction, History & Applications, Basic Steps, Network Diagram Representation, Rules, Time Estimates and Critical Path in Network Analysis, Uses and Applications of PERT/CPM.

Readings:

1. Operations Research By H.A.Taha
2. Operations Research By V.K.Kapoor
3. Operation Research By S.D. Sharma

MCA-204 **ELECTIVE-III** **(1)**

E-Commerce

1. Introduction, Definition, Objectives, Advantages and disadvantages, Forces driving E-Commerce, Traditional commerce Vs. E-Commerce, E-Commerce opportunities for industries, Growth of E-Commerce.

2. E-Commerce Models: Business to consumer, Business to Business, Consumer to Consumer, other models – Brokerage Model, Aggregator Model, Info-mediary Model, Community Model and value chain Model.

3. Electronic Payment Systems: Special features required in payment systems, Types of E-payment systems, E-Cash, E-cheque, credit card, Smart Card, Electronic Purses.

4. E-Marketing, E-Customer Relationship Management, E-Supply Chain Management.

5. Security Issues in E-Commerce: Security risk of E-Commerce, Types of threats, Security tools and risk management approach. Cyber laws, Business Ethics, EDI Application in business.

 Readings:

1. Ravi Kalakota, Andrew Winston, "Frontiers of Electronic Commerce", Addison Wesley.
 2. Bajaj and Nag, "E-Commerce the cutting edge of Business", TMH
3. P. Loshin, John Vacca, "Electronic commerce", Firewall Media, New Delhi

MCA-204   **ELECTIVE-III**   **(2)**

Cloud Computing

1. **Fundamental Cloud Computing-**Concepts, terminology, technologies, benefits, challenges, SLAs and business cost metrics associated with cloud computing,SaaS, IaaS, PaaS delivery models, common cloud deployment models, and cloud characteristics. Various applications of cloud computing.

2. **Cloud Architecture:** The technology architecture of cloud platforms and cloud-based solutions and services and their utilization via a set of cloud computing design patterns. hybrid cloud deployment models, compound design patterns, and solution architectures that span cloud and on-premise environments.

3. **Cloud Security & Governance**:**Cloud Security** :The cloud security mechanisms, A cloud security architecture. a set of security design patterns. **Cloud Governance :**the definition of cloud governance precepts, roles, practices, and processes, common governance challenges and pitfalls specific to cloud computing.

4.
    Cloud Storage: The cloud storage devices, structures, and technologies, cloud storage mechanisms, persistent storage, redundant storage, cloud-attached storage, cloud-remote storage, cloud storage gateways, cloud storage brokers, Direct Attached Storage (DAS), Network Attached Storage (NAS), Storage Area Network (SAN), various cloud storage-related design patterns.

5. **Cloud Virtualization& Microservices :** Core topic areas pertaining to the fundamental virtualization mechanisms and types used within contemporary cloud computing platforms are explored, along with various key performance indicators and related metrics. MicroServices of Cloud Computing.

Readings

1. Distributed Computing by Dollymore Cloud Computing (Wind) by Dr. Kumar Saurabh, 2nd Edison, Wiley India
2. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011 Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012

MCA-204 **ELECTIVE-III** **(3)**

Neural Networks and Deep Learning

1. Introduction to biological neuron, artificial neuron, biological neuron vs. artificial neuron, evolution of neural networks, basic models of artificial neural networks(ANN) : connections, learning :- supervised, unsupervised, reinforcement, activation functions, important terminology of ANN. McCulloh-Pitts neuron, linear separability, types of neural networks.

2. Perceptron Networks, implementation of AND gate, OR gate, NAND gate etc., Gradient descent algorithm, implementation of AND gate, OR gate, NAND gate etc., Building a neural controller for obstacle avoidance, Pseudo inverse solution, nonlinear separability, Back propagation(BP) networks, Derivation of BP algorithm for single hidden layer architecture, momentum terms, implementation of XOR problem using BP algorithm.

3. Radial basis function neural network (RBFNN): architecture, training algorithm, Recurrent neural network(RNN) : architecture, training algorithm, Back propagation through time (BPTT). Real time recurrent learning algorithm(RTRL), Functional link artificial neural networks (FLANN): architecture, training, delta learning rule, Extreme Learning Machine(ELM): architecture, learning algorithm, Modified multilayer neural network, modified Back propagation (BP) algorithm, Self organizing map(SOP)

4. Deep Learning : Introduction, Long short term memory(LSTM) network, Convolution neural network, Boltzman Machine network.

5. Applications: function optimization, classification, prediction, detection

Readings:

1. Neural Networks and Learning machines by Simon Haykin, PHI, 3rd Edition
2. Neural Network Design by M. Hagan, 2nd Edition, eBook
3. Principles of Soft Computing by S. N. Shivanandam and S. N. Deepa, Wiley, 2nd Edition
4. Artificial neural networks by B. Yegnanarayana, PHI.
5. Deep Learning by John D. Kelleher, MIT Press.
6. Neural networks and Deep learning by Charu C. Aggarwal, Springer, 1st Edition, 2018.
7. Research papers

MCA-205   **ELECTIVE-IV   (1)**

Web Technology

1 **Internet Concept**: Fundamental of Web ,History of Web, Web development overview, Domain Name System (DNS),DHCP,and SMTP and other servers ,Internet service provider (ISP), Concept of IP Address, Internet Protocol, TCP/IP Architecture ,Web Browser and Web Server.

2. **HTML and DHTML:-** HTML Tag, Rules of HTML, Text Formatting and Style, List, Adding Graphics to Html Document, Tables and Layout , Linking Documents, Frame, Forms, Project in HTML, Introduction to DHTML, CSS, Class and DIV, External Style Sheet.

3. **Scripting Languages:** Java Script (JS) in Web Page, Advantage of Java Script, JS object model and hierarchy ,Handling event, Operators and syntax of JS, JS Function, Client side JS Vs Server side JS ,JS security, Introduction to VB Script, Operator and Syntax of VB Script, Dialog Boxes, Control and Loop, Function in VBS.

4. **XML:**Introduction to XML, XML in Action, Commercial Benefits of XML, Gaining Competitive advantage with XML, Programming in XML, XML Schema ,XSLT ,DOM structure model ,XML quires and transformation.

5. **Active Server Page (ASP):** Introduction ,Internet Information System (IIS),ASP object ,Server object, File system object, session ,Accessing data base with an ASP page ,ODBC – ADO connection object, common methods and properties, ADO record set object .Introduction to ASP.Net.

   Readings:

   1.   The complete Reference By Thomos A. Powell ,TMH publication
   2.   Web Technology :A Developers Perspective ,N.P.Gopalan ,J.Akilandeswani,PHI Publication.
   3.   Java Script :The definite Guide By Flangam , O"Reilly
   4. Java Script :Developers Resource by Kamran Husain and Jason Levitt PTR-PHI publication.
   5."Mastering VB Script" BPB Publication.
   6.World Wide Web design with HTML by Xavier Tata McGraw Hill Publication .
   7.   XML By Example, Sean Mc Grath Pentice Hall Publication.
   8.   Web Technology : A Developments Perspective , N.P. Gopalan, J. Akilandeswari, PHI Publication

MCA-205   ELECTIVE-IV   (2)

Digital Image Processing

1. **Digital Image Processing (DIP):** Introduction, examples of fields that use DIP, fundamental steps in DIP, components of an image processing system. **Digital Image Fundamentals:** elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels.

2. **Image Transforms:** Two-dimensional (2D) impulse and its shifting properties, 2D continuous Fourier Transform pair, 2D sampling and sampling theorem, 2D Discrete Fourier Transform (DFT), properties of 2D DFT. **Other transforms and their properties:** Cosine transform, Sine transform, Walsh transform, Hadamard transform, Haar transform, Slant transform, KL transform.

3. **Image Enhancement: Spatial domain methods**: basic intensity transformation functions, fundamentals of spatial filtering, smoothing spatial filters (linear and non-linear), sharpening spatial filters (unsharp masking and high boost filters), combined spatial enhancement method. **Frequency domain methods:** basics of filtering in frequency domain, image smoothing filters (Butterworth and Gaussian low pass filters), image sharpening filters (Butterworth and Gaussian high pass filters), selective filtering.

4. **Image Restoration:** Image degradation/restoration, noise models, restoration by spatial filtering, noise reduction by frequency domain filtering, linear position invariant degradations, estimation of degradation function, inverse filtering, Wiener filtering, image reconstruction from projection.

5. **Image Compression**: **Fundamentals of data compression**: basic compression methods: Huffman coding, Golomb coding, LZW coding, Run-Length coding, Symbol based coding.

Readings

1. Gonzalez and Woods: Digital Image Processing, Pearson Education.
2. Anil Jain: Fundamentals of Digital Image Processing, PHI Learning.
3. Annadurai: Fundamentals of Digital Image Processing, Pearson Education.
4. Sonka, Hlavac and Boyle: Digital Image Processing and Computer Vision, Cengage Learning.
5. Chanda and Majumder: Digital Image Processing and Analysis, PHI Learning.
6. Jayaraman, Esakkirajan and Veerakumar: Digital Image Processing, TMH.
7. William K. Pratt, Digital Image Processing, Wiley India.

MCA-205   ELECTIVE-IV   (3)

Pattern Recognition

1. **Pattern Concept:** Meaning of pattern, examples of patterns, importance of study of patterns in machine learning, meaning of labels, attributes, features, dimensions in patters with examples, pattern recognition and classification, meaning of machine learning

2. **Pattern Recognition and classification:** Meaning and importance in machine learning, supervised and unsupervised learning with meaning and examples, classifiers, k-nn classification and k-means clustering, implementation and applications

3. **Decision Trees:** Meaning of tree and hence decision tree, building a decision tree, decision tree induction, classification using a decision tree, classification using ID3

4. **Evolutionary Computing:** Meaning of evolutionary computing, various operators used in evolutionary computing, genetic algorithms and their applications, Particle Swarm Optimization and their applications, Multi-objective Genetic Algorithms with examples

5. **Ensemble of classifiers:** Meaning and importance of ensembles, boosting and AdaBoost algorithm, bagging and random forest, weak and strong learning, ensembles of classifiers with voting

Readings:

1. Pattern Classification: Duda, R.O, Peter Hart, David Stork, 2010, Wiley India
2. Data Mining: Concept and Techniques, Morgan and Kaufmann, 2001
3. Pattern Recognition: Rajjan Shinghal, Oxford University Press New Delhi, 2006
4. Ensemble Methods, Foundations and Algorithms, Zhi-Hua Zhou, A CRC Press, Chapman and Hall Book, 2010
5. Pattern Recognition, Robi Polikar, Wiley Encyclopedia of Biomedical Engineering, 2006 John Wiley & Sons, Inc

MCA- 301

Machine Learning

1. **Introduction**: Meaning and need of Machine Learning, Types of Machine Leaning: Supervised Learning, Unsupervised Learning, Semi Supervised Learning, Reinforcement Learning, Applications of Machine Learning, Type of Data in Machine Learning, Data Repository

2. **Introduction to Feature Analysis and Bayesian Theory**: Meaning of patterns and pattern classification, feature selection and curse of dimensionality, Bayesian theorem and concept learning, examples.

3. **Supervised Learning**: Introduction to supervised learning, its examples, classification models, classification algorithms with Implementation: k-nearest neighbor (kNN), Decision Tree, Random forest, Support Vector Machine (SVM),

4. **Unsupervised Learning** : Introduction to unsupervised learning, metrics for evaluating a feature, Clustering, types of clustering techniques, partitioning, hierarchical and density based clustering

5. **Modeling a classifier**: Validation, classification and prediction accuracy, confusion matrix, learning, bootstrap aggregation (bagging) , boosting, ensembles for classification

Readings:

1. Pattern Classification 2nd Edition By R.O. Duda, Hart, Stork (2001) ,John wiley, New York.

2. Pattern Recognition : Technique and Applications By Shinghal (2006) ,Oxford University Press, New Delhi.

3. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006

MCA- 302

Computer Graphics and Multimedia

1. **Fundamentals of Computer Graphics:** Concepts and applications, Random and Raster scan devices,input-output devices: CRT, LCD, laser printer. Output primitives: Line drawing algorithm: DDA and Bresenham"s; Circle generating algorithm: Bresenham"s Midpoint algorithms, Ellipse: midpoint ellipse drawing algorithm. Antialising techniques: super sampling, pixel weighting, area sampling, pixel phasing Area filling: boundary fill algorithm, flood fill algorithm: Scan-line Polygon Fill Algorithm.

2. **Transformation, viewing, Clipping:** 2-D Transformation: Translation, scaling, rotation, reflection,shear, matrix representation of all homogeneous coordinates, composite transformations. Two dimensional viewing: Viewing pipeline Window-to-view port transformation. Clipping operations: Line Clipping: Cohen Sutherland and Liang-barsky, Polygon Clipping: Cohen-Sutherland-Hodgeman and Weiler – Atherton Polygon clipping.

3. **3D Transformation, Visible Surface Detection and curves:** Visible Surface detection Algorithm:Object based and image based methods, depth comparison, A-Buffer, Back face removal, Scan-line method, Depth Sorting Method Area subdivision method. 3-D Transformation: translation, scaling,rotation, reflection. Three- dimensional object representations 3-D Viewing Projections – parallel and perspective projection. Curved lines and Surfaces: Spline representations, Interpolating and approximation curves, continuity conditions Bezier curves: concept and characteristics; B-Spline curves: concept and characteristics.

4. **Color Models and Basic Concept of Animation:** Introduction of multimedia: Properties and applications, types of medium, data stream characteristics, Basic File and Data format: BMP, JPEG,GIF, TIFF. Color models: RGB, YIQ, CMY, HSV. Animation: Basic concept, animation languages,computer-based animation, methods of controlling animation, display of animation, animation techniques: onion skinning, motion cycling, masking, morphing, and transmission of animation, Multimedia Authoring tools.

5. **Multimedia Systems:** Data compression: storage space, coding requirements. Source, entropy and hybrid coding some basic compression technique: runlength code, Huffman code. JPEG: Image preparation, Lossy sequential DCT –based mode, expanded Lossy DCT based mode, Lossless mode,and hierarchical mode. MPEG, Huffman Encoding, LWZ compression.

   Readings:

   1 Principles of interactive compo Graphics; W.M. Newman & Robert F Sproull.
   2 Computer Graphics By Rogers TMH
   3 Introductions to Computer Graphics AnirbanMukhopadhyay&Arup Chattopadhyay
   4 Schaum's outlines -computer Graphics Mc Graw Hill International Edition.5
   5 .Principles of Multimedia by Ranjan Parekh TMH
   6 "Multimedia Systems Design", P. K.Andleigh& K. Thakrar, Prentice Hall Pvt. Ltd

MCA-303

Data Mining and Data Warehousing

1. **Data Mining:** Meaning, necessity, steps, Normal searching Vs. knowledge extraction

2. **Data Mining on different types of databases:** Relational, Data Warehouses, Transactional, Object oriented, Object relational, Spatial, Temporal and time series, Text and multimedia, Heterogeneous and legacy.

3. **Data Warehouse:** Meaning, definition, OLTP Vs. OLAP, Data cube, star schema, snow flake schema, **fact** constellations, basic concepts in writing of DMQL, Three Tier Architecture of data warehouse, data mart, Indexing.

4. **Data Preprocessing :** Data cleaning, Data integration, Chi-square test, Data transformation, Data reduction, Dimensionality reduction : Principal component analysis (PCA), factor analysis (FA), Data compression : discrete Fourier Transform(DFT), discrete cosine transform (DCT), discrete Wavelet transform(DWT)

5. **Classification, Clustering and Prediction:** Meaning, k-nearest neighbourhood (k-NN), Neural network based classification, Support vector machine(SVM) classifier, Naïve Bayes classifier. Clustering : types of variables, distance measures, types of Clustering, Partioning Method: k-means, k-medoid clustering, Unsupervised : Hierarchical clustering, Prediction using Regression, nonlinear regression and Neural Network, Performance Measures. Types of training: holdout method, cross validation, leave-one-out method.

6. **Association rule mining**: Market basket analysis, support, confidence, Apriori algorithm

Readings:

1. Data Mining: Concepts and Techniques, Jiawei Han, Micheline Kamber, Morgan Kaufmann Publishes (Elsevier, 2nd edition), 2006
2. Data Mining Methods for Knowledge Discovery, Cios, Pedrycz, Swiniarski,Kluwer Academic Publishers, London – 1998.

MCA 304 **ELECTIVE –V** **(1)**

Big Data Analytics

1. **Understanding Big Data**: Datasets, Data Analysis, Data Analytics-Descriptive Analysis, Diagnostics Analytics, Predictive Analytics, Prescriptive Analytics, Big Data Characteristics – volume, velocity, variety, veracity, value, Different Types of Data – Structured Data, Unstructured Data, Semi-Structured Data

2. **INTRODUCTION HADOOP**: Big Data – Apache Hadoop & Hadoop EcoSystem – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Data Serialization.

3. **HADOOP ARCHITECTURE** : Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands , Anatomy of File Write and Read, NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce paradigm, Map and Reduce tasks, Job, Task trackers - Cluster Setup
– SSH & Hadoop Configuration – HDFS Administering –Monitoring & Maintenance.

4. **Theory and methods for big data analytics**: Regression Modeling, Multivariate Analysis, Bayesian Modeling, Inference and Bayesian Networks, Support Vector and Kernel Methods, Analysis of Time Series: Linear Systems Analysis, Nonlinear Dynamics, Rule Induction, Decision Trees.

5. **Programming with R** : Basic Syntax, Data types, Variables, Operators, Decision Making, Loops, Functions, Vectors, lists, Matrices, Arrays, Data Frames, R Data Interfaces – CSV Files, Excel Files, Database, R charts & graphs , R statistics – Mean, Median, Mode, Linear Regression.

Readings:

1. Chris Eaton, Dirk deroos et al. , "Understanding Big data ", McGraw Hill, 2012.
2. "Big Data Fundamentals: Concepts, Drivers & Techniques", 1/e, 2016, Thomas Erl, Wajid Khattak, Paul Buhler, Prentice Hall.
3. "Big Data Analytics with R and Hadoop", 1e, 2013, Vignesh Prajapati, Packt Publishing Ltd, UK.
4. "The Art of R Programming: A Tour of Statistical Software Design",revised,2011, Norman Matloff, No Starch Press
    5. . "Hadoop:The Definitive Guide," 3/e, 2012, Tom White, O'REILLY Publications.
6. "Understanding Big Data: Analytics for Enterprise Class Hadoop and streaming Data" ,2012, Paul Zikopoulos, IBM, Chris Eaton, Paul Zikopoulos, The McGraw-Hill Companies.
7. "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications",2014, Bart Baesens, Wiley Publications .
8. "Mining of Massive Datasets", 2012, Anand Rajaraman and Jeffrey David Ullman , Cambridge University Press

MCA 304   Elective-V (2)

Advanced Operating System

1. Advanced Course in Operating System, Distributed Systems, Communication in distributed systems, processes and processors in distributed systems. Threads, systems Models, Process allocation, scheduling in distributed systems, fault tolerance, real-time distributed systems.

2. Theoretical issues in distributed systems: Logical clock, mutual exclusion, deadlock detection, agreement protocols, resource security and protection, concurrency control.

3. Distributed File System: Design and implementation, trends. Distributed shared Memory, consistency models, page-based distributed shared memory, shared variable distributed shared memory, object-based distributed shared memory.

4. Multiprocessor OS, Database OS: General features and theoretical issues.

5. Case Studies: Amoeba, Mach, chorus, DCE, etc. Multimedia Operating Systems: Process scheduling, File system, caching, Disk scheduling for multimedia.

Readings

1. A.S. Tanenbaum, Distributed Operating System, Prentice-Hall, 1995.
2. A.S. Tanenbaum, Modern Operating Systems, Pearson Education Asia, 2001.
3. M. Singhal and N. G. Shivaratri, , Advance Concepts in Operating Systems, McGraw-Hill, 1994.
4. J. W. S. Liu, Real-Time Systems, Pearson Education, 2000.

MCA- 304 **ELECTIVE-V** **(3)**

Data Science using Python

1. **Introduction to Python:** Introduction to python, variable, data type, control statements, loop statements, functions.
2. **Python for Data Science :** Numpy, Pandas, Matplotlib ,Seaborn etc

3. **Introduction to Data Science:** Introduction to data science, Overview of the data science process, Data PreProcessing.

4. **Machine Learning :** Introduction to machine learning, Linear regression and regularization, Model selection and evaluation, **Classification:** KNN, decision trees, SVM.
5. **Clustering:** K-means, hierarchical clustering, **Dimensionality reduction:** PCA and SVD, Text mining and information retrieval, Network analysis,

Readings

1. James, G., Witten, D., Hastie, T., Tibshirani, R. An introduction to statistical learning with applications in Springer, 2013.
2. Han, J., Kamber, M., Pei, J. Data mining concepts and techniques. Morgan Kaufmann, 2011.
3. Hastie, T., Tibshirani, R., Friedman, J. The elements of statistical learning 2nd edition Springer.
4. Murphy, K. Machine learning: A probabilistic perspective, MIT Press.
5. Manning :Big Data using Python

MCA -305   **ELECTIVE-VI**   **(1)**

Compiler Design

1. **Basics of Compilers and Lexical Analysis:** Compilers and Translators, Bootstrap compiler, Phases of Compiler, Compiler writing tools, Bootstrapping, Overview of one pass compiler, Finite Automation, Basics of DFA, NFA, Regular sets and Regular expressions.

2. **Syntax analysis & Parsing techniques:** Basics of context free grammars and derivation of parse trees, Top down parsing and its implementation, Operator precedence parsing, Predicative top down parser, Bottom up parsing, Handel of right sentential form, LR parser, Canonical collection of sets, Construction of parsing action and GOTO table, Construction of LALR parsing table, Handling ambiguous grammar.

3. **Syntax directed definition and Translation**: L-attributed definition, Syntax directed translation scheme, Intermediate code generation**,** Representing three address statements, Syntax directed translation scheme to specify the translation of various programming language construct, Implementing increment and decrement operators, Array reference, Switch/case.

4. **Symbol table management & Error Handling**: Various approaches to symbol table organization, Representation of scope information in symbol table, Storage allocation activation of procedure and record, Static allocation and stack allocation. Error recovery, Error recovery in LR parsing, Predicative parsing error recovery.

5. **Code Optimization and Code Generation** : Introduction, Loop optimization, Eliminating induction variable, Eliminating local common sub expression, DAG, Eliminating global common sub expression, loop unrolling, loop jamming, Problems hindering code generation, Straight forward code generation, Using DAG for code generation, Peephole optimization.

Readings:

1.Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman. "Compilers Principles, Techniques and Tools". Pearson Education,2008.

2.O.G.Kakde, "Compiler Design", 2005, Laxmi Publication.

3. AdeshK.Pandey" Concepts of Compiler Design ", First Edition, S.K.Kataria& Sons Publication.

4.Steven S. Muchnick, "Advanced Compiler Design Implementation", Morgan Koffman,1997. 5.AllenHolub, "Compiler Design in C", Prentice Hall of India, 1990.

MCA-305   ELECTIVE-VI   (2)

Network Security

1. **Foundations of Cryptography and security:** Security trends, The OSI Security architecture Security attack, services and mechanism**,** Ciphers and secret messages, Mathematical tools for cryptography: substitution techniques, modular arithmetic, Euclid's algorithm, finite fields, polynomial arithmetic.

2. **Symmetric Cipher:** Symmetric cipher model, Design Principles of Block Ciphers, Theory of Block Cipher Design, Feistel cipher network structure, Data Encryption Standard (DES), Strength of DES Triple DES ,Modes of operation.Advance encryption Standard (AES)- Evaluation criteria of AES,AES cipher ,key distribution.

3. **Public Key cryptography and Hash function:** Prime numbers and testing for primarily, factoring large
numbers, Principles of public key cryptosystem, RSA algorithm. Key management: Diffie-Helman Key exchange, Hash and Message authentication Code (MAC), Hash and MAC algorithms, Digital signature.

4. **IP and Web security protocols:**Authentication application: Kerberos, Public key infrastructure .E-mail:
Pretty Good Privacy (PGP), S/MIME. IP security, Web Security: Secure Socket layer (SSL) and Transport layer security, Secure Electronic Transaction (SET).

5. **System Security**: Firewall, and Intrusion Detection system (IDS), Malicious Software.

Readings

1 . Cryptography and Network Security By William Stallings, 4th Edition Pearson Publication
2. Applied cryptography - protocols and algorithm By Buce Schneier, Springer Verlag 2003
3. Cryptography and Network Security By Atul Kahate , TMH Publication.
4. Cryptography and Network Security By Behrouz A. Forouzan, First Edition, TMH Publication.
5. Network Security:Private Communication in Public World By Charlie Kaufman,Radia Perlman and Mike Speciner ,PHI Publication.

MCA-305 **ELECTIVE-VI** **(3)**

Parallel Processing

1 Introduction to parallel processing: Trends towards parallel processing; Parallelism in Uniprocessor systems: Basic Uniprocessor Architecture, Parallel Processing mechanisms, Multiprogramming and Time Sharing; Parallel Computer Structures: Pipeline computers, Array computers, Multiprocessor systems, Performance of Parallel Computers; Architectural classification schemes; Parallel processing applications.

2 Principles of Pipelining and Vector Processing: Principles of Linear Pipelining, Classification of Pipelined processors, General pipelines & Reservation tables, Instruction and Arithmetic Pipelines: Design examples and principles of design, Vector Processing: characteristics, Multiple Vector Task Dispatching, Pipelined Vector Processing methods. Architecture of Cray-I.

3 Structure of Array Processors- SIMD Array Processors: Organizations, Masking and Data Routing Mechanisms; SIMD Interconnection Networks: Static, Dynamic, Mesh-Connected, Cube Interconnection Networks, Shuffle Exchange, Omega Networks; Performance Enhancement methods; Associative Array processing: Associative Memory Organization, Associative Processors.

4 Multiprocessor Architecture: Functional Structures – Loosely Coupled and Tightly coupled multiprocessors; Interconnection Networks for multiprocessors: Crossbar Switch and multiport memories, Multistage Networks for multiprocessors; Exploiting Concurrency for multiprocessors, Parallel Memory Organizations: High order & Low order interleaved memory; Multiprocessor Scheduling strategies, Interprocess communication mechanisms: Process Synchronization Mechanisms, Synchronization with Semaphores, Conditional critical section & monitors.

5 Algorithms on Array processors; Parallel Algorithms on Array Processors- SIMD Matrix Multiplication, Parallel Sorting on Array Processors, SIMD Fast Fourier Transform, Parallel Algorithms of Multiprocessors-Classification of Parallel Algorithms, Synchronized Parallel Algorithms, Asynchronous Parallel Algorithms, Performance of Parallel Algorithms.

 Readings

1. Computer Architecture & parallel Processing- Kai Hwang & A. Briggs (McGraw Hill)
2. Designing Efficient Algorithms for Parallel Computers – H.J. Quinns (McGraw- Hill)
3. Advanced Computer Architecture: parallelism, Scalability, Programmability- By:- Kai Hwang(TMH) 2. Computer Organization & Programming – By – Gear (TMH)
4. Parallel Processing for Supercomputers & Artificial Intelligence –By – Hwang &Degroo

MCA- 601

MAJOR PROJECT

GUIDELINES FOR PROJECT WORK (MCA)

A project report has to be submitted as per the rules described. Some additional guidelines regarding the Project Report are:

Number of Copies:

The student should submit One hardbound copy of the Project Report with one RW/CD/DVD. Acceptance / Rejection of Project Report:

The student must submit a project report to the Head of Department/Project Guide for approval. The Head of Department/Project Guide holds the right to accept the project or suggest modifications for resubmission.

Format of the Project Report :

The student must adhere strictly to the following format for the submission of the Project Report
a. Paper

The Report shall be typed on white paper, A4 size or continuous computer stationary bond, for the final submission. The Report to be submitted to the University must be original and subsequent copies may be photocopied on any paper.
b. Typing

The typing shall be of standard letter size, double-spaced and on one side of the paper only, using black ribbons and black carbons.
c. Margins
The typing must be done in the following margins
Left ----- 35mm,   Right   ----- 20mm
Top ----- 35mm,   Bottom ----- 20mm
d. Binding
The Report shall be Rexene bound in black. Plastic and spiral bound Project Reports
not be accepted. **e. Front Cover:**
The front cover should contain the following details:
TOP   **:** The title in block capitals of 6mm to 15mm letters.
CENTER   **:** Full name in block capitals of 6mm to 10mm letters.
BOTTOM   **:** Name of the University, year of submission- all in block capitals of 6mm to 10mm letters on
separate lines with proper spacing and
centering. **f. Blank Sheets**
At the beginning and end of the report , two white black bound papers should be provided, one for the purpose of binding and other to be left blank.

Abstract

Every report should have an Abstract following the Institute"s Certificate. The abstract shall guide the reader by highlighting the important material contained in the individual chapters, section, subsection etc.

The report should contain the following:

 Certificate from Company
 Institute Certificate: Successful completion of project by competent authority.
 Acknowledgments

Abstract
List of
Figures
Tables
Nomenclature and Abbreviations

Contents of the Project Report
 1. Company Profile (only for M.I.S. projects)
 2. Introduction to the project
 3. Scope of work.
 4. Existing System and Need for System.
 5. Operating Environment - Hardware and Software.
 6. Proposed System.

    6.1 Objectives to be fulfilled

    6.2 User Requirements

    6.3 Requirements Determination Techniques and Systems Analysis Methods Employed.

    6.4 Prototyping.

    6.5 System Features

        -Design of Input

        -Design of Output screens and reports -
        Module specifications

        -D.F.D.‟s and ER‟s -
        System flow charts -Data
        Dictionary -Structure
        charts -Database /File
        layouts -User Interfaces -
        Coding system

        -Design of Control Procedures -
        Design of Exception Handling
 7. Testing procedures and Implementation Phases
 8. Acceptance Procedure
 9. Post-Implementation Review
 10. User Manual

    Menu explanation -
    User guide
    -Expected problems/errors and their solutions
 11. Problems encountered
 12. Drawbacks and Limitations
 13. Proposed Enhancements
 14. Conclusions
 15. Bibliography
 Annexure:

    -Sample documents (manual or computer generated) -

Source code listing in a separate file

-Output reports

List of Tables:

The Contents shall be followed by a „List of Tables" indicating the table number, table title and the corresponding page number(s).The table number shall be in decimal point notation indicating the chapter number and the table number in that chapter.

NOTE : Any reference within the text shall be given by quoting relevant number.eg: „Table5.2"

List of Figures:

The „List of Figures, shall follow the „List of Tables" indicating the figure numbers, figure titles and corresponding page number. The figure numbers shall be in decimal point notation.

Nomenclature and Abbreviations:

The „Nomenclature and Abbreviations" shall follow the „List of Figures" and contain the list of symbols and abbreviations and their long names used. The nomenclature should be given for ER"s, DFD"s, STRUCTURED CHARTS, and RUN CHARTS and for all other symbols in the techniques used. The nomenclature for every technique should appear on a separate sheet. As far as possible, accepted standard symbols shall be used.

Chapter Numbering:

The Chapters shall be numbered in Arabic numerals. Section and subsections of any chapters shall be in decimal notation. All chapters shall begin on a new page. The titles for the chapters and the title shall be properly centered at the top of the page and have three spaces between them.

Company Profile:

This chapter should highlight the company details. This would be chapter 1 and should include the main stream activity of the company, the product line of the company and the details of the department where the student was working. This should not exceed two pages or 800 words.

N.B. : Only relevant for M.I.S. Projects.

Introduction:

The „Introduction" shall highlight the purpose of project work It will also define the chapters to be followed in the Project Report.

Existing System and the Need for the System:

If there is some system already in use, then a brief detail of it must be included, to help the examiner understand the enhancements carried out by6 the student in the existing system. Based on this, the student should exemplify the need for the computerization should be given.

N.B. : Only where relevant.

Proposed System :

1. Objectives   : Clearly define the objective(s) of the system in a few lines.

2. User Requirements: State the requirements of the use in an unambiguous manner.

3. Requirements Determination Techniques and System Analysis Methods Employed:

Use the formal methods to describe the requirements of the use. Like Fact Finding
Methods, Decision Analysis, Data Flow Analysis etc.

4. Prototyping : If the prototypes has been developed prior to the detailed design , then give details
of the prototype.

5. System Features :

      5.1Design of Input   :Inputs, Data Dictionary, Screens.

      5.2Design of Output   :Outputs, Reports etc.

      5.3Design of Control Procedures : Structured charts, Module Specifications, Run charts etc.

      5.4 Design of Exception Handling : Error handling and recovery procedures.

The choice of including topics in this chapter entirely depends on the student. The freedom given for this chapter is obvious. Students will be working on various types of projects. A typical M.I.S. development project must include DFD‟s and structured charts etc. Thus a student is allowed to employ the techniques of his/her own choice suitable to his/her work. However, there is a guideline that the student must employ the techniques taught during the MCA course.

BRIDGE COURSE

MCA_BRIDGE_1

Fundamentals of Computer Science

1. **Introduction -** Introduction, Fundamental uses of computers, Types of Computers, Generations of Computers. Input Devices: Keyboard, Mouse, Track ball, Joystick, Scanner, Digital Camera, MICR, OCR, Barcode Reader, Touch Screen, Light Pen. Output Devices: Monitor, Printer, Plotter, Sound Card and Speaker. Memory Unit: RAM, ROM, PROM, EPROM, and EEPROM, Auxiliary Storage Devices: Magnetic storage devices-Floppy Diskettes, Hard disks, Removable Hard disks, Magnetic Tapes. Optical Storage- CD-ROM.

2. **Application of Computer Software:** Machine Language, Assembly Language, High Level Language, Types of High Level Language, Compiler and Interpreters, System software, Application Software, Utility software, Firmware. **Computer Virus** - Introduction, Virus, A few Prominent Viruses, Types of Computer Virus, Antivirus software.

3. **Computer Network and Internet:** Basic concept of Computer Network, protocol, Communication Process, Communication Types, topology, types of Network: LAN,WAN,MAN, Types of Network devises, Concept of Internet; Applications of Internet, World Wide Web, Web Browsing software, Search Engines; Understanding URL; Domain name; IP Address, E-mail.

4. **Computer Organization:** Number System, 1's and 2's complement system, 2's complement addition(Signed / Unsigned), Logic gates, Half adder, Full adder, Multiplexer, De-Multiplexer, Encoder, Decoder, Flip Flops, Shift register.

5. **Data Structure:** Basic concept of Data Structure, Array, Stack, Queue, Link List, Tree, Graph.

Readings:

1. Fundamental of Computer 5th Edition By V. Rajaraman, PHI Publication.
2. Fundamental of IT: Leon and Leon, Leon Tec World.
3. Data Structure By Lipshutz, McGraw Hill.
4. Data structures Through C by G. S. Baluja.
5. Computer System Architecture, 3rd Edition. M. Morris R. Mano, Pearson publication.

MCA_BRIDGE_2

1. **C Basics:** History of C, Characteristics of C, C Program Structure, data types, Enumerated types, Variables, Defining Global Variables, Printing Out and Inputting Variables, Constants, Arithmetic Operations, Comparison Operators, Logical Operators, Order of Precedence, Escape sequence characters, Conditionals (The if statement , The switch statement) Looping and Iteration (The for statement, The while statement, The do-while statement, break ,continue, goto statements).

2. **Functions:** Call by Value, Call by Reference, Functions returning value, Void functions, Inline Functions, Return data type of functions, Functions parameters, Command Line Arguments/Parameters in Functions, Functions with variable number of Arguments. **Arrays**: Single and Multi-dimensional Arrays, Accessing individual elements in an Array, Manipulating array elements using loops, Pointers: Pointer declaration, Pointers arithmetic, Pointer to an array, Array of pointers, Function pointers, Dynamic Memory Allocation and Dynamic Structures: malloc, calloc and realloc; sizeof, free, **String functions**.

3. **Structure and Union:** Definition, Programs using Structure and Union, Difference between Structure and Union, User defined data types (typedef), Self referential structures The C Preprocessor: Macros, File inclusion, Other Preprocessor Commands).

4. **File Handling:** Opening and Closing data files, Read and Write Functions, different modes of Files, Library functions for file handling, Command Line Argument.

5. **Introduction to C++:** Features of C++, Structure of C++ program, Object and Class: Defining class, Abstract class ,Function prototype, Function with parameter ,Passing object as a parameter, Constructor function , Destructor function, Friend function , Polymorphism, Inheritance, Virtual class , virtual function.

Readings

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2. Paul Deitel, Harvey Deitel, "C++ How to Program", 8th Edition, Prentice Hall, 2011.
3. John R. Hubbard, "Programming with C++", Schaum's Series, 2nd Edition, 2000.
4. Andrew Koeni, Barbara, E. Moo, "Accelerated C++", Published by Addison-Wesley , 2000.
5. Scott Meyers, "Effective C++", 3rd Edition, Published by Addison-Wesley, 2005.
6. Harry, H. Chaudhary, "Head First C++ Programming: The Definitive Beginner's Guide", First Create space Inc, O-D Publishing, LLC USA.2014
7. Walter Savitch, "Problem Solving with C++", Pearson Education, 2007.
8. Stanley B. Lippman, JoseeLajoie, Barbara E. Moo, "C++ Primer", Published by Addison-Wesley, 5th Edition, 2012