आर्यभट्ट ज्ञान विश्वविद्यालय
ARYABHATTA KNOWLEDGE UNIVERSITY

SYLLABUS

For

MASTERS OF COMPUTER APPLICATIONS (MCA) PROGRAMME

Based on

Choice Based Credit System (CBCS)

(2020-2022 onwards)

Introduction to Choose Based Credit System (CBCS):

The CBCS provides an opportunity to the students for choosing t h e courses from the prescribed list of courses comprising the core, elective/minor or skill-based courses. The courses can be evaluated on the basis of grading system, which is considered to be better than the conventional marking or evaluation system. Grading system provides uniformity in the evaluation and computation of the **C**umulative **G**rade **P**oint **A**verage (**CGPA**) based on student's performance in examinations which enables the student to move across institutions of higher learning. The uniformity in the evaluation system also enables the potential employers to assess the performance of the candidates.

Basic connotation of various terms commonly used in Choice Based Credit System CBCS:

Academic Program - means an entire course of study comprising its program structure, course details, evaluation schemes etc. designed to be taught and evaluated in a teaching Department/Centre or jointly under more than one such Department/Centre.

Course - means a segment of a subject that is part of an Academic Program.

Program Structure - means a list of courses (Core, Elective, Practical, Project, etc.) that makes up an Academic Program, specifying the syllabus, Credits, hours of teaching, evaluation and examination schemes.

Core Course - means a course that a student admitted to a particular program must successfully complete to receive the degree and which cannot be substituted by any other course.

Elective Course - means an optional course to be chosen or selected by a student out of such courses offered in the same or any other Department/Centre.

Credit - means the value assigned to a course which indicates the level of instruction; One-hour lecture per week equals 1 Credit, 2 hours practical class per week equals 1 credit. Credit for a practical class could be proposed as part of a course or as a separate practical course.

SGPA - means **S**emester **G**rade **P**oints **A**verage calculated for the courses of a particular semester.

CGPA - is **C**umulative **G**rade **P**oints **A**verage calculated for all courses completed by the students at any point of time. CGPA is calculated each year for both the semesters clubbed together.

Grand CGPA - is calculated in the last year of the course by clubbing together of CGPA of two years, i.e., four semesters.

Conversion of Marks into Grades
In each course, numeric scores will be awarded to both the evaluation components: Internal Assessment and End-semester Examination. Internal assessment score will be based on the average of the numeric scores of the various components such as quizzes, assignments, class participation, discipline, etc. The total score in a paper is obtained by adding the internal assessment marks and the End-semester Examination marks. The total score obtained in a paper is converted to a letter grade on the basis of the grading scale given below:

Marks	Grade	Grade Points
90+	A+	10
80+	A	9
70+	B	8
60+	C	7
50+	D	6
40+	P	5
	F	0

Grade Points: To be considered on the basis of the grading scale table given above.

CWP (Credit Weightage Point) = Grade Point x Credit Point

SGP (Semester Grade Point) = $\sum$ **CWP**

$$\text{SGPA (Semester Grade Point Average)} = \frac{\sum CWP}{\sum Credit\ Points}$$

$$\text{CGPA (Cumulative Grade Point Average)} = \frac{\sum SGP}{\sum Credit\ Points}$$

MCA (Two-Year Full-Time) Program Details

Program Structure:

The Master of Computer Application is a full time Program of two years and each year consists of two semesters which are given in the table below.

Years	Semester - Odd	Semester- Even
First Year	Semester - I	Semester - II
Second Year	Semester - III	Semester - IV

Program Learning Outcomes (PLOs):

PLO – 1: Ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modelling and design of computer-based systems.

PLO – 2: Ability to apply the engineering knowledge in all domains, viz., health care, banking and finance, other professions such as medical, law, etc.

PLO – 3: Ability to design and conduct experiments as well as to analyze and interpret data.

PLO – 4: Ability to analyze the problem, subdivide into smaller tasks with well-defined interface for interaction among components, and complete within the specified time frame and financial constraints.

PLO – 5: Ability to propose original ideas and solutions, culminating into a modern, easy to use tool, by a larger section of the society with longevity.

PLO – 6: Ability to design, implement, and evaluate secure hardware and/or software systems with assured quality and efficiency.

PLO – 7: Ability to communicate effectively the engineering solution to customers/users or peers.

PLO – 8: Ability to understand contemporary issues and to get engaged in lifelong learning by independently and continually expanding knowledge and abilities.

Semester-wise Course Credit Scheme:

Semester	No. of courses offered	Total marks (Semester-wise)	Total credits (Semester-wise)
I	8	800	28
II	8	800	28
III	8	800	28
IV	1	500	26
TOTAL	25	2900	108

SEMESTER - I								
Course Code	Course Name	ESE (Marks)	IA (Marks)	Full (Marks)	L	T	P	Credit
CORE COURSES (THEORY)								
MC 101	Computational Mathematics	70	30	100	4	-	-	4
MC 102	Computer Organization and architecture	70	30	100	4	-	-	4
MC 103	Object Oriented Programming, Analysis and Design	70	30	100	4	-	-	4
MC 104	Modern Operating Systems	70	30	100	4	-	-	4
MC 105	Advance Database Design concepts	70	30	100	4	-	-	4
MC 106	Computer Network	70	30	100	4	-	-	4
CORE COURSES (PRACTICAL)								
MC 107	LAB – 1	100	-	100	-	2	4	2
MC 108	LAB – 2	100	-	100	-	2	4	2
**Total				800	24	4	8	**28**

*** All the Theory and Practical courses are compulsory.

SEMESTER - II								
Course Code	**Course Name**	**ESE (Marks)**	**IA (Marks)**	**Full (Marks)**	**L**	**T**	**P**	**Credit**
CORE COURSES (THEORY)								
MC 201	Fundamentals of Management & Organization Behaviour	70	30	100	4	-	-	4
MC 202	Data Analytics	70	30	100	4	-	-	4
MC 203	Java Programming	70	30	100	4	-	-	4
MC 204	Data Structures and Algorithms	70	30	100	4	-	-	4
MC 205	Artificial Intelligence and Knowledge Management	70	30	100	4	-	-	4
ELECTIVE COUSES								
MC 206	Program Elective -1	70	30	100	4	-	-	4
CORE COURSES (PRACTICAL)								
MC 207	LAB – 1	100	-	100	-	2	4	2
MC 208	LAB – 2	100	-	100	-	2	4	2
**Total				**800**	24	4	8	**28**

*** All the Theory and Practical courses are compulsory and one elective course will be offered if minimum 1/3rd of MCA-II Semester students will opt for the same or it will be decided by the concerned department or authority.

** Totaling is on the basis of seven compulsory (five core courses theory and two core courses practical) courses and one elective course opted by the students of MCA-II semester.

	SEMESTER - III							
Course Code	Course Name	ESE (Marks)	IA (Marks)	Full (Marks)	L	T	P	Credit
CORE COURSES (THEORY)								
MC 301	Software Engineering principles	70	30	100	4	-	-	4
MC 302	Machine Learning	70	30	100	4	-	-	4
MC 303	Visual Programming	70	30	100	4	-	-	4
MC 304	Web Techonologies	70	30	100	4	-	-	4
ELECTIVE COURSES								
MC 305	Program Elective -2	70	30	100	4	-	-	4
MC 306	Program Elective -3	70	30	100	4	-	-	4
CORE COURSES (PRACTICAL)								
MC 307	LAB – 1	100	-	100	-	2	4	2
MC 308	LAB – 2	100	-	100	-	2	4	2
**Total				800	24	4	8	**28**

*** All the Theory and Practical courses are compulsory and two elective courses will be offered if minimum 1/3rd of MCA-III Semester students will opt for the same or it will be decided by the concerned department or authority.

** Totaling is on the basis of six compulsory (four core courses theory and two core courses practical) courses and two elective courses opted by the students of MCA-III semester.

SEMESTER - IV								
Course Code	Course Name	ESE (Marks)	IA (Marks)	Full (Marks)	L	T	P	Credit
CORE COURSES (PROJECT)								
MC 401	Project Work	500	-	500	-	-	-	20
**Total				500	-	-	-	20

Project is a compulsory course for all MCA – IV Semester Students.

L/T//E – Lecture/**T**utorial/**P**ractical **ESE – E**nd **S**emester **E**xamination   **IA – I**nternal **A**ssessment

List of Program Elective – I

Course Code	Name Of Program Electives	L	T	P	IA	Exam	Total	Credit
MCPE101	Internet Of Things	4	-	-	30	70	100	4
MCPE102	Management Information System	4	-	-	30	70	100	4
MCPE103	Principle Of Compiler Design	4	-	-	30	70	100	4
MCPE104	Micro Processors and Application	4	-	-	30	70	100	4
MCPE 105	Client / Server Technology	4	-	-	30	70	100	4
MCPE 106	Neural Networks	4	-	-	30	70	100	4
MCPE 107	Marketing Management	4	-	-	30	70	100	4
MCPE108	Parallel Computing	4	-	-	30	70	100	4
MCPE109	Computer Graphics and Multimedia	4	-	-	30	70	100	4
MCPE110	Accounting and Financial Management	4	-	-	30	70	100	4

List of Program Elective – II

Course Code	Name of Program Electives	L	T	P	IA	Exam	Total	Credit
MCPE201	Operation Research	4	-	-	30	70	100	4
MCPE202	Data Warehousing and Mining	4	-	-	30	70	100	4
MCPE203	Software Architecture and Software Testing	4	-	-	30	70	100	4
MCPE204	Systems Programming	4	-	-	30	70	100	4
MCPE205	Big Data Analytics	4	-	-	30	70	100	4
MCPE206	Human Resources Management	4	-	-	30	70	100	4
MCPE207	Cryptography and Network Security	4	-	-	30	70	100	4
MCPE208	Natural Language Processing	4	-	-	30	70	100	4
MCPE209	Image Processing	4	-	-	30	70	100	4
MCPE210	High Performance Computing	4	-	-	30	70	100	4

List of Program Elective – III

Course Code	Name of Program Electives	L	T	P	IA	Exam	Total	Credit
MCPE301	Embedded System	4	-	-	30	70	100	4
MCPE302	Modeling and computer Simulation	4	-	-	30	70	100	4
MCPE303	Principles Of Programming Languages	4	-	-	30	70	100	4
MCPE304	Soft Computing	4	-	-	30	70	100	4
MCPE305	Cloud Computing And Grid Computing	4	-	-	30	70	100	4
MCPE306	Android Application Development	4	-	-	30	70	100	4
MCPE307	Mobile Computing	4	-	-	30	70	100	4
MCPE308	E-Commerce	4	-	-	30	70	100	4

Semester – I

MC – 101: Computational Mathematics

Objective: To develop logical thinking and introduce basic concepts.

Unit – 1

Graph Theory: Basic terminology, multigraphs and weighted graphs, paths and circuits, searching techniques: BFS, DFS and their applications, shortest paths in weighted graphs, Eulerian paths and circuits, Hamiltonian paths and circuits, Traveling Salesperson problem, planar graphs, trees and rooted trees, prefix codes, minimal spanning trees, cut sets, directed graphs.

Unit – 2

Finite Automata and Regular Languages: Deterministic and non-deterministic finite automata, regular expressions, regular languages and their relationship with finite automata, pumping lemma and closure properties of regular languages.

Unit – 3

Context Free Grammars and Pushdown Automata: Context free grammars (CFG), parse trees, ambiguities in grammars and languages, pushdown automaton (PDA) and the language accepted by PDA, deterministic PDA, Non- deterministic PDA, properties of context free languages; normal forms, pumping lemma, closure properties, decision properties.

Unit – 4

Turing Machines: Turing machine as a model of computation, programming with a Turing machine, variants of Turing machine and their equivalence.

Unit – 5

Undecidability: Recursively enumerable and recursive languages, undecidable problems about Turing machines: halting problem, Post Correspondence Problem, and undecidability problems about CFGs.

Reference Books

1. Narsingh Deo,"**Graph Theory and application to Engineering and Computer sciences** ",1986 PHI.
2. J.A Anderson , " **Automata Theory Of Modern Application"** Cambridge University Press,2006
3. H.R Lewis, C.H Papadimitriou, C. Papadimitriou, "**Elements Of The Theory Of Computation (2nd edition)"** Prentice Hall NJ 1997.
4. Thomas Koshy, **Discrete Mathematics with Applications**, Academic Press, Reprint 2005.
5 . Kenneth H Rosen, **Discrete Mathematics & its Applications with Combinatorics and Graph Theory**, 6th Edition, McGraw Hill, 2007.

MC – 102: Computer Organization and Architecture

Objective: To introduce the nature and characteristics of modern-day Computers

Unit – I

Digital Logic Circuit: Number Systems – Binary, Octal, Hexadecimal, Boolean Algebra, Map Simplification, Logic gates, Combinational Circuits, Adder, Subtractor, Multiplexer, Decoders, Sequential Circuits, Flip Flops, Registers, Counters.

Unit – II

Memory: Internal Memory – RAM and ROM CHIPS, External Memory – Magnetic Tape, Magnetic Disk, RAID, Optical Memory, Memory Organization- Associative Memory, Virtual memory, Cache Memory

Unit – III

Central Processing Unit: Arithmetic and Logic Unit- Instruction sets, Characteristics and function, Machine Instruction Characteristics, Type of operands, Type of operations, Addressing Modes and Format, Processor Organization, Instruction Cycle, Instruction Pipelining

Unit – IV

Peripherals: External devices, I/O Modules, Programmed I/O, Interrupt driven I/O, Direct Memory Access, I/O Channels and Processors, The external Interface, Asynchronous Data transfer

Unit – V

Advanced Architecture: Reduced Instruction Sets Computers, RISC Pipelining, The RISC Versus CISC, Super Scalar Processors- Design issues, Parallel Processing, Multi-Processing Vector Computation, Parallel Processors,

Reference Books

1. M. Morris Mano, **Computer System Architecture** (3rd ed.), Prentice –Hall of India, 2007.
2. W. Stallings, **Computer Organization and Architecture: Designing for Performance** (7th ed.), Pearson Education, 2006
3. A.S. Tanenbaum, **Structured Computer Organization** (4th ed.), Prentice–Hall of India, 1999.
4. J.P. Hayes, **Computer Architecture and Organization** (2nd ed.), McGraw-Hill Book Company, 1988.

MC – 103: Object Oriented Programming, Analysis and Design

Objective: To Study the Programming analysis and design aspects of Object-Oriented Methodology.

Unit – I

Concepts, Operator Overloading, Friends: Concepts in object-oriented programming, Classes and Objects, C++programming basics, Object-oriented analysis, Object-oriented Design methods, Operator Overloading, Friend functions and operators.

Unit – II

Arrays, Pointers and Inheritance: Arrays, Pointers and inheritance: Derived classes, the protected access specifier, Derived class constructors, Overriding Member functions, Class Hierarchies, Public and Private inheritance, Multiple Inheritance and other types of inheritance.

Unit – III

Polymorphism, Virtual Functions Files: Polymorphism: Virtual Functions, Abstract base classes and Pure Virtual Functions, File and Streams, Templates, Generic Programming

Unit – IV

Concepts: Object Oriented Analysis, Object Oriented Design Method, Object Model, Classes and Object, Nature Relationship among Objects, Nature of a class, Nature of Class, Relationship among classes, Identifying Classes and Object, Key abstraction and mechanism, Module and Process diagram UML

Unit – V

Methods: Notational elements- Class, State Transition Object, Interaction, OMT analysis (James & Rumbaugh), Comparison of various Object Oriented Analysis of Design Methodologies, Case Studies.

Reference Books

1. Neill Graham, "**Learning C++**" 1991 Mc Graw Hill Inc. Intl. Edition.
2. Robert Lafore, "**Object Oriented Programming in Turbo C++",**1992 Galgotia Publications.
3. Grady Booch, "**Object Oriented Analysis and Design With Application**",1994 Benjamin Cummings Publishing Company Inc.
4. Strastroup, "**C++ Programming Language** ".
5. Roger S. Pressman "Software Engineering a Practiton Approach", McGraw-Hill Book Company.

MC – 104: Modern Operating Systems

Objective: To understand the concept of OS and its various function, to impart knowledge of various strategies and techniques used to realize these functions and to enable the students understand and appreciate the design principles involved in some of current OS.

Unit – I

Operating System Overview: What is an Operating System (OS), Goals of an Operating System, Generations of Operating Systems, Types of Operating Systems, Functions of OS.

Unit – II

Processes: Concept of Process, System Calls for Process Management, Process Scheduling, Scheduling Algorithms, scheduling, Performance evaluation of the Scheduling Algorithms, Interprocess Communication, Interprocess Synchronization, Semaphores, Classical problems in concurrent programming, Deadlock detection and recovery, deadlock avoidance, Deadlock prevention and other issues.

Unit – III

Memory Management: Overlays and Swapping, Logical and Physical Address Space, Single Process Monitor, Contiguous Memory Methods, Paging, Principles of operation, Page allocation, Hardware Support for Paging, Protection and Sharing, Segmentation, Principles of operation, Address Translation Protection and Sharing. Virtual Memory, Principles of operation, Virtual Memory management, Protection and sharing, Demand paging, Page Replacement policies, Thrashing, Working Set Model, Page Fault Rate, Demand Segmentation, Combined Systems, Segmented paging, Paged segmentation

Unit – IV

I/O and File Management: Organization of the I/O function, I/O Buffering, Disk Organization, Disk Scheduling, RAID, Disk Cache, Command language user's view of File System, The System programmer's view of the file, System, The Operating systems' view of file Management, Directories, Disk Space Management, Disk address translation, File related system services, Asynchronous Input / Output.

Unit – V

Distributed Operating Systems: History of Distributed Computing, Distributed Systems, Key features and Advantages of a Distributed System, Design Goals of Distributed Systems, Design Issues Involved in Distributed Systems, Distributed System Structure, Mutual Exclusion in Distributed Systems, Remote Procedure Calls Other Middleware Technologies.

Reference Books

1. William Stallings: **Operating Systems: Internals and Design Principles**, Prentice Hall, 2013, 6th Edition.
2. Gary Nutt: **Operating Systems**, Pearson, 2014, 3rd Edition.
3. Silberschatz, Galvin, Gagne: **Operating System Concepts**, Wiley, 2008, 8th Edition.
4. Andrew S. Tanenbaum, Albert S. Woodhull: **Operating Systems, Design and Implementation**, Prentice Hall, 2006, 3rd Edition.
5. Pradeep K Sinha: **Distributed Operating Systems, Concept and Design**, PHI, 2007.

MC – 105: Advanced Database Management Systems

Objective: To introduce the concepts of database systems and to study in detail about relational databases.

Unit – I

Review on Fundamentals of Databases: Concepts, Architecture, ER Modelling, Relational Databases, Fundamental and extended operations in Relational Database Model, SQL, basic and Complex queries in SQL. **Database Normalization and Security**: Normalization of Database Tables, Transaction and concurrency control, Database security, Authorization and Encryption.

Unit – II

Object Relational Database Systems: Objects, Object Identity, and Reference Types, Inheritance, Features of Object-relational Systems, Database Design for an ORDBMS, New Challenges in Implementing an ORDBMS, OODBMS, Comparing RDBMS with OODBMS and ORDBMS.

Emerging Database Technologies: Active Database Concepts and Triggers, Temporal Database, Multimedia Databases, Spatial Databases, Geographic Information Systems (GIS) and Deductive Databases.

Unit – III

Distributed Databases: Introduction to Distributed DBMS, Client-Server Model, Data Fragmentation, Replication, and Allocation Techniques for Distributed Database Design. Types of distributed database systems: - Federated database systems, Multi-database systems; Query processing in distributed databases. **XML and Internet Databases:** Structured, unstructured and semi structured data, XML Hierarchical data model, XML document, DTD and XML Schema XML documents and databases, and XML query.

Unit – IV

Data Warehousing: Characteristics of data warehouses, Data warehousing Components – Building a Data warehouse, Typical functionality of a data warehouse: Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools – Metadata.

Reference Books

1. Raghu Ramakrishnan and Jhonnes Gehrke: Database Management Systems, McGrawHill 2000, Second Edition.

2. Elmasri and Navathe: Fundamentals of Database Systems, Addison-Wesley, 1999, Sixth Edition.

MC – 106: Computer Networks

Objective: To impart Knowledge of various topology and layers associated with computer network.

Unit – I

Introduction to computer Networking concepts: Local, Metropolitan and Wide Area Networks; Telecommunications and Cellular Networks Overview, Physical Layer - Basics of communications, Transmission Media, Protocols and standards, Standards Organizations, Line Configuration, Topology, Transmission mode, Networks Signals, Wired and Wireless media including copper cables, optical fiber and Wireless, Multiplexing and switching methods.

Unit – II

Data Link Layer and Logical Link Control (LLC) sub-Layer: Framing, Error control including Bit-parity, CRC and Hamming Codes, Reliable transmission and Automatic Repeat Request (ARQ) protocols including Stop-and-Wait, Go-back-N, Selective Repeat. Performance analysis of ARQ protocols. Example protocols such as HDLC and PPP.

Unit – III

Medium Access Control (MAC) sub–layer: Shared media systems, Bus, Star and Ring topologies, TDMA, FDMA, CSMA, CSMA/CD, Ethernet, related protocols such as ICMP, NAT, ARP and RARP.

Unit – IV

Network Layer: Internet Protocol (IP) suite, Hierarchical network architectures, IPv4 and IPv6 addressing and headers, Routing protocols including distance-vector and link-state approaches, Interior and Exterior Gateway Protocol concepts, Routing Algorithms including Dijkstra's algorithm and distributed Bellman – Ford algorithm; Example protocols : OSPF, RIP, BGP.

Unit – V

Transport Layer: Reliable end –to–end transmission protocols, UDP header; Details of TCP header and operation including options headers and congestion control, TCP variants such as Reno, Tahoe, Vegas, Compound and CUBIC.

Unit – VI

Application Layer: Socket Interface, Socket programming; Example Protocols such as DNS, SMTP, FTP and HTTP.

Reference Books

1. WilliamStallings– **Data & Computer Communications**, PHI, 6[th]ed.
2. Behrouz A Forouzan-**Data Communication & Networking**, McGrawHill, 2000, 2nd edition
3. Forouzan, B.A., "**TCP/IP Protocol**", TMH
4. LauraChappell (ed),"**Introduction to Cisco RouterConfiguration**", Techmedia, 1999.
5. Tananbaum A.S., "**ComputerNetworks",** PHI .
6. Black U.,"ComputerNetworks-Protocols, Standards andInterfaces", PHI,1996.

MC – 107:   PROGRAMMING LAB – 1

- Object Oriented Programming in C++

MC – 108: PROGRAMMING LAB – 2

- DBMS

MC – 201: Fundamentals of Management and Organization Behavior

Unit – I

Concepts of Management: Definition, Nature and Scope; An overall View of Man. Relation with other social sciences and industry Evolution of Management Thought Classical theory of Management, Bureaucracy- Introduction by Max Weber, Scientific Management -PW Taylor and his followers, Process Management- introduced by H. Fayol and others.

Unit – II

Neo-Classical Theory of Management: Human Relations - E. Mayo and Roethlisberger. Behavioral Science approach - by McGregor, Maslow and others, Modern Management theories : Peter Drucker.

Management Functions: Planning, Staffing, Directing and Controlling. Executive Functions: Production, Marketing. finance, Personnel. Planning: Concept, Nature, Importance, Procedure, Strategies and Method of Decision Making.

Organizations: Definitions, Theories of Organization, Forms of Organization. Forms of Organization. Formal and Informal Organization, Types of Formal Organization, Line and Staff Relationship, Span of Management, Authority, Responsibility, Delegation, Centralization, Decentralization. Committees.

Unit – III

Organization Behavior: Introduction to Organization Behavior: Historical roots of Organizational Behavior, Fundamental concepts, Nature, Emerging trends in the organizational behavior, Limitation of Organization Behavior, Challenges & Opportunities for Organization Behavior Motivation- Importance of motivation at work, approaches to motivation, content theories, process theories, motivation and its effects, McGreoger theory X and Y, Maslow's need hierarchy, Herzberg's two factor theory, Vroom expectancy theory, OB modification.

Unit – IV

Power and Politics: Definition and nature of Power, Types of Power, Contingencies of Power, Organizational Politics, where does it occur, Types of political activity, Political strategies for power acquisition in modern organization, Coping with organizational politics. Empowerment. Organizational politics and its effects, Organizational politics and ethics. Conflicts and Negotiation.

Leadership: Concept and style, Fiedler's contingency mode, path-goal theory, leadership effectiveness.

Reference Books

1. Narender. K. Chadha, **Perspectives in Organizational Behavior**, Galgotia Publications Pvt. Ltd., New Delhi, 2007
2. F. Luthans, **Organizatonal Behavior** (9th ed.), McGraw-Hill companies Inc., 2002
3. J. Greenberg, R.A. Baron, **Behavior in Organizations** (8th ed.), Pearson Education Inc, 2005
4. Masse, •Essentials of Management u, 4th edition, Prentice Hall of India, 1996.
5. Agarwal, R.D., Organization and Management Tata McGraw Hill,1986.

MC – 202:   Data Analytics

Objective: To discuss various real-world scenarios where analytics has been used to solve problem and also explains as to how it helps in different domains.

Unit – I

> **Introduction:** data science, need for analytics, steps in data analysis projects, Data-sources of data, data sets, data warehouses, data types, privacy, and confidentiality, samples vs. population, Data summarization and visualization: tables and graphs.

Unit – II

> **Data Preprocessing:** cleaning, transformation, dimensionality reduction, Data Analysis and Visualization: descriptive, inferential statistics, uni-variate and multi-variate analysis

Unit – III

> **Grouping:** Cluster Analysis: distance measures, partitioning, hierarchical, density-based methods,

Unit – IV

> Market Basket Analysis, Association Analysis, Market Basket Analysis, Classifiers: Bayesian, k-nearest neighbor, neural network, Support Vector Machine, Decision Trees,

Unit – V

> **Prediction:** Regression models, Evaluating Classification and Predictive performance, ensemble methods, Anomaly Detection, Forecasting models

Unit – VI

> **Applications in Data Analytics:** Case studies, Web Mining, Text Mining, Business Intelligence, Supply Chain Analytics, Time series, Spatial Data Analysis.

Reference Books

1. Glenn J. Myatt, Wayne P. Johnson, *Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining*, 2nd Edition, John Wiley & Sons Publication, 2014.

2. Glenn J. Myatt, Wayne P. Johnson, *Making Sense of Data II: A Practical Guide to Data Visualization, Advanced Data Mining, and Applications*, John Wiley & Sons Publication, 2009.

3. Galit Shmueli, Nitin R. Patel, and Peter C. Bruce, *Data Mining for Business Intelligence,* John Wiley and Sons, 2014.

4. Ian H. Witten, Eibe Frank, Mark A. Hall, *Data Mining: Practical Machine Learning Tools and Techniques*, Morgan Kaufmann, 2011.

MC – 203: Java Programming

Objectives: To learn and write programs in Java using object-oriented paradigm. Approach in this Course is to take Java as a language that is used as a primary tool in many different areas of programming work

Unit – I

Introduction: Java and Java Applications, Features, Bytecode and Interpretation, JDK, JVM; Object-Oriented Programming, Simple Programs; Data Types, Variables, Arrays and Type Conversions; Operators and Expressions; Control Statements: Selection Statements, Iteration Statements and Jump Statements. **Classes and Objects:** Classes in Java, Declaring a Class, Creating Instances of Class, Members of a Class, Method Overloading; Different Types of Constructors, Inner Class; Uses of this Keyword; Garbage Collection; Recursion; Access Control; Static Members.

Unit – II

Inheritance: Introduction; Method Overriding and Dynamic Method Dispatch; Uses of super and final Keywords; Command Line Arguments; Varargs; Enumerations;

Exception Handling: Exception Handling in Java.

Packages and Interfaces: Packages, Importing Packages; Interfaces.

I/O: Basics, Console I/O, Reading and Writing Files;

Generics: Overview, Examples, Multiple Generic Parameters, Bounds, Wildcards, Generic Methods, Interfaces and Classes.

Collections: Overview, Interfaces, Classes – Array List, Linked List, Hash Set and Map. Applets: What are Applets? The Applet Class; The Applet and HTML; Life Cycle of an Applet; The Graphics Class; Painting the Applet; User Interfaces for Applet; Adding Components to user interface; AWT Controls.

Unit – III

Multi-threaded Programming: Introduction; Creating Threads: Extending Threads; Implementing Runnable; Synchronization, Priorities, Inter-Thread Communication, Thread States and Methods on Thread Objects.

Event Handling: Two Event Handling Mechanisms; The Delegation Event Model; Event Classes; Sources of Events; Event Listener Interfaces; Using the Delegation Event Model; Adapter Classes; Inner Classes.

Java Database Connectivity (JDBC): The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC Process; Database Connection; Statement Objects; Result Set; Transaction Processing; Metadata, Data Types; Exceptions.

Unit – IV

Networking: Basics, Useful Classes and Interfaces, Inet Address, Sockets, URI, URL, URL Connection, Http URL Connection, Datagrams.

Java Beans: Introduction, Advantages, Introspection, Bound and Constrained Properties, Persistence, Customizers, Java Beans API.

Unit – V

Servlets: Background, Life Cycle, Development Options, Tomcat, Example, Servlet API, Reading Parameters, javax. servlet. http Package, Handling HTTP Requests and Responses, Using Cookies, Session Tracking.

Java Server Pages (JSP): JSP; JSP Tags; Tomcat; Request String; User Sessions; Cookies; Session Objects.

Reference Books

1. Jim Keogh, **J2EE - The Complete Reference**, Tata McGraw Hill, 2008.
2. Herbert Schildt, **Java - The Complete Reference**, McGraw Hill Education, 2014, 9th Edition.
3. Gavin King et.al., **Java Persistence with Hibernate**, Manning Publications, 2016,2nd Edition.
4. Cameron McKenzie, **Hibernate Made Easy**, Pulpjava, 2008
5. Phil Hanna, **JSP 2.0: The Complete Reference**, Osborne

MC – 204: Data Structures and Algorithms

Objectives: To impart knowledge in fundamentals of programming elements with a view to developing professional software development skills.

Unit – I

    Introduction to Data Structures: Elementary Data Structures - Stacks, Queues, and Linked Lists with Applications Implementing Pointers and Objects, Representing Rooted Trees - Hash Tables - Direct Address Tables, Hash Tables, Hash Functions, Open Addressing - Binary Search Trees - Querying a Binary Search Tree, Insertion and Deletion.

Unit – II

    Advanced Data Structures: Red-Black Trees - Properties, Rotations, Insertion and Deletion - B-Trees - Definition, Basic Operations, Deleting a key from B-Tree - Graphs - Representations, Breadth-First and Depth-First Searches - Data Structures for Disjoint Sets - Operations and Representations.

Unit – III

    Introduction to Algorithms: Algorithms - Definition, Complexity Concepts, Asymptotic Notations, Recurrences and Solutions - Design Strategies - Recursion, Divide-and-Conquer, Greedy and Dynamic Programming -Complexity Analysis of Sorting Algorithms - Insertion, Selection, Bubble, Quick and Heap Sorting Techniques. - Searching Algorithms - Linear and Binary Search Selection in Linear Time.

Unit – IV

    Graph Algorithms: Greedy Strategy - Elements of the Strategy, Explanation with Huffman Coding as Example - Minimum Spanning Trees – Kruskal´s and Prim's Algorithms - Single-Source Shortest Paths - All-Pairs Shortest Paths - Topological Sort.

Unit – V

    Selected Topics and Tractability: Polynomials and FFT, Probabilistic Algorithms Introduction, Probabilistic Methods for Selection, Sorting and Searching - Algorithms for Random Number Generation - Basic Concepts of NP-Hard and NP-Complete Problems - Cook's Theorem (Without Proof) - Reduction - Clique Decision Problem.

Reference Books
1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Second Edition, 2001 , PHI.
2. Ellis Horowitz, Sartaj Shani, and S.Rajasekaran, "Fundamentals Of Computer Algorithms"' 2000, Galgotia.
3. G. Brassard and P.Bratley, "Fundamentals of Algorithmics", 1995, PHI.
4. E.Horowiz, S.Sahni, and S. Anderson, "Fundamentals of Data Structures in C." 1992, W.H.Freeeman and Co.
5. M.A. Weiss and i. Thompson, "Data Structures and Algorithm Analysis", Second Edition, 1991, Pearson Publishers.

MC – 205: Artificial Intelligence and Knowledge Management

Objectives: To study the concepts of artificial Intelligence and methods of solving problems using Artificial Intelligence and introduce the concepts of Knowledge Management.

Unit – I

Introduction and Problem Solving: Various definitions of AI, Introduction to AI applications and AI techniques, Production systems, control strategies, reasoning - forward & backward chaining

Intelligent Agents - Definitions of a rational agent, reflex, model-based, goal-based, and utility-based agents, the environment in which a particular agent operates

Unit – II

Search and Game Playing: Breadth first search, depth first search, iterative deepening, uniform cost search, hill climbing, simulated annealing, genetic algorithm search, heuristic search, Best first search, A* algorithm, AO* algorithm, Minmax & game trees, refining minmax, Alpha – Beta pruning, constraint satisfaction

Unit – III

Knowledge Representation: First order predicate calculus, resolution, unification, natural deduction system, refutation, logic programming, PROLOG, semantic networks, frame system, value inheritance, conceptual dependency, Ontologies

Unit – IV

Planning: basic representation for planning, symbolic-centralized vs. reactive-distributed, partial order planning algorithm

Uncertainty: different types of uncertainty - degree of belief and degree of truth, various probability constructs - prior probability, conditional probability, probability axioms, probability distributions, and joint probability distributions, Bayes' rule, other approaches to modeling uncertainty such as Dempster-Shafer theory and fuzzy sets/logic

Unit – V

Natural language processing: component steps of communication, contrast between formal and natural languages in the context of grammar, parsing, and semantics

Reference Books
1. Elaine Rich, "Artificial Intelligence", 1985, McGraw Hill.
2. Nilsson N.J., "Principles of Artificial Intelligence", 1992, Narosa.
3. Hayes & Roth, "building Expert Systems", 1982, Narosa

MC – 206: Program Elective – 1

One elective course from the list will be offered if minimum 1/3rd of MCA-II Semester students will opt for the same or it will be decided by the concerned department or authority.

MC – 207: Programming Lab – 1

- Java Programming

MC – 208   Programming Lab – 2

- Data Structures and Algorithms

MC – 301: Software Engineering

Objective: To know the software engineering methodologies for the development of quality, cost effective and schedule meeting software.

Unit – I

Software Engineering and its models: Evolution of Software Engineering, Software development models, Capability maturity models, Software process technology

Unit – II

Principles of Software Requirements Analysis, Design and Testing: Engineering the product, Modeling the system architecture, Software prototyping and specification, Different types of project metrics, Software project estimation, Models for estimation, Automated tools for estimation,

Data design, Architectural design, Interface design, HCI design, Modular design, Testing techniques, Testing for specialized environments, Debugging

Unit – III

Software Project Planning: Different types of project metrics, Software project estimation, Models for estimation, Automated tools for estimation

Unit – IV

Risk management and Project Scheduling: Identification of Software risks, monitoring of risks, Management of risks, formulating a task set for the project, Choosing the tasks of software engineering, Scheduling methods, The Software project plan Software Quality Assurance, Formal technical reviews, Software reliability, Software quality standards

Unit – V

Software change management and Advance Software Engineering: Baselines, Version control, change control, Auditing and reporting, Web Software Engineering, Mobile Software Engineering, CASE Tools, Clean room Software engineering, Component based Software engineering, Re-engineering, Reverse engineering

Reference Books

1. **Ian Somerville**, Software Engineering, Pearson Education, 2012, 9th Edition.
2. **Roger.S.Pressman**, Software Engineering - A Practitioners approach, Tata McGraw Hill, 7thEdition.
3. **PankajJalote**: An Integrated Approach to Software Engineering, Wiley India

MC – 302: Machine Learning

Objective: To Study the **machine learning** Concepts to discover patterns in our data and then make predictions based on often complex patterns to answer business questions, detect and analyze trends and help solve problems.

Unit – I

Python for Machine Learning : Introduction to python, the concept of data types; variables, assignments; immutable variables; numerical types; arithmetic operators and expressions; understanding error messages; Conditions, Boolean logic, logical operators; ranges; Control statements: if-else, loops (for, while); short circuit evaluation; Strings and text files; manipulating files and directories, os and sys modules; text files: reading/writing text and Numbers from/to a file; creating and reading a formatted file (csv or tab-separated).

String manipulations: subscript operator, indexing, slicing a string; strings and number System: converting strings to numbers and vice versa. Binary, octal, hexadecimal numbers Lists, tuples, and dictionaries; basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding and removing keys, accessing and Replacing values, Oops, Python Numpy and Pandas, Data Preprocessing, Data Manipulation, Data Visualization

Unit – II

Overview and Introduction to Bayes Decision Theory: Machine intelligence and applications, pattern recognition concepts classification, regression, feature selection, supervised learning class conditional probability distributions, Examples of classifiers bayes optimal classifier and error, learning classification approaches.

Linear machines: General and linear discriminants, decision regions, single layer neural network, linear separability, general gradient descent, perceptron learning algorithm, mean square criterion and widrow-Hoff learning algorithm; multi-Layer perceptions: two-layers universal approximators, backpropagation learning, on-line,off-line error surface, important parameters.

Unit – III

Learning decision trees: Inference model, general domains, symbolic decision trees, consistency, learning trees from training examples entropy, mutual information, ID3 algorithm criterion, C4.5 algorithm continuous test nodes, confidence, pruning, learning with incomplete data.

Instance-based Learning: Nearest neighbor classification, k-nearest neighbor, nearest neighbor error probability,

Unit – IV

Machine learning concepts and limitations: Learning theory, formal model of the learnable, sample complexity, learning in zero-bayes and realizable case, VC-dimension, fundamental algorithm independent concepts, hypothesis class, target class, inductive bias, occam's razor, empirical risk, limitations of inference machines, approximation and estimation errors, Tradeoff.

Unit – V

Machine learning assessment and Improvement: Statistical model selection, structural risk minimization, bootstrapping, bagging, boosting.

Reference Books

1. E. Alpaydin**, Introduction to Machine Learning**, Prentice Hall of India, 2006.
2. T. M. Mitchell, **Machine Learning**, McGraw-Hill, 1997.
3. C. M. Bishop, **Pattern Recognition and Machine Learning**, Springer, 2006.
4. R. O. Duda, P. E. Hart, and D.G. Stork, **Pattern Classification**, John Wiley and Sons, 2001.
5. Vladimir N. Vapnik, **Statistical Learning Theory**, John Wiley and Sons, 1998.
6. Shawe-Taylor J. and Cristianini N., Cambridge, **Introduction to Support Vector Machines**, University Press, 2000.

MC – 303: Visual Programming

Objective: it aims to teach basic of visual programming concepts and to design object oriented visual programs with Visual Studio programming development environment and coding.

Unit – I
GUI concept - Data types - GUI Architecture - Message Processing - Keyboard and Mouse Handling Displaying Text and Graphics - File and Printer Handling - DDE – DDL ODBC COM/DCOM / CORBA

Unit – II
NET Namespaces, Assemblies, .NET Memory Management, Process Management, Interoperation with COM. Transactions in NET, Structures Exception Handling, Code Access Security, Web Controls using the .NET framework, The NET Framework Class Library.

Unit – III
VB.NET - Variables and Operators, functions, Decision and Loop statements, Inheritance, Value Types, Operator Overloading, Exception Handling, Arrays and Collections, Properties, Delegates and Events, Windows Forms, Dialog Boxes and Controls, Graphical Output, Files, DATA ACCESS.

Unit – IV
C#.NET - Variables, Operators and Expressions, Writing Methods and Applying Scope, Decision statements, Iteration statements, Managing errors and Exceptions values and references, Value types with enumerations and Structures, Arrays and Collections parameter arrays, Inheritance, Garbage collection and Resource management.

Unit – V
Introducing ASP.NET - Understanding validation controls - Accessing Data with web forms- Building ASP.NET applications Building and XML web service handling XML.

Reference Books
1. Jeff Prosise, Programming Microsoft .NET, Microsoft Press

2. David S Plat, Introducing Microsoft .NET, 3 Edition, Microsoft Press

3. Jessse Liberty, Programming Visual Basic .NET 2" Edition, O'Reilly & Associates

4. Jesse Liberty, Programming C#, 3rd Edition, O'Reilly & Associates

5. Jesse Liberty. Dan Hurwitz, Programming ASP.NET, O'Reilly & Associates

MC – 304: Web Technologies

Objective: - To study the World Wide Web as a platform for interactive applications, content publishing and social services. The development of web-based applications requires knowledge about the underlying technology and the formats and standards the web is based upon.

Unit – I

Introduction: Web Publishing, Web Browsers, Web Servers, URL; Essential Web Developer Tools; Web hosting. **HTML5 and CSS3:** Introduction, Basics – Structure, Essential Tags, Lists, Links; Formatting Text with HTML and CSS, Including Style Sheets in a Page, Varieties of Selectors, Units of Measure, Box Model, Using Images on Web Pages, Image Formats, Using Images – Basics, Text Alignments, Links, Scale, Backgrounds, Bullets; Image-map, Image Etiquettes. Tables, Creating Table, Parts of Table; Formatting Tables – Size, Borders, Cells; Alignment and Spacing; Spanning; Advanced Enhancements.

Unit – II

Using CSS to Position Elements: Positioning Schemes, Absolute Positioning, Fixed Positioning, Controlling Stacking, Creating Drop-Down Menus. **Designing HTML5 Forms:** Basics; Creating Controls, Buttons and Fields; Grouping Controls; Displaying Updates; Applying Styles. **Structuring a Page with HTML5:** History, Laying Out a Page, Structural Tags, Page Outline, Structural Elements. **Advanced CSS Page Layouts:** Laying Out Page, The Role of CSS in Web Design.

Unit – III

JavaScript and jQuery: JavaScript – Significance, Basics, Environment, Events, Validating Forms, Hiding and Showing Content, Adding New Content to a Page. **Using jQuery:** Introduction, JavaScript Libraries, Selecting Elements from the Document, Binding Events, Modifying Styles on the Page, Modifying Content on the Page, Special Effects, AJAX and jQuery.

Unit – IV

PHP: Introduction, Basics, Loops, Built-In Functions, User-Defined Functions, Processing Forms, Using PHP Includes, Database Connectivity, Regular Expressions, Sending Mail, Object-Oriented PHP, Cookies and Sessions, File Uploads.

Reference Books

1. Laura Lemay et.al., **Sams Teach Yourself HTML, CSS & JavaScript Web Publishing in One Hour a Day**, Pearson Education, 2016, 7th Edition.

2. Jon Duckett, **Web Design with HTML, CSS, JavaScript and jQuery** (set), Wiley, 2014

3. Robert W. Sebesta, **Programming the World Wide Web**, Pearson Education

MC – 305: Program Elective – 2

Two elective courses from the list will be offered if minimum $1/3^{rd}$ of MCA-II Semester students will opt for the same or it will be decided by the concerned department or authority.

MC – 306: Program Elective – 3

Two elective courses from the list will be offered if minimum $1/3^{rd}$ of MCA-II Semester students will opt for the same or it will be decided by the concerned department or authority.

MC – 307:   Programming Lab – 1

- Visual programming

- Python

MC – 308:   Programming Lab – 2

- Web technology

LIST OF COURSES WITH CONTENTS FOR ELECTIVE - 1

MCPE – 101:   Internet of Things

Objective: - Students will be explored to the interconnection and integration of the physical world and the cyber space. They are also able to design & develop **IOT** Devices.

Unit – I

Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT–IoT Protocols, IoT communication models, IoT Communication APIs IoT enabled Technologies– Wireless Sensor Networks, Cloud Computing, Bigdata analytics, Communication protocols, Embedded Systems, IoT Levels and Templates Domain. Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle.

Unit – II

IoT and M2M – Software defined networks, network function virtualization, difference between SDN and NFV for IoT Basics of IoT System Management with NETCOZF, YANGNETCONF, YANG, SNMP NETOPEER

Unit – III

Introduction to Python - Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib

Unit – IV

IoT Physical Devices and Endpoints - Introduction to Raspberry PI-Interfaces (serial, SPI, I2C) Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins. IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API

Reference Books

1. ArshdeepBahga and Vijay Madisetti,Internet of Things - A Hands-on
Approach, Universities Press, 2015.

2. Matt Richardson & Shawn Wallace, O'Reilly (SPD), Getting Started with Raspberry
Pi, 2014.

MCPE – 102: Management Information System

Objective: It aims to teach to help executives of an organization make decisions that advance the organization's strategy and to implement the organizational structure and dynamics of the enterprise for the **purpose** of managing the organization in a better way for a competitive advantage.

Unit – I

Foundations of information systems: - Decision Making Process – Simon's Model – Global business Environment and organizations – Introduction to IS in business – Solving problems with IS – Introduction to MIS.

Unit – II

Information Technology: A managerial overview - Computer Software – hardware – Database Management-normalization Process – Types of Data Model.

Unit – III

Business Application of information Technology: Internet – intranet and Extranets – Decision Support System – Transaction Processing System – EJS – Enterprise wide Information Systems.

Unit – IV

Building Information systems and Implementation – Tools and Techniques for Building System Analysis and Design – Methodologies – Implementation Techniques.

Unit – V

Management of Information system: functional Subsystems of MIS – marketing, finance, URD, Manufacturing – strategic Information Systems.

Reference Books

1. Obrien, J.A, "Management Information Systems", 4th Edition, TMFI, 1999.

2. Landon K.C, & Landon J.P., MIS – Macmillan – New York, 1998.

3. Davis G.D and Olson M.H, "Management Information System", 2nd edition, TMH,

MCPE – 103: Principles of Compiler Design

Objective: To study the general features of Compilers.

Unit – I

Lexical Analysis: Introduction on the phase of the compiler - Lexical Analysis, Regular Expression, Automata, Deterministic Automata equivalent to NFA's. Minimizing the states of DFA, Implementation of Lexical Analyzer.

Unit – II

Syntax Analysis: Topdown Parsing Concepts, Recursive Descent Parsing, Predictive Parsers, Nonrecursive Predictive Parsing - Bottom Up Parsing, Handle pruning, Shift reduce parsing - Operator Precedence Parsing - Error recovery in Parsing, LR Parsers, Parser Generators - YACC.

Unit – III

Intermediate Code Generation: Syntax directed Definitions, Construction of Syntax trees - Top down Translation, Bottom up Evaluation of Inherited Attributes, Recursive Evaluators, Assigning Space at Computer Construction time - Type checking - Overloading of functions and operators, polymorphic function.

Unit – IV

Storage Organization: Storage Organization, Storage Allocation strategies, Parameter Passing, Symbol tables, Dynamic Storage Allocation, Intermediate Languages - Representation of Declarations, Assignment statement, Boolean Expression, Back Patching, Procedure calls.

Unit – V

Code Generation and Optimization: Design of the code generators, Runtime storage management, Basic blocks and Flow graphs, Register Allocation and Assignment, DAG representation of Basic blocks, Peephole optimization, Code optimization - The principle Sources of Optimization, Optimization of basic blocks, Global data flow Analysis, Loop optimizations.

Reference Books
1. Alfred Aho, Ravi Sethi, Jeffy D Uliman, "Compilers Principles, Techniques and Tools" 1986Addison Wesley.
2. Dhamdhere D.M, "Compiler Construction Principles and Practice 1981 ,Macmillan lndia.

3. Reinhard Wilhelm, Dicter Mauser ," Compiler Design", 1995, Addison Wesley.

MCPE – 104: Microprocessors and Applications

Objective: To study the basic concepts of 8085 microprocessor and to interface various peripherals with it.

Unit – I

Introduction to Micro Computers: Micro computers, Microprocessors and Assembly Language Microprocessors Architecture and Micro Computer Systems - 8085 Microprocessor, Architecture -Instruction and Timings.

Unit – II

Programming 8085: 8085 Basic Instructions. Programming Techniques with Additional Instructions -Counters and Timing Delays - Stack and Subroutines.

Unit – III

Interfacing Peripherals (I/O'S): Parallel & Serial: Parallel I/O & interfacing Applications - Interrupts:8085 interrupts. Serial I/O: Basic Concepts - 8085, Serial I/O lines: SOD and SID.

Unit – IV

Data Transfer Techniques Using Programming Devices: Basics in programmable I/Os - Data Transfer using 8155 - Programmable keyboard display controller 8279 - Programmable interrupt controller 8259A.

Unit – V

Interfacing DMA & Data Converters: Direct Memory Access - 8257 DMA - Interfacing Data   Converters - 8257 DMA controller - Interfacing Data Converters: DIA converter - A/D converters - Comparative study of microprocessors. Microprocessors - 8086, 80286, 80386, 80486 & Pentium.

Reference Books:

1. Ramesh S. Gaonkar," Microprocessor, Architecture, Programming and Applications", 1989, Wiley Eastern Ltd.,

2. Douglas V Hall, "Microprocessors and Interfacing ', 1997, Tata McGraw Hill Edition.
3. Hany Fainhead, "The 386/486 PC - A Paver Users Guide".
4. Yu - Cheng Liu, Glenn A Gibsen, "Microcomputer Systems", 1986, Prentice - Hall Of India PVT Ltd.

MCPE – 105: Client / Server Technology

Objective: To provide knowledge of developing systems in distributed environments.

Unit – I
Overview of Client/Server Computing: What is Client/Server Computing Application Tasks: Rightsizing, Benefits of Client/Server Computing, Evolution of Client Server Computing, Hardware and Software Trends, Evolution of operating systems, Networking Trends, Business considerations.

Unit – II
Client/Server Applications: Components, Classes, Categories Understanding client/Server Computing: Obstacles, Open Systems and Standards, Standards setting organizations. Factors for success, RPC messaging Peer to Peer.

Unit – III
Client Hardware and Software: Client Components, Client Operating Systems, GUI, Database Access, Application Logic. Server Hardware and Environment, Categories of Servers. SQL DB Servers, Network management and Network Computing Environment, Network operating systems, Loadable Module, Middleware, Data warehousing.

Unit – IV

Client/Server requirements: GUI Design standards interface Independence, Platform independence, Transaction Processing, Connectivity, Reliability, Back up and Recovery mechanisms, TP Monitors, Groupware, and Distributed Object Components.

Unit – V
Future Trends - CORBA, COM, OLE, WEB Server, Mobile Computing, Net Management Standard, intelligent Wiring Hubs, Wireless LANS, ATM Switching, Object Technology, CASE Tools, Repositories, Multimedia, Workgroup Computing.

Reference Books

1. Dawna Travis Dewire, 'Client/SerVer Computing", 1993, McGraw Hill
2. Bruce Elbert & Bobby Martyna, "Client/Server Computing:Architecture. Applications and Distributed Systems Management", 1994, Artech House.
3. Robert Orgall, Dan Harkay & Jeri Edwards, "The Essential Client/Server Survival Guide".

MCPE – 106:   Neural Networks

Objective: To study the algorithms and physical components applied in neural networks.

Unit – I

Introduction: Artificial Neural Network - Principles and promises - Pattern and Pattern Recognition tasks - Conventional methods Promises of neural networks - Scope.

Unit – II

Characteristics, Neuron Models: Basics of ANNs - Characteristics of biological neural networks - Artificial neural networks - Terminology - Models of neuron - Topology - Activation and Syntactic Dynamics.

Unit – III

Pattern Recognition Methods and Concepts in ANN: Functional units of ANN for pattern recognition tasks - Pattern recognition by feedforward and feed backward ANNs - Pattern Association Pattern classifier - Perception Pattern Mapping Backpropagation learning algorithm.

Unit – IV

Storage, Clustering and Mapping: Pattern storage (STM) - Pattern Clustering Competitive learning feature mapping Kohonen [i]s Self-organizing networks.

Unit – V

Architecture, Memory and Applications: Neural Architecture for complex pattern recognition task - Associative memory Data and Image compression Pattern Classification - Spatio temporal patterns (Avalanche) - Pattern variability (Neocognitron) - Other Applications.

Reference Books

1. J.Hertz, A.Korth and R.G.Palmer, "An Introduction to the Theory of Neural Computation", Addison Wesley, 1991.

2. Philip D. Wassermann, "Neural Computing Theory and Practice", Van Nostran Reinhold.
3. James A.Freeman and David M.Skapura, "Neural Networks; Algorithms and Applications", Addison Wesley, 1991.
4. B.Muller and J.Reinhardt, "Neural Networks: An Introduction", Addison Wesley 1990.
5 L.B.Almedia and C.J. Wel. Lekans, "Neural Networks", Addison Wesley, 1990.

MCPE – 107: Marketing Management

Objective: To gain a basic understanding about the marketing function and about the marketing strategy formulation.

Unit – I

Introduction Buyer Behavior: Core concepts of marketing: Needs, wants and demands, product, value, satisfaction. Marketing and markets. Evolution of marketing: production concept, product concepts, selling concepts and marketing concepts. Buyer behavior: Model, influencing factors, buying decision process, buying roles and buying stages.

Unit – II

Segmentation - N.P.D-P.L.C.: Segmentation: Approach, factors and procedure. Targeting and Positioning. New Product de NPD model, reasons for success and failures. Product Life Cycle: PLC concepts and strategies to be followed in various stages.

Unit – III

Product and Pricing Strategies: Product: Classification, mix decisions and line decisions, branding decisions and packaging. Pricing: Objectives, influencing factors, methods and strategies.

Unit – IV

Channel and Promotion Strategies: Channel: Nature, function, dynamics, design and management decisions. Promotion: Advertising decisions objectives, budget, message, media and evaluation of advertisements. Personal selling principles. Sales Promotion - objectives and types.

Unit – V

Marketing Control and Strategies: Marketing control: Annul plan control, Profitability control, Efficiency control and strategies control. Marketing strategies: for leaders, followers, challengers, niche players and global markets.

Reference Books

1. Kotler, Philip, Marketing Management: The Millennium edition, PHI pvt. Ltd: New Delhi. 10th edition, 1999.

2. Ramaswamy V.S. and Namakumari .S, "Marketing Management: Planning, implementation and control", Macmillan, New Delhi, 2 edition, 1997.

3. Kotter, Philip and Armstrong, Gary, "Principles of Marketing" PHIpvt. Ltd.: New Delhi. 7L edition. 1996.

MCPE – 108: Parallel Computing

Objective: To study the concepts and ideas in **parallel computing** and its applications.

Unit – I

Introduction: Advent of practical parallel processing. Parallel Processing terminology, The sieve of Eratosthenes.

PRAM Algorithms: The PRAM model of parallel computation, PRAM algorithms, reducing the number of processors, problems defying fast solutions on PRAMS.

Unit – II

Processor Arrays, multiprocessors, Multicomputer, Processor organizations, processor arrays, Multiprocessors, multicomputer, Flynn's taxonomy, speed up and parallelizability.

Unit – III

Mapping Scheduling and Algorithms; Data Mapping on processor arrays and multicomputer, classifying parallel algorithms, reduction, broadcast, prefix sums matrix multiplication, solving linear system of equations.

Unit – IV

sorting, Searching and Graph Algorithms; Enumeration sort, Lower bounds on parallel sorting, Odd – Even transposition sort, bitonic merge, quick sort based algorithms, complexity of parallel search, searching on graph, connected components, all pairs shortest path, single source shortest path, minimum cost spanning tree.

Reference Books

1. Hwang, Kai: "Advance Computer Architecture", McGraw Hill.

2. Hwang, K. , Briggs, F.A. : "Computer Architecture and Parallel Processing", McGraw Hill.

3. Evans, D.J. : "Parallel Processing System", Cambridge University.

MCPE – 109: Computer Graphics and Multimedia

Objective: To study the software and hardware aspects of computer graphics,

Prerequisite: Mathematics, Matrix Theory, Analytical Geometry, Trigonometry

Unit – I

Graphics Devices – Line and Circle Drawing Algorithms: Overview of Graphic Systems - Display Devices Hard copy Devices - Interactive Input devices -- Display Processors, graphics Software - Line drawing various algorithms and comparisons Circle drawing algorithms.

Unit – II

Filling Transformation and Segments: Attributes - Area filling algorithms - Scan conversion algorithms - Transformations Two dimensional - Basic Composite and Other Transformations - Matrix representations Windowing and Clipping - Viewport Transformations - Segments.

Unit – III

Graphics and 3D Graphics: Interactive input methods - Input Devices - Input Functions - Three Dimensional Concepts - 3D Transformations-Curves Projections - Hidden Surface Elimination algorithms.

Unit – IV

Multimedia Introduction: Multimedia applications - System architecture - Objects of Multimedia Systems -Multimedia databases Compression and File formats Image compression CCITI' - JPEG-Video image compression - MPEG DVI Technology - Audio compression - RTF format TIFF file format -- RIFF FILE format - MIDI - JPEG DIB - TWAIN, Video & Audio Codecs.

Unit – V

Application Classes: Types of systems Virtual reality design - Components Databases Authoring Systems - Hyper media - User interface design Display/Playback issues - Hypermedia linking and embedding - Production of Multimedia systems.

Reference Books

1. Donald Hearn, M.Pauline Baker, 'Computer Graphics", 1992, PHI,
2 William M.New Man, Robert F. Sproull," Principles of Interactive Graphics", 1979, McGraw Hill.
3. Fred Hofstterrn, Multimedia Literacy", 1995, McGraw Hill.
4. Burger, "Desktop Multimedia Bible", 1993, Addison Wesley.
5. Matthew E.Hodges and Russell M.Sasnett, "Multimedia Computing", 1990, Addison
6. John F. Koegel Beford, "Multimedia Systems", 1994, Addison Wesley, University of Massachusetts, Lowell.
7. Simon Gibbs, Dennis Tsichritzis, "Multimedia Programming", 1995, Addison Wesley, University of Geneva.

MCPE – 110: Accounting and Financial Management

Objective: To present the whole range of book-keeping concepts and to give a comprehensive coverage to management accounts.

Unit – I

Basic Concepts: Assets Current assets, Fixed assets - Liabilities, Current liabilities - other liabilities Owner's equity - Trading account - Accounting records and Systems - Control accounts and Subsidiary Ledgers Limitations. Preparation of income statement - Interpretation and use of these fixed statements by Management.

Unit – II

Depreciation: Fixed assets and Depreciation - Methods for Depreciation, Assets Acquisition, Disposal, Intangible. assets, Inventory methods, Sources of working capital, Fund flows, Cash flows.

Unit –III

Financial Statement Analysis: Ratio analysis - Use of ratios in interpreting Trading Accounts and Financial Statements, Limitations.

Unit – IV

Management Accounting: Variable costs - Fixed costs - Cost Volume Profit Analysis - Break even marginal and full costing contribution, Standard costing Analysis of variance computer accounting and algorithms.

Unit – V

Budgets and Capital Budgeting: Characteristics of Budgets, Definition, Advantages, Preparation, Forecasting - Long term, Short term - Methods of capital investment decision making, Discounted cash flows, Internal rate of return, Payback, Rate of return, Sensitivity Analysis, Cost of capital.

Reference Books

1. Maheswari S.N. and Maheswari 5K., "An Introduction to Accountancy", 5 edition. Vikas Publishing, New Delhi.

2. Manmohan and Goyal, " Principles of Management and Accounting", 5 Edn., Sahirva Bhawan,Agra

3. J.Batty,i' Management Accountancy%', 3 Edn., 1970, Macdonald & Evan Ltd., London

4. Hampton,"Financial Management", 1980, PHI

5 S.C.Kuchhal, "Financial Management", 1979, Chaitanya Pub. House

6 Anthony R.N., " Management Accounting", 1970, Homewood Illion

LIST OF COURSES WITH CONTENTS FOR ELECTIVE - 2

MCPE – 201: Operation Research

Objective: To understand the general concept of operations research relating to the optimization criteria in computer applications and helps software in this area.

Unit – I
Constrained and Unconstrained Optimization: Use of Optimization Techniques in computer applications. One dimensional unconstrained optimization - Fibonacci method - Golden section method - Quadratic approximation method - constrained optimization with Lagrangian multipliers - simple problems.

Unit – II
Linear Programming: Formulation of linear programming problems - Simplex method - BIG M method Two Phase method - Primal Dual problems, Sensitivity Analysis, Transportation problem Assignment problem.

Unit – III
Dynamic Programming: DPP Formulation Investment problem General allocation problem - Stage coach problem - Production scheduling - LPR

Unit – IV
Inventory Control: Functions of inventories - Infinite delivery rate with no backordering - Finite delivery rate with no backordering - Infinite delivery rate with ordering - Finite delivery rate with backordering Probabilistic models - Single period models.

Unit – V
Queuing Theory: Notation and assumption - Characteristics of Queue - Poisson input process - exponential service times - Queuing models - M/M/C MIM/St MIMI 1 .IN - MIM/SIN - Simple problems.

Reference Books
1. Billy.E.Gillet, "Introduction to Operations Research - A Computer Oriented Algorithmic Approach", 1976, McGraw Hill.

2. Rao.S.S, "Optimization Theory and Applications", 1981 , Wisely Eastern.

3. Taha .H.A, "Operations Research an Introduction", 3 Edition, 1982, Macmillan Pub.

4. Ackoff Sasieni M.V, "Fundamentals of Operations Research", 1968, Wisely Eastern.

5. Bunday D.Bruab, "Basic Optimization on Methods", 1984, Edward Arnold Pub.

6. Kanti Swaroop et al, "Operations Research", 1995, Sultan Chand.

MCPE – 202: Data Warehousing and Data Mining

Objective: To understand the general concept of Data Warehousing and Data Mining.

Unit – I

    Introduction: Data Mining-motivation, importance-DM Functionalities, Basic Data Mining Tasks. DM Vs KDD, DM Metrics, DM Applications, Social implications.

Unit – II

    Data Warehousing: Difference between Operational Database and Data warehouse- Multidimensional Data Model: From tables to data Cubes, Schemas, Measures-DW **Architecture:** Steps for design and construction of DW, 3-tier DW Architecture-DW **Implementation:** Efficient computation of DATA Cubes, Efficient Processing of OLAP queries, Metadata repository.

Unit – III

    Data processing, Data Mining Primitives, Languages, Data cleaning, Data Integration and Transformation, Data Reduction. Discretization and concept Hierarchy Generation. Task-relevant data, Background Knowledge, Presentation and Visualization of Discovered Patterns. Data Mining Query Language-other languages for data mining

Unit – IV

    Data Mining Algorithms: Association Rule Mining: MBA Analysis, The Apriori Algorithm, Improving the efficiency of Apriori. Mining Multidimensional Association rules from RDBMS and DXV. Classification and Predication: Decision Tree. Bayesian Classification back propagation, Cluster Analysis: Partitioning Methods. Hierarchical Method, Grid-based methods, Outlier Analysis.

Unit – V

    Web, Temporal and Spatial Data Mining: Web content Mining, Web Structure Mining, Web usage mining. Spatial Mining: Spatial DM primitives, Generalization and Specialization, Spatial rules, spatial classification and clustering algorithms. Temporal Mining: Modeling Temporal Events, Times series, Pattern Detection, Sequences.

Reference Books

1. Jiawei I-Ian, & Micheline kamber, "data Mining: Concepts and Techniques". Harcourt lndia Private Limited, First Indian Reprint,2001

2. Margaret H.Dunham,Data Mining: Introductory and Advanced Topics". Pearson Education, First Indian Reprint,2003

3. Arun K. Pujari," Data Mining Techniques", University Press (India) Limited, First Edition,2001

4. Efrem O. Mallach,"Decision Support and Data Warehouse Systems", Mcgraw-HiII International Edition, 2000.

MCPE – 203: Software Architecture and Software Testing

Objective: To Study an introduction to methods and theory for development of data warehouses and data analysis using data mining.

Unit – I

Definition - software components, COTS and infrastructure - Moving from project. centric to architecture-centric software engineering - software variability management.

Unit - II

Software architecture design method: Top-down versus bottom-up design - functionality-based architecture design - variability analysis - architecture evaluation and assessment - scenario-based evaluation simulation-based evaluation - experience-based evaluation architectural styles architectural patterns applying design patterns - convert quality requirements to functionality.

Unit – III

Design Patterns-Evolution Patterns-Software artifact evolution processes: Interdependence, dependence or Independence - Case studies: examples and experiences Use of Java Beans.

Unit – IV

History of Software Testing: Overview of Verification and Validation With the Software Life-Cycle- Formal Methods as Opposed to Software Testing- Importance of Systematic Methods for Testing- Techniques for Program Analysts- Software Testing Techniques Test Data Generation- Software Quality Assurance- Software Metrics- Comparison of Software Testing Techniques.

Unit – V

Software Reliability: Comparison of Software and Hardware Reliability- Development of Software Reliability Models- Parameter Estimation of Models and Prediction of Reliability Levels- Comparison of Models- Relation Between Software Reliability and Software Testing Techniques- Application of Software Testing and Reliability to Safety Critical Systems.

Reference Books
1. Len Bass, Paul Clements, and Rick Kazman, Software Architecture in Practice. 2nd Ed. Addison-Wesley Longman, Inc., Reading, MA. 2003.
2. Jacobson, Ivar, Griss, Martin, Jonsscn, Patrik, Software Reuse. Architecture, Process and Organization for Business Success. Addlson-Wesley Longman, Inc., Harlow. UK, 1997
3. Mary Shaw and David Garian, Software Architecture, Perspectives on an Emerging DISciphne. Prentice Hall, 1996
4. J. Bosch, Product-one Architectures in Industry: A Case Study, Proceedings of the 21st International Conference on Software Engineering, pp. 544-554, May 1999.
5. J. Bosch, Design & Use of Software Architectures - Adopting and Evolving a Product -Line Approach, Addison Wesley, ISBN 0-201-6749

MCPE – 204: Systems Programming

Objective: To study the components and concepts of System Programming.

Unit – I

Introduction: Language Processing - Its activities, Fundamentals of Language Processing Development Tools- System Software and Machine Architecture - Hypothetical Computer - CISC and RISC Machines.

Unit – II

Assembler and Macro Processors: Basic Assembler functions - Machine-dependent and Machine-independent Assembler features - Assembler Design options - Implementation Examples - Basic Macro Processor Functions Machine- independent Macro Processor features - Design options and Examples.

Unit – III

Loaders and Linkers: Basic Loader Functions - Machine-dependent and Machine-independent Loader features Design options - Linkage Editors, Dynamic Linking and Bootstrap Loaders. Implementation Examples -MS-DOS linker, SUN-OS linkers and Cray MPP linker.

Unit – IV

Translators and Software Tools: Comparison of Compilers and Interpreters - Software Tools - Tools for Programming

Development - Editors - Debug monitors Programming Environments - User Interfaces.

Unit – V

Case Studies: Introduction to Device Drivers Windows NT internals - UNIX Shell Programming and Batch Processing in MS-DOS.

Reference Books
1. Leland L. Beck," System Software - An Introduction to Systems Programming", 3rd Edition, 1999, Addison Wesley.
2. D.M.Dhamdhore, "Systems Programming and Operating Systems", 2 Edition, 1997. TMH.
3. Donovan J.J. "Systems Programming", 1972, McGraw Hill.
4. David K I-Hsiao, u Systems Programming - Concepts of Operating & Database Systems 1975, Addis On Wesley.

MCPE – 205: Big Data Analytics

Objective: Ability to pursue new business models or to achieve a significant competitive advantage on the company's traditional business.

Unit – I

Introduction to Big Data: Introduction – distributed file system – Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce.

Unit – II

Introduction Hadoop: Big Data – Apache Hadoop & Hadoop Eco System – Moving Data in and out of Hadoop – Understanding inputs and outputs of Map Reduce - Data Serialization. Hadoop Architecture: Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands, Anatomy of File Write and Read., Name Node, Secondary Name Node, and Data Node, Hadoop Map Reduce paradigm, Map and Reduce tasks, Job, Task trackers - Cluster Setup – SSH & Hadoop Configuration – HDFS Administering –Monitoring & Maintenance.

Unit – III

Hadoop Ecosystem and Yarn: Hadoop ecosystem components - Schedulers - Fair and Capacity, Hadoop 2.0 New Features Name Node High Availability, HDFS Federation, MRv2, YARN, Running MRv1 in YARN.

Unit – IV

Hive and Hiveql, Hbase: Introduction to No Query Language, Hive Architecture and Installation, Comparison with Traditional Database, HiveQL - Querying Data - Sorting And Aggregating, Map Reduce Scripts, Joins & Sub queries, HBase concepts Advanced Usage, Schema Design, Advance Indexing - PIG, Zookeeper - how it helps in monitoring a cluster, Hbase uses Zookeeper and how to Build Applications with Zookeeper.

Reference Books

1. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, "Professional Hadoop Solutions", Wiley, 2015.

2. Chris Eaton, Dirk deroos et al. , "Understanding Big data ", McGraw Hill, 2012.

3. Tom White, "HADOOP: The definitive Guide" , O Reilly, 2012.

4. VigneshPrajapati, "Big Data Analytics with R and Haoop", Packet Publishing 2013.

5. Tom Plunkett, Brian Macdonald et al, "Oracle Big Data Handbook", Oracle Press, 2014.

6. JyLiebowitz, "Big Data and Business analytics",CRC Press, 2013.

MCPE – 206: Human Resource Management

Objective: The objective of the course is to sensitize students to the systems and strategies in managing people professionally in view of the rapidly evolving aspirations of individuals, and changing business contexts.

Unit – I

Foundations and Principles of Managing People in Organizations: Concepts and Perspectives; Contemporary issues and challenges in managing human resources;

Unit – II

Job Analysis; Human Resource Planning: Demand and Supply Forecasting, Downsizing and Retention; Talent Acquisition: Recruitment, Selection and Induction; Performance Management: Systems and Strategies; Learning, Training and Development: Process and methods; Compensation and Rewards Management;

Unit – III

Industrial Relations: Dynamics of Employer, Employee and the State; Trade Unions: Past, present and the future; Industrial Harmony: Workers' Participation, Collective Bargaining, Grievance, Discipline; Dispute Resolution and Conflict Management; Employee Engagement; International Dimensions of HRM.

Reference Books

1. Armstrong, M. & S. Taylor. (2017). *Armstrong's Handbook of Human Resource Management* P*ractice* (14[th]ed.). London: Kogan Page.

2. Aswathappa, K. (2017) *Human Resource Management: Text and Cases.* (8[th]ed.) New Delhi: McGraw Hill.

3. Bohlander, G.W.,&Snell, S.A. (2016) *Principles of Human Resource Management* (16[th]ed.). New Delhi: Cengage India.

4. Carbonara, S. (2013) *Manager's Guide to Employee Engagement*. New York: McGraw Hill.

5. Cascio, W. (2015). *Managing Human Resources: Productivity, Quality of Work Life, Profits* (10[th]ed.). New York: McGraw Hill.

MCPE – 207: Cryptography and Network Security

Objective: To give an exposure on symmetric key cryptosystems, stream ciphers, public key cryptosystem, factoring and related topics.

Unit – I

Introduction to information systems, Types of information Systems, Development of Information Systems, Introduction to information security, Need for Information security, Threats to Information Systems, Information Assurance, Cyber Security, and Security Risk Analysis.

Unit – II

Application security (Database, E-mail and Internet), Data Security Considerations-Backups, Archival Storage and Disposal of Data, Security Technology-Firewall and VPNs, Intrusion Detection, Access Control. Security Threats -Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail viruses, Macro viruses, Malicious Software, Network and Denial of Services Attack, Security Threats to E-Commerce- Electronic Payment System, e- Cash, Credit/Debit Cards. Digital Signature, public Key Cryptography.

Unit – III

Developing Secure Information Systems, Application Development Security, Information Security Governance & Risk Management, Security Architecture & Design Security Issues in Hardware, Data Storage & Downloadable Devices, Physical Security of IT Assets, Access Control, CCTV and intrusion Detection Systems, Backup Security Measures

Unit – IV

Security Policies, Why Policies should be developed, WWW policies, Email Security policies, Policy Review Process-Corporate Policies-Sample Security Policies, Publishing and Notification Requirement of the Policies. Information Security Standards-ISO, IT Act, Copyright Act, Patent Law, IPR. Cyber Laws in India; IT Act 2000 Provisions, Intellectual Property Law: Copy Right Law, Software License, Semiconductor Law and Patent Law.

Reference Books

1. Charles P. Pfleeger, Shari LawerancePfleeger, "Analysing Computer Security", Pearson.

2. V.K. Pachghare, "Cryptography and information Security", PHI Learning Private Limited, Delhi India.

3. Dr. Surya Prakash Tripathi, RitendraGoyal, Praveen Kumar Shukla, "Introduction to Information Security and Cyber Law", Willey.

4. Schou, Shoemaker, "Information Assurance for the Enterprise", Tata McGraw Hill.

5. Chander, Harish, "Cyber Laws And It Protection", PHI.

MCPE – 208: Natural Language Processing

Unit – I

Overview and Language Modeling: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages- NLP Applications-Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model.

Unit – II

Word Level and Syntactic Analysis: Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word Classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency-Parsing-Probabilistic Parsing.

Unit – III

Semantic Analysis and Discourse Processing: Semantic Analysis: Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation. Discourse Processing: cohesion-Reference Resolution- Discourse Coherence and Structure.

Unit – IV

Natural Language Generation and Machine Translation: Natural Language Generation: Architecture of NLG Systems- Generation Tasks and Representations-Application of NLG. Machine Translation: Problems in Machine Translation-Characteristics of Indian Languages- Machine Translation Approaches-Translation involving Indian Languages.

Reference Books

1. Edward Loper, Ewan Klein, and Steven Bird, Natural Language Processing with Python, , O'Reilly Publication 2009.;

2. Christopher D. Manning, Hinrich Schütze ,Foundations of Statistical Natural Language Processing , MIT press,1999.

3. Dan Jurafsky, James H. Martin, Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition, Prentice Hall, 2009.

MCPE – 209: Image Processing

Unit – I

Introduction: -Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Image Sensing and Acquisition, Image Sampling and Quantization. **Image**

Enhancement in the Spatial Domain: - Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations. Basics of Spatial Filtering: Smoothing Spatial Filters, Sharpening Spatial Filters.

Unit – II

Image Transforms such as FT, DCT, and HAAR Transform etc.

Image Enhancement in the Frequency: Introduction to the Fourier Transform and the Frequency Domain, Smoothing Frequency- Domain Filters, Sharpening Frequency Domain Filters.

Unit – III

Image Restoration: Model Of the Image Degradation/Restoration Process, Restoration in the Presence of Noise Only Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function.

Image Compression: Fundamentals, Image Compression Models, Error Free Compression, Lossy Compression.

Morphological Image Processing Preliminaries, Dilation and Erosion,
Opening and Closing the Hit – or Morphological Algorithms

Unit – IV

Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation, The Use of Motion in Segmentation.

Representation and Description: Representation, Descriptors, Use Of principal Components for description, Relational Descriptors.

Reference Books

1. R.C.GonzalezandR.E.Woods**, Digital Image Processing**, Prentice Hall.

2. B.Chanda,andD.DuttaMajumder**, Digital Image Processing and Analysis**,Prentice-HallPvt.Ltd, 2000

MCPE – 210: High Performance Computing

Objective: To introduce various High-performance computing environments and implementation issues.

Unit – I

Introduction to Parallel Computing Introduction Computational Demands - Two real-time needs - Parallel Processing Terminology - Data, Temporal and Control Parallelisms - Flynn's Taxonomy Processor arrays, Multiprocessors, Multicomputer - Fundamental Algorithms - Broadcasting and All-prefix-sums Criteria for Complexity Analyses.

Unit – II

Parallel Algorithms: Parallel algorithms on various models with complexity analyses for selection, merging sorting and searching problems. Introduction to Parallel Programming Languages - CS and Sequent C - Comparison of Parallel Computing with Supercomputing and Distributed Computing.

Unit – III

Introduction to Distributed Computing Message Passing Model - Message passing, general programming models and PVM-Remote Procedure Call - Parameter passing, locating the server, Semantics in the presence of failures, security, Problem Areas.

Unit – IV

Grid Computing: Introduction - Definition, Evolution and Elements - Current Perspective - Definition, block Diagram, Grid Computing Business areas and Applications - Grid Computing Infrastructure and vulnerability security Issues-Resource Management.

Unit – V

Cluster Computing: Introduction - Cluster Computer and its Architecture, Parallel Applications and Their Development - Strategies for Developing Parallel Applications - Code Granularity and Levels of Parallelism - Parallel Programming Models and Tools Parallel Languages, Message Passing, Virtuai Shared Memory, Parallel Object-Oriented Programming, Programming Skeletons - Methodical Design of Parallel Algorithms - Partitioning, Communication, Agglomeration or Mapping.

Reference Books

1. A.Y.Zomaya, "Parallel and Distributed Computing handbook", 1995, McGrawHill Professional.

2. Michael J.Quinn, "Parallel Computing: Theory and Practice", Second Edition, 1994, Tata McGrawHill, Inc

3. M. Sasaikumar, Dinesh Shikhare, P.Ravi Praksh , "Introuduction to Parallel Processing", 2000, PHI.

4. Joshy Joseph, Creig Fellenstein, "Grid Computing", 2003, PHI

LIST OF COURSES WITH CONTENTS FOR ELECTIVE - 3

MCPE – 301: Embedded Systems

Unit – I

Introduction to embedded systems hardware needs; typical and advanced, timing diagrams, memories (RAM, ROM, and EPROM) Tri state devices, Buses, DMA, UART and PLD's Built-in on the microprocessor. Interrupts basics, ISR; Context saving, shared data problem. Atomic and critical section, Interrupt latency.

Unit – II

Survey of software architectures, Round Robin, Function queue scheduling architecture, Use of real time operating system. RTOS, Tasks, Scheduler, Shared data reentrancy, priority inversion, mutex binary semaphore and counting semaphore. Inter task communication, message queue, mailboxes and pipes, timer functions, events Interrupt routines in an RTOS environment.

Unit – III

Embedded systems of forwarded sign RTOS Hard real-time and soft real time system principles, Task division, need of interrupt routines, shared data. Embedded Software development tools.

Unit – IV

Host and target systems, cross compilers, linkers, locators for embedded systems. Getting embedded software into the target system. Debugging techniques. Testing on host machine, Instruction set emulators, logic analyzers In-circuit emulators and monitors.

Reference Books

1. David A . Simon, An Embedded Software Primer, Pearson Education.

2. Daniel W. Ewis,Fundamentals of Embedded Software Where C and Assembly Meet,Pearson Education.

3. Oliver H. Baileg,Embedded System: Desktop Integrations, Wordware Publishing Inc.

4. Tammy NoergaardNewnes,Embedded System Architecture.

MCPE – 302: Modeling and Computer Simulation

Objective: To introduce the concept of System Modeling and Computer Simulation.

Unit – I

    Introduction yo simulation and simulation Software: Systems - Models - Types, Components, Steps in Modeling - Simulation – Definition Examples - Steps in Computer Simulation - Advantages and Disadvantages of Simulation -Techniques - Monte Carlo Simulation - Types of Simulation - Lag Models - Cobweb Models - Simulation Languages - GPSS, DYNAMO.

Unit – II

    Simulation of Statistical Queuing Manufacturing and Material Handling: Useful Statistical Models - Discrete Distribution - Continuous Distributions Poisson Empirical Distribution - Manufacturing and Material Handling System - Models - Goals and Performances Measure - Issues in Simulating - Queuing System Characteristics Transient and Steady-State Behavior of Queues - Long-Run Measures - Infinite Population Markovian Models.

Unit – III

    Random Numbers: Generation of Pseudo Random Numbers - Mid-Square Method - Linear Congruential Generators - Generating Random Variates from Continuous and Discrete Probability Distributions.

Unit – IV

    System Dynamics and Object-Oriented Approach in Simulation: Generalization of Growth Models - System Dynamics Diagram Decision Function Multi Segment Model - Representation of Time Delays * Inventory and Flow Distribution Systems - World Model - Object Oriented Approach - Rule Based Approaches for Simulation - Casual Loops - Flow Diagrams- Levels and Rates ^{m}- Simple examples of Animation.

Unit – V

    Analysis of Simulation: Analysis of Simulation - Input - Output - Verification and Validation of Simulation Models Comparison and Evaluation of Alternative System Design.

Reference Books

1. J.Banks, John.S.Carson and B.L.Nelson, "Discrete Event System Simulation",

2. Geoffrey Gordon, "System Simulation", 2" Edn., 1989, PHI

3. A.Milan and W.D. Kelton, "Simulation Modeling& Analysis", 1991, McGraw Hill

4. Narsingh Deo, "System Simulation with Digital Computers", 1993, Plll

5. Nancy Roberts et al, "Introduction to Computer Simulation - A System Dynamics Approach", 1983, Addison Wisely

MCPE – 303: Principles of Programming Languages

Unit – I

Preliminary Concepts: High Level Languages, Issues in Programming - Case studies, Programming paradigms, Language implementation. Syntactic Structure - Language representation, Abstract Syntax tree, -Lexical syntax, Context Free Grammars, Variants of CFG, Issues Involved and Normal Forms for CFG.

Unit – II

Imperative Languages: Structured Programming - Need and Design issues. Block types arrays, records, sets, pointers, procedures, parameter passing, scope rules(in C).

Unit – III

Object Oriented Languages: Grouping of data and Operations - Constructs for Programming Information Hiding, Program Design with Modules, Defined typos, Templat0G programming - concept of Object, inheritance, Derived classes and Information hiding C++ as example language).

Unit – IV

Functional Programming: Functional Programming - Features, Implementation, Types - values and operations, Product of types. Lists and Operations on Lists, Functions from a domain to a range, Function Application, Lexical Scope. Bindings of values and functions (Using Haskell as example language)

Unit – V

Logic Programming: Formal Logic Systems, Working with relations and their implementation. (Using Prolog as example). Database query Languages, Exception handling (Using SQL as example)

Reference Books

1. Pratt, Ze!kowitz, "Programming Languages: Design and Implementation Edition, 1998, PHI

2. Ravi Sethi, "Programming Language Concepts and Constructs", Addison Wesley, 1989

3. Doris Appleby, Julius J. Vandekopple, "Programming Languages: Paradigms and Practice", McGraw Hill, 1997

4. Damir Medak and Gerhard Navratil, "Haskell-Tutorial", Available on the Web, Feb 2003.

5. Paul Hudak, John Peterson and Joseph H. Fasel, "A gentle Introduction to Haskell-98", Available on the Web, Oct 1999.

MCPE – 304: Soft Computing

Unit – I
Introduction to soft computing: Concept of computing systems, soft computing versus Hard computing, characteristics of soft computing, some applications of soft computing techniques.

Unit – II
Fuzzy logic: Introduction to Fuzzy logic, Fuzzy sets and membership functions, Operations on Fuzzy sets, Fuzzy relations, rules, propositions, implications and inferences, Defuzzification techniques, Fuzzy logic controller design, Some applications of Fuzzy logic.

Unit – III
Genetic Algorithms: Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques, Basic GA framework and different GA architectures, GA operators: Encoding, Crossover, Selection, Mutation, etc. Solving single-objective optimization problems using GAs.

Unit – IV
Multi-objective Optimization Problem Solving: Concept of multi-objective optimization problems (MOOPs) and issues of solving them, Multi-Objective Evolutionary Algorithm (MOEA), Non-Pareto approaches to solve MOOPs, Pareto-based approaches to solve MOOPs, Some applications with MOEAs.

Unit – V
Artificial Neural Networks: Biological neurons and its working, Simulation of biological neurons to problem solving, Different ANNs architectures, Training techniques for ANNs, Applications of ANNs to solve some real life problems.

Reference Book

1. Introduction to soft computing, Samir Roy, Udit Chakrabothy, Pearson Publication

2. Principle of soft computing S.N Deepa Wiley International .

MCPE – 305: Cloud and Grid Computing

Unit – I

Introduction: Evolution of Distributed computing: Scalable computing over the Internet –Technologies for network-based systems – clusters of cooperative computers - Grid computing Infrastructures – cloud computing - service oriented architecture – Introduction to Grid Architecture and standards – Elements of Grid – Overview of Grid Architecture. Grid Services: Introduction to Open Grid Services Architecture (OGSA) – Motivation – Functionality Requirements – Practical & Detailed view of OGSA / OGSI – Data intensive grid service models – OGSA services.

Unit – II

Virtualization: Cloud deployment models: public, private, hybrid, community – Categories of cloud computing: Everything as a service: Infrastructure, platform, software - Pros and Cons of cloud computing – Implementation levels of virtualization – virtualization structure – virtualization of CPU, Memory and I/O devices – virtual clusters and Resource Management – Virtualization for data center automation.

Unit – III

Programming Model 9 Open source grid middleware packages – Globus Toolkit (GT4) Architecture, Configuration – Usage of Globus – Main components and Programming model - Introduction to Hadoop Framework - MapReduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job – Design of Hadoop file system, HDFS concepts, command line and java interface, dataflow of File read & File write.

Unit – V

Security 9 Trust models for Grid security environment – Authentication and Authorization methods – Grid security infrastructure – Cloud Infrastructure security: network, host and application level –aspects of data security, provider data and its security, Identity and access management architecture, IAM practices in the cloud, SaaS, PaaS, IaaS availability in the cloud, Key privacy issues in the cloud.

Reference Books

1. Kai Hwang, Geoffery C. Fox and Jack J. Dongarra, "Distributed and Cloud Computing: Clusters, Grids, Clouds and the Future of Internet", First Edition, Morgan Kaufman Publisher, an Imprint of Elsevier, 2012.

2. Jason Venner, "Pro Hadoop- Build Scalable, Distributed Applications in the Cloud", A Press, 2009.

3. Tom White, "HadoopThe Definitive Guide", First Edition. O"Reilly, 2009.

4. Bart Jacob (Editor), "Introduction to Grid Computing", IBM Red Books, Vervante, 2005.

5. Ian Foster, Carl Kesselman, "The Grid: Blueprint for a New Computing Infrastructure", Morgan Kaufmann, 2nd Edition.

6. Frederic Magoules and Jie Pan, "Introduction to Grid Computing" CRC Press, 2009.

7. Daniel Minoli, "A Networking Approach to Grid Computing", John Wiley Publication, 2005

MCPE – 306: Android Application

Unit – I

Introduction to Android Operating System: Android OS design and Features – Android development framework, SDK features, Installing and running applications on Eclipse platform, Creating AVDs, Types of Android applications, Best practices in Android programming, Android tools Android application components – Android Manifest file, Externalizing resources like values, themes, layouts, Menus etc, Resources for different devices and languages, Runtime Configuration Changes Android Application Lifecycle – Activities, Activity lifecycle, activity states, monitoring state changes.

Unit – II

Android User Interface: Measurements – Device and pixel density independent measuring units Layouts – Linear, Relative, Grid and Table Layouts User Interface (UI) Components – Editable and non editable Text Views, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers Event Handling – Handling clicks or changes of various UI components Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities

Unit – III

Intents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters, finding and using Intents received within an Activity Notifications – Creating and Displaying notifications, Displaying Toasts.

Unit – IV

Persistent Storage: Files – Using application specific folders and files, creating files, reading data from files, listing contents of a directory Shared Preferences – Creating shared preferences, saving and retrieving data using Shared Preference Database – Introduction to SQLLite database, creating and opening a database, creating tables, inserting retrieving and deleting data, Registering Content Providers, Using content Providers (insert, delete, retrieve and update). Advanced Topics: Alarms– Creating and using alarms Using Internet Resources – Connecting to internet resource, using download manager Location Based Services – Finding Current Location and showing location on the Map, updating location.

Reference Books

1. RetoMeier,,Professional Android 4 Application Development, Wiley India, (Wrox) , 2012.
2. James C Sheusi,,Android Application Development for Java Programmers, Cengage Learning, 2013
3. Wei-MengLee,,Beginning Android 4 Application Development, Wiley India (Wrox), 2013

MCPE – 307: Mobile Computing

Unit – I

Introduction: Mobile Computing – Mobile Computing Vs wireless Networking – Mobile Computing Applications – Characteristics of Mobile computing – Structure of Mobile Computing Application. MAC Protocols – Wireless MAC Issues – Fixed Assignment Schemes – Random Assignment Schemes – Reservation Based Schemes

Unit – II

Mobile Internet Protocol and Transport Layer: Overview of Mobile IP – Features of Mobile IP – Key Mechanism in Mobile IP – route Optimization. Overview of TCP/IP – Architecture of TCP/IP- Adaptation of TCP Window – Improvement in TCP Performance. Mobile Telecommunication System: Global System for Mobile Communication (GSM) – General Packet Radio Service (GPRS) – Universal Mobile Telecommunication System (UMTS)

Unit – III

Mobile Ad-Hoc Networks: Ad-Hoc Basic Concepts – Characteristics – Applications – Design Issues – Routing – Essential of Traditional Routing Protocols –Popular Routing Protocols – Vehicular Ad Hoc networks (VANET) – MANET vs VANET – Security.

Unit – 4

Mobile Platforms and Applications: Mobile Device Operating Systems – Special Constrains & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – M Commerce – Structure – Pros & Cons – Mobile Payment System – Security Issues.

Mobile Platforms And Applications: Mobile Device Operating Systems – Special Constrains & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – M Commerce – Structure – Pros & Cons – Mobile Payment System – Security Issues.

Reference Books

1. Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt. Ltd, New Delhi – 2012.

2. Jochen H. Schller, "Mobile Communications", Second Edition, Pearson Education, New Delhi, 2007.

3. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2005.

4. UweHansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2003

5. William.C.Y.Lee,"Mobile Cellular Telecommunications-Analog and Digital Systems", Second Edition,TataMcGraw Hill Edition,2006.

6. C.K.Toh, "AdHoc Mobile Wireless Networks", First Edition, Pearson Education, 2002.

MCPE – 308:   E – Commerce

Unit – I

IT and business, various applications of IT in business field**.** History of e-commerce, definition, classification- B2B, B2C, C2C, G2C, B2G sites, e-commerce in education, financial, auction, news, entertainment sectors, Doing ecommerce., EDI and its components

Unit – II

Electronic payment systems – credit cards, debit cards, smart cards, e-credit accounts, e-money, EFT, security concerns in e commerce, authenticity, privacy, S-HTP, Secure e-mail protocols, integrity, non-repudiation, encryption, secret key cryptography, public key cryptography, SET, SSL, digital signatures, firewalls.

Unit – III

Internet Marketing Phase, Marketing on the web, marketing strategies, creating web presence, advertising, customer service and support, web branding strategies, web selling models.

Unit – IV

E-commerce; case study of two internationally successful e-commerce web sites and two Kerala-based e-commerce web sites; IT act (India) and e-commerce.

Reference Books

1.   C. S. V.Murthy, E-Commerce, Himalaya Publishing House.

2. NIIT, Basics of E-Commerce, PHI.

3. Erfan Turban et. al., Electronic Commerce–A Managerial Perspective, Pearson Education.

4. R Kalokota, Andrew V. Winston, Electronic Commerce – A Manager's Guide, Pearson Education.

<u>Semester – IV</u>

MC 401:   Project Work (6 month)