



# Uttar Pradesh Rajarshi Tandon Open University

*Near Rapid Action Force Campus, Shantipuram Rd, Shantipuram, Phaphamanu,  
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## Syllabus

for

### Master In Computer Application (MCA)

(THE NEW COURSE STRUCTURE AND SYLLABUS WILL BE EFFECTIVE FROM THE ACADEMIC SESSION JULY 2015-16. THEREFORE THOSE STUDENTS WHO WILL BE ENROLLED/ADMITTED IN FIRST YEAR FROM SESSION JULY 2015-16 & ONWARDS WILL STUDY ACCORDING TO THIS NEW SYLLABUS AND THE STUDENTS ADMITTED BEFORE JULY 2015-16 WILL FOLLOW OLD SYLLABUS.)

November 2016

# Contents

Contents i

<b>1</b>	<b>Master In Computer Application (MCA)</b>	<b>1</b>
1.1	Course Details and Structure	1
1.2	MCA-01(Discrete Mathematics)	2
1.3	MCA-02(Problem Solving and Programming)	3
1.4	MCA-03(Computer Organization And Assembly Language Programming)	4
1.5	MCA-E1( Computer Architecture)	5
1.6	MCA-E2 (Microprocessor and its Applications)	5
1.7	MCA-05 (C++ and Object Oriented Programming)	6
1.8	MCA-06(Database Management System)	6
1.9	MCA-E3 (Data Warehouse and Mining)	7
1.10	MCA-E4(Systems Analysis And Design)	8
1.11	MCA-09(Software Engineering)	9
1.12	MCA-10(Data Communication Networks)	9
1.13	MCA-11(Object oriented Technologies and Java Programming)	10
1.14	MCA-E5 (Mobile Computing)	11
1.15	MCA-13 (Theory Of Computation )	12
1.16	MCA-14 (RDBMS)	13
1.17	MCA-15(Operating Systems)	14
1.18	MCA-E7(Artificial Intelligence)	14
1.19	MCA-17 (UNIX Shell Programming)	15
1.20	MCA-18(Numerical And Statistical Computing)	15
1.21	MCA-19 (Design and Analysis of Algorithm)	16
1.22	MCA-E9 (Computer Graphics)	18
1.23	MCA-E10( Operations Research)	18
1.24	MCA-E11 (Object Oriented Analysis and Design)	19
1.25	MCA-E12(Information and Network Security)	20

1

# Master In Computer Application (MCA)

## 1.1 Course Details and Structure

**कम्प्यूटर विज्ञान में स्नातकोत्तर (एम.एस.-सी. कम्प्यूटर साइंस)**

**Master of Computer Science (M.Sc. Computer Science)**

कार्यक्रम कोड/ Programme Code	: 706	कार्यक्रम अवधि (सर्वां में)	: न्यूनतम : 2 अधिकतम : 4
कार्यक्रम माध्यम/Medium of Instruction	: English/अंग्रेजी	Programme Duration (in yrs.)	Minimu : 2 m Maximu : 4 m
प्रवेश हेतु न्यूनतम अर्हता/Minimum Qualification for Admission	: कम्प्यूटर विज्ञान में तीन वर्षीय स्नातक/ Three Year Bachelor Degree with Computer science	कार्यक्रम शुल्क प्रतिवर्ष / Programme Fee Per Year	: 12000/-
		अधिन्वास कार्य/ Assignment Work:-	आवश्यक/Essential

### Course code and Details

Semester	Paper No.	Course Code	Title of Course	Credits	Compulsory/Elective
First Semester	<b>Compulsory Core Course</b>				
	6026	MSc-CS-01	Discrete Mathematical Structure	3	<b>Compulsory</b>
	6027	MSc-CS-02	Introduction to Programming Language Through 'C'	3	
	6028	MSc-CS-03	Digital Computer Fundamentals and Assembly Language Programming	3	
	6029	MSc-CS-04	Lab-1 ( Based on MSc-CS-02)	3	
	<b>Discipline-Centric Elective Course</b>				
	6030 OR 6031	MSc-CS-05 OR MSc-CS-06	Theory of Computation OR System Analysis & Design	4 OR 4	<b>Elective</b>
<b>Credits of First Semester 16</b>					
Second Semester	<b>Compulsory Core Course</b>				
	6032	MSc-CS-07	Software Engineering	3	<b>Compulsory</b>
	6033	MSc-CS-08	Object Oriented Programming through 'C++'	3	
	6034	MSc-CS-09	Computer Networks	3	
	6035	MSc-CS-10	Lab-2 (Based on MSc-CS-08)	3	
	<b>Discipline-Centric Elective Course</b>				
	6036 OR 6037	MSc-CS-11 OR MSc-CS-12	System Software OR Object Oriented Analysis and Design	4 OR 4	<b>Elective</b>
<b>Open Electives course (Other Discipline) (Any Two paper in Second Semester)</b>					

	6038 OR 6039 OR 6040	MSc-CS-13 OR MSc-CS-14 OR MSc-CS-15	Numerical & Statistical Computing OR Accountancy & Financial Management OR Probability & Distribution	4 OR 4 OR 4	<b>Elective</b>
<b>Credits of Second Semester</b>					<b>24</b>
Third Semester	<b>Compulsory Core Course</b>				
	6041	MSc-CS-16	Database Management System	3	<b>Compulsory</b>
	6042	MSc-CS-17	Operating System	3	
	6043	MSc-CS-18	Core Java	3	
	6044	MSc-CS-19	Lab-3 (Based on MSc-CS-18)	3	
	<b>Discipline-Centric Elective Course</b>				
6045 OR 6046	MSc-CS-20 OR MSc-CS-21	Computer Graphics OR Design and Analysis of Algorithms	4 OR 4	<b>Elective</b>	
<b>Compulsory Foundation Course</b>					
	2702 OR 2703	PGFGS OR PGFHR	Gandhian studies and Peace Education OR Human Right and Duties	Non Credit	<b>Compulsory</b>
<b>Credits of Third Semester</b>					<b>16</b>
Fourth Semester	<b>Compulsory Core Course</b>				
	6047	MSc-CS-22	Project	12	<b>Compulsory</b>
	<b>Discipline-Centric Elective Course</b>				
	6048 OR 6049	MSc-CS-23 OR MSc-CS-24	Artificial Intelligence OR Parallel Computing	4 OR 4	<b>Elective</b>
	<b>Open Electives course (Other Discipline) (Any Two paper in Fourth Semester)</b>				
	6050 OR 6051 OR 6052	MSc-CS-25 OR MSc-CS-26 OR MSc-CS-27	Correlation, Regression & Statistical Inference OR Mathematical Analysis OR Operation Research	4 OR 4 OR 4	<b>Elective</b>
<b>Credits of Second Semester</b>					<b>24</b>
<b>Total Credits</b>					<b>80</b>

## 1.2 MCA-01(Discrete Mathematics)

### Elementary Logic

**Propositional Calculus:** Propositions, Logical Connectives, Logical Equivalence, Logical Quantifiers.

**Methods of Proof:** What is a proof? Different Methods of proof and Direct proof, Indirect proofs), Principle of induction.

**Boolean Algebra and Circuits:** Boolean Algebras, Logic circuits, Boolean Functions.

### Basic Combinatorics

**Sets, Relations and Functions:** Introducing Sets, Operations on sets, Relations, Functions.

**Combinatorics – An Introduction:** Multiplication and addition Principles, Permutations

(Permutation of objects Not Necessarily distinct, circular permutation), Combinations, Binomial Coefficients, Combinatorial probability.

**Some More Counting Principles:** Pigeonhole principle, Inclusion – Exclusion Principle, Applications of inclusion exclusion.

**Partitions and Distributions:** Integer partitions, Distributions, distinguishable objects into Distinguishable Containers, Distinguishable objects into Indistinguishable containers, Indistinguishable objects into Distinguishable Containers, Indistinguishable objects into Indistinguishable Containers.

## 1.3 MCA-02(Problem Solving and Programming)

### An Introduction to C

**Problem solving:** Problem solving Techniques, Design of Algorithms, Analysis of Algorithm efficiency, Analysis of Algorithm Complexity, Flowcharts,

**Basics of C:** History of C, Salient features of C, Structure of a C Program, Compiling a C Program, Link and Run the C Program, Diagrammatic Representation of Program execution process.

**Variables and Constants:** Character set, Identifiers of Keywords, Data types and storage, Data type Qualifiers, Variables, Declaring variables, Constants, Symbolic Constants.

**Expressions and Operators:** Assignment Statement, Arithmetic operators, Relational Operators, Logical operators, Comma and Conditional Operators, Type Cast operator, Size of Operator, C shorthand, priority of operators,

### Control Statements, Arrays and Functions

**Decision and Loop Control Statements:** The if statement, the switch statement, the while loop, The do... while Loop, The for loop, The Nested Loops, The goto statement, The break statement, The continue statement.

**Arrays:** Array Declaration, Initialization, Subscript, Multi- dimensional Arrays.

**Strings:** Declaration and Initialization of Strings, Display of Strings, using different formatting Techniques, Arrays of Strings, Built in String functions and Applications

**Functions:** Definition of a function, Declaration of a function, Function prototypes, the return statement, Types of variables and storage classes, Types of function invoking, Call by value, Recursion.

### Structures, Pointers and File Handling

**Structures and Unions:** Declaration of Structures, Accessing the Members of a structure, Initializing structures, Structures as function Arguments, Structures and Arrays, unions.

**DPointers:** Pointers and their characteristics, the address and Indirection operators, Pointer type Declaration and Assignment, Pointer Arithmetic, Passing Pointers to functions, Arrays and pointers, Arrays of Pointers, Pointers and strings.

**The C Preprocessor:** # define to implement Constants # define to create, functional Macros, conditional selection of Code using # if def. Predefined Names Defined by pre- processors, Macros vs. Functions.

**Files:** File Handling in C using File pointers, Input and output using file pointers, string Input/Output Functions, Formatted Input/Output Functions, Block Input/Output Functions,

Sequential vs. Random Access Files, Positioning the file Pointer, the buffered I/O – The UNIX like file routines.

## 1.4 MCA-03(Computer Organization And Assembly Language Programming)

### Introduction to Digital Circuits

**The Basic Computer:** The Von Neumann Architecture, Instruction Execution, Instruction Cycle, Computers: Then and Now. Data Representation Number Systems, Decimal Representation in Computers, Alphanumeric Representation, Data Representation for Computation. Principles of Logic Circuits I Logic Gates, Logic Circuits, Combinational circuit (Address, Decoders, Encoders, ROM) Principles of Logic Circuits – II Sequential Circuits (Definition) Flip Flops (Basic Flip-Flops, Excitation Tables, Master slave Flip-Flop, Edge-Triggered Flip-Flops), Sequential circuit Design (Registers, Counters Asynchronous Counters, synchronous counters, RAM) Design of a sample counter.

### Basic Computer Organization

**The Memory System:** The Memory Hierarchy RAM, ROM, DRAM, FLASH Memory Secondary Memory and characteristics, Raid and its Levels, The concepts of High speed Memories, virtual memory, SIMM, DIMM. The input /Output System Input/output Devices, The input/output Interface, The Device Controllers and its structure, Device Drivers, Input – Output Techniques, Input Output Processors,

### External Communication Interfaces

**Secondary Storage Techniques:** Secondary Storage Systems, Hard Drives, Removable Storage options. The I/O Technology: Keyboard, Mouse, Video Cards, Monitors (Cathode Ray Tubes, DPI, Interlacing, Bandwidth, Liquid Crystal Displays, Digital Camera, Sound Cards, Printers, Modems, Scanners, Power Supply. The Central Processing Unit Instruction Set Architecture Instruction set characteristics, Instruction set Design Considerations, Addressing Scheme (Immediate Addressing, Direct Addressing, Indirect Addressing, Register Addressing, Register Indirect Addressing, Indexed Addressing Scheme, Base Register Addressing, Relative Addressing Scheme, Stack Addressing), Instruction set and Format Design issues (MIPS 2000, Instruction Format). Registers Micro-Operations and Instruction Execution Basic CPU Structure, Register Organization, General Registers in a processor, Micro-operation Concepts,

### Instruction Executions, Instruction Pipelining

**ALU Organization:** ALU Organization, Arithmetic Processors,

**The Control Unit:** The Control unit, the Hardwired Control, Wilkes Control, The Microprogrammed Control, The Micro instructions, The Execution of Micro Program Reduced Instruction set Computer Architecture Instruction to RISC, RISC Architecture, The use of Large register file, Comments on RISC, RISC pipelining.

### Assembly Language Programming

**Microprocessor Architecture:** Microcomputer Architectures, Structure of 8086 CPU, Register set of 8086, Instruction set of 8086, Addressing modes.

**Introduction to Assembly Language Programming:** The Need and use of the Assembly

language, Assembly program , Execution, An Assembly program and its components, Input output in Assembly program, The types of Assembly programs.

**Assembly language programming (Part-I):** Simple Assembly programs, Programming with Loops and Comparisons, programming for Arithmetic and String operations.

**Assembly language programming (Part-II):** Use of Arrays in Assembly, Modular Programming, Interfacing, Assembly language Routines to High level language programs, Interrupts, Device Drivers in Assembly.

## 1.5 MCA-E1( Computer Architecture)

**Book : Computer Architecture and Parallel Processing,**  
**By Kai Hwang (Mcgraw-Hill Education)**

- Introduction to parallel processing
- Memory and input-output subsystems
- Principles of pipelining and vector processing
- Pipeline computers and vectorization methods
- Structures and algorithms for array processors
- SIMD computers and performance enhancement
- Multiprocessor architecture and programming
- Multiprocessing control and algorithms
- Example multiprocessor systems
- Data flow computers and VLSI computations.

## 1.6 MCA-E2 (Microprocessor and its Applications)

**Book: Microprocessor and its Applications**  
**By R. Theagarajan (New Age International Publication)**

- Architecture and Pin Details of the 8085 Microprocessor
- Programming the Microprocessor-I
- Programming the Microprocessor-II
- Programming Exercises
- Interfacing Input and Output Devices
- Interrupts
- Memory in A Microprocessor Based System
- Programmable Peripheral Interface- 8255
- Keyboard and Display Interface-8279
- Serial Communication Interface-8251
- Priority Interrupt Controller-8259
- Direct Memory Access-8257.
- Microprocessor Based Applications
- Other 8 Bit Microprocessors
- 16 Bit Microprocessors

## 1.7 MCA-05 (C++ and Object Oriented Programming)

### An Introduction to Object Oriented Programming

**Object Oriented Programming:** OOP Paradigm, the soul of OOP, OOP characteristics, Advantages of OOP, Applications of object Oriented Programming (System software, DBMS, Applications of OODBMS, Advantages and Disadvantages of OODBMS), The Object Orientation, OO Languages, Advantages of C++.

**Object Oriented Programming System:** What is OOPS?, Class, Inheritance, Abstraction (Procedural language, Object-oriented language), Mechanisms of Abstraction, Encapsulation and information hiding, Polymorphism, overloading,

**Advanced concepts:** Dynamism (Dynamic Typing, Dynamic Binding, Late Binding, Dynamic Loading, Structuring programs, Reusability, Organizing Object-oriented Projects (Large scale designing, Separate Interface and Implementation, Modularizing, Simple Interface, Dynamic decisions, Inheritance of Generic Code, Reuse of tested code.

**Introduction to Object Oriented Languages:** Objective-C, Features of objective-C, Python, Features of Python, C # (C SHAR), Features of C#, Eiffel, Modula-3, Features of modula-3, Small talk, object REXX, Java, Features of Java(Object Oriented, Distributed, Interpreted, Robust, Secure, Architecturally neutral, Portable High performance, Dynamic) , Beta various object oriented programming languages Comparative chart.

**An Introduction to Unified Modelling Language (UML):** UML (Goals, History, use), Definition, UML Diagrams (Use case, class, interaction diagrams), State diagrams, Activity Diagrams, Physical diagrams.

### C++ — An Introduction

**Overview of C++:** Programming Paradigms (Procedural Programming, Modular Programming, Data Abstraction, Object Oriented Programming), Concepts of C++ functions and files.

**Classes and Objects:** Definition and Declaration of a class, Scope Resolution Operation, Private and Public member functions, Creating Objects, Accessing class data members and member functions, Arrays of objects, Objects as Function Arguments.

**Operator overloading:** Operator Functions, large objects, Assignment and initialization, Function Call, Increment, Decrement Operator, Friends.

**Inheritance-Extending classes:** Concept of inheritance, Base class and Derived class, visibility Modes, Single inheritance Multiple Inheritance, Nested classes, virtual functions.

**Streams and Templates:** Output, Input, Files Exception, handling. and streams, Templates,

## 1.8 MCA-06(Database Management System)

### The Database Management System Concepts

**Basic Concepts:** Need for a database Management System, The logical DBMS Architecture, Physical DBMS Architecture, Commercial Database Architecture, Data Models.

**Relational AND E-R Models:** The Relational Model, Relational Constraints, Relational Algebra, Entity Relationship (ER) Model, E-R diagram, Conversion of ER diagram to Relational database.



**Database integrity and Normalization:** Relational Database integrity, Redundancy and Associated problems, Single – valued dependencies, single valued Normalization, desirable properties of decomposition, Rules of Data Normalization.

**File organization in DBMS:** Physical Database Design issues, storage of database on Hard disks, file organization and its types, types of indexes, Index and tree structure, Multi-key file organization, Importance of file organization on database.

### **Structured Query language and transaction Mgt**

#### **The Structured Query language:**

SQL Data Definition language, DML, Data control, Database objects : Views sequences, Indexes and synonyms, table Handling, Nested Queries.

**Transactions and Concurrency Management:** The transactions, the concurrent transactions, the locking protocol, Deadlock and its prevention, optimistic concurrency control.

**Database Recovery and Security:** Recovery, Recovery Techniques, Security and Integrity, Authorization.

**Distributed and Client Server Databases:** Need for Distribution Database Systems, Structure of distributed Database, Advantages and Disadvantages of DDBMS, Design of Distributed database, client server Database.

**Application Development:** Development of A Hospital Management System, Needs to Develop HMS, Creating a database for HMS, Developing Front and forms, Reports, using Queries and Record set.

#### **Study Centre Management System: A Case Study**

**Introduction :** Introduction to Software, Software Development process: Analysis, System Designing, Software Development, Testing and Maintenance.

## **1.9 MCA-E3 (Data Warehouse and Mining)**

### **Book: Data mining: concepts and techniques**

By Han, Jiawei, Micheline Kamber, and Jian Pei. (Morgan Kaufmann Publication)

- Introduction
- Data Preprocessing
- DataWarehouse and OLAP Technology: An Overview
- Data Cube Computation and Data Generalization
- Mining Frequent Patterns, Associations, and Correlations
- Classification and Prediction
- Cluster Analysis
- Mining Stream, Time-Series, and Sequence Data
- Graph Mining, Social Network Analysis, and Multirelational Data Mining
- Mining Object, Spatial, Multimedia, Text, and Web Data
- Applications and Trends in Data Mining

## 1.10 MCA-E4(Systems Analysis And Design)

### Introduction to Systems Development

**Introduction to SAD:** Fundamentals of Systems, Real Time Systems, Distributed Systems, Development of a successful System, various Approaches for Development of information systems (Model Driven, Accelerated approach, Joint Application Development).

**System Analyst – A profession:** Needs Systems Analysts, users, Analysts in various functional Areas (Systems Analyst in Traditional Business, Systems Analyst in Modern Business), Role of a Systems Analyst, Duties of a Systems Analysts, Qualification of a Systems Analyst.

**Process of System Development:** Systems Development Life Cycle, Phases of SDLC, Products of SDLC Phases, Approaches to Development (Prototyping, Joint Application Design, Participatory Design ), Case Study (College Library).

**Introduction to documentation of Systems:** Concepts and process of Documentation, Types of Documentation, Different Standards for Documentation, Documentation and Quality of Software.

### Planning and Designing Systems

**Process of Systems Planning:** Fact Finding Techniques, Need for fact finding, Issues involved in Feasibility Study, Cost Benefit Analysis, Preparing Schedule, Gathering Requirements of System.

**Modular and Structured Design:** Design principles (Top Down Design, Bottom up Design), Structure Charts, Modularity (Goals of Design, Coupling, Cohesion).

**System Design and Modeling:** Logical and Physical Design, Process Modelling, Data Modeling (ER Diagram), Process specification Tools (Decision Tables, Decision Trees, Structured English Notation), Data Dictionary.

### More Design Issues and Case Tools

**Forms and Reports Design:** Forms, Reports, Differences between forms and Reports, Process of Designing Forms and Reports, Deliverables and outcomes, Design specifications, Types of Information, General formatting Guidelines, Guidelines for Displaying Contents, Criteria for form Design, Criteria for Report Design.

**Physical file Design and Database Design:** Introduction to Database Design, Design of Database fields, Design of Physical Records, Design of Physical Files, Design of Database, Case Study (Employee database),

**Case Tools for Systems Development:** Use of Case Tools by Organizations, Advantages and Disadvantages of CASE Tools, Components of CASE, Types of CASE tools, classification of CASE Tools, Reverse and Forward Engineering, Visual and Emerging Case tools.

### Implementation and Security of Systems & MIS

**Implementation and Maintenance of Systems:** Implementation of Systems, Maintenance of Systems.

**Audit and Security of Computer Systems:** Definition of Audit, Audit of Transactions on computer, Computer Assisted Audit Techniques, Computer System and Security Issues, Concurrent Audit Techniques.

**Management Information Systems:** Role of MIS in an organization, Different kinds of information systems, Expert Systems.

## 1.11 MCA-09(Software Engineering)

### Software Engineering Concepts

**Introduction to Software Product, and Characteristics:** Component Software Engineering Phases, Documentation of the Software product, Software process and Models (Software Life Cycle, Requirements analysis and specification, Design and Specification, Coding and module testing).

**Software Process Management:** Software Process Management, Human Resource Management, The software team (DD, CD, CC), Organization, information and Decision, Problem Identification, Software crisis, Role of a System Analyst.

**Project Planning and Control:** Project planning and control, Project Scheduling, Project Standards, Project outsourcing.

**Risk Management Concepts:** Introduction and Risk Management Concepts (Managing Risk, Typical Management Risks in software Engineering. Technical Planning, Project Tracking, Delivery Timings, Partial Recovery, Bench mark Testing.

### Software Quality Concepts and Case Tools

**Software Performance:** Customer Friendliness, Software Reliability, Software Reviews, Software upgradation, Software tools and environment, Software Libraries and Toolkits, Software Modules, Reapplication of Software modules, Development tools (Code Generators, Debuggers),

**Quality Concepts:** Important Qualities of Software product and process (correctness, Reliability, Robustness, user Friendliness verifiability, Maintainability, Reusability, Portability, Data Abstraction, Modularity), Principles of Software Engineering.

**Software Methodology an Object oriented concepts:** The Evolving role of Software, An Industry perspective , structured Methodologies, Major influencing factors (Evolution of End user computing, Emergence of CASE tools, use of Prototyping and 4GL tools, Relational Database, Object Oriented Programming), using the Methodology, Choosing the Right Methodology, Implementing a Methodology, Current Generation of Software Development tools, Considerations in Application Development.

**CASE Tools:** Software crisis, An Engineering Approach to Software, CASE tools, factors Affecting Software Development, The Benefits of using CASE.

## 1.12 MCA-10(Data Communication Networks)

### Introduction to data Communication and computer network concepts

**Introduction to computer Networks:** Network Goals and Motivations, classification of Networks, Network topology, Application of Network, Networking model, Network Architecture, ARPANET, Types of Networks, Advantages of Networks.

**Data Transmission:**Data communication Terminology, Models of Data Transmission, Analog and Digital data transmission, Transmission Impairments, Transmission Media and its Characteristics, wireless transmission, wireless LAN.

**Data Encoding and Communication Technique:**Encoding, Analog-to- Analog Modulation, Analog to Digital Modulation, Digital to Analog Modulation, Digital to Digital Encoding.

**Multiplexing and Switching:** Multiplexing, Digital Subscriber lines, ADSL Vs. CABLE, Switching.

### **Media Access Central and Data Link Layer**

**Data Link Layer Fundamentals:** Framing, Basics of Error Detection, Forward error Correction, cyclic redundancy check Codes for error detection, Flow Control.

**Retransmission Strategies:** Stop & wait ARQ, GO-BACK ARQ, Selective Repeat ARQ pipelining, piggybacking.

**Contention – Based Media Access Protocols:** Advantages of Multiple Access sharing of channel Resources, Pure Aloha, Slotted Aloha, CSMA, CSMA/CD, Ethernet frame format (IEEE 802.3).

**Wireless LAN and Data link layer switching:** Introduction to wireless LAN, wireless LAN architecture (IEEE 802.11), Hidden station and Exposed Station problems, wireless LAN protocols : MACA and MACAW, IEEE 802.11 protocol stack, switching at Data link layer.

### **Network layer**

**Introduction to layer functionality and Design issues:** Connection oriented vs. connectionless services, Implementation of the network layer services, comparison between virtual circuit and Datagram subnet, Addressing, concept of Congestion, Routing concept.

**Routing Algorithms:** Flooding, shortest path routing algorithm, Distance vector routing, Link state routing, Hierarchical routing, Broadcast routing, Multicast routing.

**Congestion Control in Public Switched Network:** Reasons for congestion in the network, congestion control vs. flow control, congestion prevention mechanism, General principles of congestion prevention mechanism, General principles Congestion control, open loop control, congestion control in Packet-switched Network.

**Internetworking:** Internetworking, Network layer protocols, ICMP, OSPF, BGP.

### **Transport Layer and Application Layer Services**

**Transport Services and Mechanism:** Transport services, Elements of transport layer protocols.

**TCP/UDP:** Services provided by internet transport protocols, Introduction to (UDP, TCP), TCP segment header TCP connection establishment, TCP connection Termination, TCP Flow control, TCP Congestion control, Remote procedure call.

**Network Security-I – :** Cryptography, Symmetric key cryptography, public key cryptography, Mathematical background.

**Network Security-II:** Digital Signatures, Management of public Keys, Communication Security, Web Security.

## **1.13 MCA-11(Object oriented Technologies and Java Programming)**

### **Object Oriented Technology and Java**

**Object Oriented Methodology-1:** Paradigms of Programming languages, Evolution of OO Methodology, Basic Concepts of OO Approach, Comparison of object oriented and procedure – oriented Approaches, Benefits of OOPS, Applications of OOPS.

**Object – oriented Methodology -2:**Classes and objects, Abstraction and Encapsulation, Inheritance, Method overriding and Polymorphism.

**Java Language Basics:**Introduction to Java, Primitive Data Type and Variables, Java Operators.

**Expressions Statements and Arrays:** Expressions, Statements, Control Statements, Selection Statements, Iterative Statements, Jump statements, Arrays.

### **Object oriented concepts and Exceptions Handling**

**Class and objects:** Class Fundamentals, Introducing Methods, this Keyword, Using objects as Parameters, Method overloading, Garbage collection, the finalize () Method.

**Inheritance and Polymorphism:**Inheritance Basics, Access, Multilevel, inheritance, Method overriding Abstract classes, Polymorphism, Final Keyword.

**Packages and interfaces:**Package, Accessibility of Packages, using Package members, Interfaces, Implementing interfaces, interface and Abstract classes, Extends and Implements together.

**Exceptions Handling:**Exception, Handling of Exception, Types of Exceptions, Throwing, Exceptions, writing Exception subclasses.

### **Multithreading, I/O, and Strings Handling**

**Multithreaded Programming:** Multithreading, The Main thread, JAVA Thread Model, Thread Priorities, Synchronization in JAVA, Inter thread Communication.

**I/O In Java:**I/O Basics, Streams and stream, Classes, the predefined streams, Reading from and writing to console, reading and writing files, the transient and volatile Modifiers, using instance of Native Methods.

**Strings and Characters – :**Fundamental of Characters and Strings, the String class, String operations, Data Conversion using value of () Methods, Strings Buffer and Methods.

**Exploring Java I/O:** Java I/O classes and interfaces, Stream classes, Text streams, Stream Tokenizer, Serialization, Buffered stream, print stream, Random Access file.

### **Graphics and user interfaces**

**Applets:** The applet class, Applet architecture, An applet Skeleton: Initialization and Termination, Handling events, HTML Applet TAG.

**Graphics and user interfaces:**Graphics contests and Graphics objects, user interface components, Building user interface with AWT, Swing – Based GUI, Layouts and layouts and layout Manager, Container.

**Networking Features:**Socket overview, Reserved parts and proxy servers, Internet Addressing: Domain Naming Services (DNS), Java and The Net: URL, TCP/IP Sockets, Datagrams.

**Advance Java:**Java database connectivity, an overview of RMI Application, Java Servlets, Java Beans.

## **1.14 MCA-E5 (Mobile Computing)**

- Mobile Communications: An Overview
- Mobile Devices and Systems
- GSM and Other 2G Architectures
- Wireless Medium access Control, CDMA, 3G and 4G Communication
- Mobile IP network layer
- Mobile Transport Layer

- Databases and Mobile Computing
- Data Dissemination and Systems for Broadcasting
- Data Synchronization in Mobile Computing Systems
- Mobile Devices: Application Servers and Management
- Mobile Ad-hoc and Wireless Sensor Networks
- Mobile Wireless Short range Networks and Mobile Internet
- Mobile Application Languages- XML, Java, J2ME, and JavaCard
- Mobile Application Development Platforms

## 1.15 MCA-13 (Theory Of Computation )

### Finite Automata and Formal Languages

**Finite Automata and Languages:** Regular Expressions (Introduction to Defining of languages, Kleene closure Definition, Formal Definition of Regular, Expressions, Algebra of Regular Expressions), Regular languages, Finite automata, Mealy and Moore Machines. Non-Deterministic Finite Automata Equivalence of NFA and DFA, Pumping Lemma, Closure properties (Regular Languages and Finite Automata), Equivalence of Regular expression and Finite Automata.

**Context Free Grammar:** Grammar and its classification, Chomsky, Classification for Grammar, Context free grammar, pushdown Automata (PDA), Non-Context free languages, Pumping Lemma for context free Languages, Equivalence of CFG and PDA.

### Turing Machine and Recursive Functions

**Turing Machine:** Prelude to formal definition, Instantaneous Description and transition diagrams, Turing Machines as Computer of functions, Modular Construction of Complex turing machines, Symbol Writing machines, Right/Left head moving machines.

**Turing Machine Miscellany:** Extensions –cum-Equivalents of Turing Machine, Universal Turing Machine (UTM), Languages Accepted/Decided by TM, The diagonal language and the universal language, Chomsky Hierarchy.

**Recursive Function Theory:** Recursive Function Theory Recursive Definitions, Partial, Total and Constant Functions, Primitive Recursive Functions, Intuitive Introduction to primitive recursion, Primitive Recursion is weak Technique, The Techniques of unbounded minimization, Partial Recursion and  $\mu$ -Recursion.

### Complexity of Computability

**Computability/Decidability:** Decidable and undecidable problems, The halting, problem, Reduction to another undecidable problem, decidability of post correspondence problem, undecidable problems for context free languages.

**Complexity:** Notations for Growth rates of functions (The Constant Factor in Complexity Measure, Asymptotic considerations, well known Asymptotic growth rate Notations, The  $O$  Notation, The Notation  $\theta$ , The Notation  $\omega$ , classification of problems, Reduction, NP-Complete and NP- Hard Problems, Establishing NP-Completeness of problems.

**Applications:** Applications of Finite Automata, Applications of Regular Expressions, Application of Context free grammars (Definition of C-type small language, Definition of Part of HTML), ACM Code of Ethics and Professional Conduct.

## 1.16 MCA-14 (RDBMS)

### RDBMS Design

**RDBMS Terminology:** Introduction, Database, Database management system, Instances and Schemas, Traditional File Oriented Approach, Benefits of Conventional or Centralized DBMS, Data Independence, Data Dictionary, Database Security, Domain Definition, A Relation, Relational data integrity, Candidate keys, primary key, Foreign keys, Referential Integrity, Candidate keys and Nulls, Data dictionary checklist.

**Overview of Logical Database Design:** Introduction, The Steps of Database design, Conceptual Design, Schema Refinement, Physical database Design and Tuning, ER Model, ER Model basics (Entity, Entity type and Entity set), Attributes (Attribute, key Attributes in Entity types, Composite vs. Simple attributes, Single vs. Multivalued Attributes, Derived vs. Stored Attributes, Null values, value sets of Attributes, Relationship, Degree of Relationship type, Structural Constraints, weak entities, Components of an E-R Diagram, ER Diagram Development examples.

**Overview of Normalization:** Introduction, Redundancy and associated problems, Role of Normalization, Single valued dependencies, single valued normalizations, (1NF, 2NF, 3NF, BC NF), Desirable properties of decompositions (Attribute Preservation, Lossless-Join Decomposition, Dependency Preservation, Lack of Redundancy, Deriving BC NF), Multivalued dependencies, Multivalued Normalization – Fourth Normal Form, The fifth Normal form, Rules of data Normalization.

**Practical on RDBMS:** Introduction, DBMS and file oriented approach, Relational Databases and Integrity Constraints Entity- Relationship diagram, Functional dependency and Normalization, Normalization Structured Query Language (SQL), Microsoft-Access, views and Security using SQL.

### RDBMS Lab: Introduction to MS Access

**Introducing Microsoft Access:** Introduction, DBMS, Microsoft Access database, tables and Queries, forms and Reports,

**Microsoft Access Basics:** Introduction, Starting and Quitting Microsoft Access, Opening a database, The database window, objects of the Access database.

**Working with database:** Introduction, creating a Microsoft Access database, Creating objects, set toolbars to your working style.

**Creating a table:** Introduction, Plan fields and data types, create a table, set field properties, save and close a table, Add and save records, Edit records and close a table, Modify fields in a table, Modify Columns and rows in datasheet, Attach validation rule to a field.

**Finding Data:** Introduction, Find a value, find and replace, create and apply a filter, specify criteria, sort Records.

**Creating a Query:** Create a Query, The Query Window, Join tables, select fields, specify criteria sort Records, Calculate Totals, Modify a Query, Save a Query.

**Creating a form:** Introduction, Create a form with a form wizard, view records in a form, Add, Delete and save Records, Save and close a form.

**Customizing your form:** Introduction, Change a form's design select and Resize controls, Move and Delete Controls, Change Fonts, Size and color of text.

**Showing data from more than one table on a form:** Introduction, create a form that contains a sub form, use a Query to include fields from more than one table.

**SCreating Reports and mailing labels:** Introduction, Use Reports to present data, create a Report, preview, print and save a Report, A Report in design view, create and print mailing labels.

## 1.17 MCA-15(Operating Systems)

**Introduction:** Operating System, Generation of operating systems, Processors, Memory, Disks, Tapes, I/O Devices, Buses, Mainframe Operating Systems, Server Operating Systems Multiprocessor Operating Systems, Real time, Operating systems, smart card operating systems.

**Operating System Structure:** Monolithic systems, Layered systems, Microkernels, client, Server Model, Virtual Machines.

**Processes and Threads:** The process Model, process creation, Process Termination Process States Implementation of Processes, Thread usage, The classical thread Model, Hybrid Implementations, Interprocess Communication, Race Conditions, Critical Regions, Mutual Exclusion with busy waiting, sleep and wakeup, semaphores,

**Memory Management:** The Notation of an Address Space, Swapping virtual memory, Paging Page labels, speeding up paging, page Replacement Algorithms, The optimal Page Replacement Algorithm, the (FIFO) Page, Replacement Algorithm, The second chance page Replacement Algorithm, The clock Page Replacement Algorithm, Design issues for Paging systems, Implementation Issues, Segmentation. .Basics of Cryptography, protection Mechanisms, Authentication, Malware, Defenses. page Replacement Algorithms, The optimal Page Replacement Algorithm, the (FIFO) Page, Replacement Algorithm, The second chance page Replacement Algorithm, The clock Page Replacement Algorithm, Design issues for Paging systems, Implementation Issues, Segmentation.

**Deadlocks:** Resources, The OSTRICH Algorithm, Deadlock, Avoidance, Deadlock prevention, Deadlock Detection and Recovery. Security: Basics of Cryptography, protection Mechanisms, Authentication, Malware, Defenses.

**Case Study 1:** LINUX

**Case Study 2:** WINDOWS VISTA

## 1.18 MCA-E7(Artificial Intelligence)

**Introduction to Artificial Intelligence:** Overview of A.I., Knowledge : General Concepts, Definition and Importance of knowledge, knowledge Based systems, Representation of knowledge, knowledge organization, knowledge Manipulation, Introduction to Lisp, Functions, Predicates and Conditionals, Input, Output and Local variables, Iteration and Recursion, Property lists



and Arrays.

**Knowledge Representation:** Formalized symbolic logics, syntax and Semantics for Propositional logic, Syntax and Semantics for FOPL, Properties of wffs, Inference Rules, The Resolution Principle, Truth Maintenance Systems, Model and Temporal Logics, Fuzzy Logic and Natural Language computations. Associative Networks, Frame Structures, Conceptual Dependencies and Scripts, Objects, class, Message, and Methods, object Oriented Languages and systems.

**Knowledge Organization and Manipulation:** Preliminary Concepts, Uniformed or blind search, Informed Search, Indexing and Retrieval Techniques, Integrating knowledge in Memory, Measures for Matching, Matching like patterns, Partial Matching, Fuzzy Matching Algorithms, The RETE Matching Algorithm

**Perception Communication, and Expert systems:** Commands and Languages, Basic Parsing Techniques, Semantic Analysis and Representation Structures, Natural language Generation, Natural language Systems, Pattern Recognition, The Recognition and classification Process, Learning classification Pattern, Recognizing and understanding speech.

**Knowledge Acquisition:** Types of Learning, General Learning Model, performance Measures, Perceptions, learning Automata, Genetic Algorithms, Induction Basic Concepts, Inductive Bias, Generalization and specialization, The ID3 system, the LEX system The INDUCE system, Learning structure concepts.

## 1.19 MCA-17 (UNIX Shell Programming)

**Book: UNIX Shell Programming**

By Yashwant kanitkar(BPB Publications)

- Getting Started
- Shell Metacharacters
- Communication - Unix Style
- Tricks of The Trade
- Shell Programming - The First Step
- Shell Miscellany
- Taking Decisions
- System Administration
- The Loop Control Structure
- Shell Programming Project

## 1.20 MCA-18(Numerical And Statistical Computing)

**FORTRAN 77 and FORTRAN 90**

**Introductory FORTRAN Concept:** Character set, Constants and variables, Data Types, Subscripted variables and simple Fortran functions, Fortran Expressions, Naming Fortran Programs, Assignment statement, Fortran Commands.

**Data transfer and Program Execution Control:** Format Specification for Read and Write statements, Format Commands, Control Commands, Transfer Commands.

**Arrays and Repetitive Computations:** Arrays, Array storage, Dimension Statement, DO Construct, Nested DO loops, continue statement Implied-DO.

**DSubprogram: Functions and Subroutines:** Subprograms, Functions in FORTRAN, Function Arguments, Subroutines save variables, Function vs. Subroutine Subprograms.

### **Additional Features of FORTRAN**

**Global variables and Additional Features:** Common statements, Equivalence declarations, Data Command, Block Data Subprogram, Declaration External, Character Expressions and Assignment.

**File Manipulation:** Records and Files, File structures, File Connection, The open and close statements, Preconnected files, File Inquiry, Additional Sequential file manipulation statements, Internal files, File Input/output.

**FORTRAN 90:** Character set, Names, Source Program, Data types and Declarations, Type declaration Commands, Expressions and Assignments, Control and Iterative constructs, Arrays Program Units, Modules, Simple pointers.

### **Statistical Computations**

**Presentation of Data:** Data and Statistical Data, Frequency distribution, Graphical Representation, Inter-Relationships of Graphs.

**Measure of Central Tendency:** Measures of Dispersion, Coefficient of variation and coefficient of Dispersion, Moments, Skewness and Kurtosis.

**Correlation, Regression and Curve Fitting:** Correlation and scatter diagram, Regression, Method of least square, Graphical Representation of Relation between correlation and Regression, Curve fitting.

**Probability:** Definitions (classical Definition of Probability, Limitation of Classical Definition of Probability, Statistical Definition of Probability, Axiomatic Approach, Simple properties of Probability of an. event, Conditional Probability, Bayes Theorem, Boales inequality, Independent Events, Random Variable Expectation or Mathematical Expectation, Properties of Expectation , Distribution, Binomial Distribution, Poisson Distribution, Normal Distribution)

**Index Number and Time Series Analysis:** Index Number (Price, Quantity, Value Indexes), Chain Base Index Number, Cost for living index, Criteria for a good Index Numbers, Time series, Analysis of Trend, Measurement of Seasonal Components, Cyclical and Random Component, Forecast and its Accuracy.

## **1.21 MCA-19 (Design and Analysis of Algorithm)**

**ELEMENTARY ALGORITHMICS Structure :** Introduction, Objectives, Example of an Algorithm, Problems and Instances, Characteristics of an Algorithm, Problems, Available Tools & Algorithms, Building Blocks of Algorithms, Basic Actions & Instructions, Control Mechanisms and Control Structures, Procedure and Recursion, Outline of Algorithmic, Understanding the Problem, Analyzing the Problem, Capabilities of the Computer System, Approximate vs Exact Solution, Choice of Appropriate Data Structures, Choice of Appropriate Design Technology, Specification Methods for Algorithms, Proving Correctness of an Algorithm, Analyzing an Algorithm, Coding the Algorithm

**SOME PRE-REQUISITES AND ASYMPTOTIC BOUNDS Structure :** Some Useful Mathematical Functions & Notations, Functions & Notations, Modular Arithmetic/Mod Function, Mathematical Expectation, Principle of Mathematical Induction, Concept of Efficiency of

an Algorithm, Well Known Asymptotic Functions & Notations, Enumerate the Five Well-Known Approximation Functions and How These are Pronounced, The Notation  $O$ , The Notation  $\omega$ , The  $\theta$  Notation, The Notation  $o$ , The Notation  $w$ .

**BASICS OF ANALYSIS:** Structure, Introduction, Objectives, Analysis of Algorithms Simple Examples, Well Known Sorting Algorithms, Insertion Sort, Bubble Sort, Selection Sort, Shell Sort, Heap Sort, Divide and Conquer Technique, Merge Sort, Quick Sort, Comparison of Sorting Algorithms, Best-Case and Worst-Case Analyses, Various Analyses of Algorithms, Worst-Case Analysis, Best-Case Analysis, Analysis of Non-Recursive Control Structures, Sequencing, For Construct, While and Repeat Constructs, Recursive Constructs, Solving Recurrences, Method of Forward Substitution, Solving Linear Second-Order Recurrences with Constant Coefficients, Average-Case and Amortized Analyses, Average-Case Analysis 3.8.2 Amortized Analysis

**DIVIDE-AND-CONQUER:** Introduction, Objectives, General Issues in Divide-and-Conquer, Integer Multiplication, Binary Search, Sorting, Merge Sort, Quick Sort, Randomization Quick-sort, Finding the Median, Matrix Multiplication, Exponentiation.

**GRAPH ALGORITHMS:** Introduction, Objectives, Examples, NIM/Marienbad Game, Function For Computing Winning Nodes, Traversing Trees, Depth-First Search, Breadth-First Search, Algorithm of Breadth First Search, Modified Algorithm, Best-First Search & Minimax Principle, Topological Sort

**DYNAMIC PROGRAMMING:** Introduction, Objectives, The Problem of Making Change, The Principle of Optimality, Chained Matrix Multiplication, Matrix 'Multiplication Using Dynamic Programming.

#### **GREEDY TECHNIQUES**

Introduction, Objectives, Some Examples, Formalization of Greedy Technique, Function Greedy-Structure (GV: set): Set, Minimum Spanning Tree, Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm.

**MODELS FOR EXECUTING ALGORITHMS-I: FA:** Regular Expressions, Introduction to Defining of Languages, Kleene Closure Definition, Formal Definition of Regular Expressions, Algebra of Regular Expressions, Regular Languages, Finite Automata, Definition, Another Method to Describe FA.

**MODELS FOR EXECUTING ALGORITHMS-II: PDFA & CFG:** Formal Language & Grammar, Context Free Grammar (CFG), Pushdown Automata (PDA).

**MODELS FOR EXECUTING ALGORITHMS - III : TM:** Prelude to Formal Definition, Turing Machine: Formal Definition and Examples, Instantaneous Description and Transition Diagram, Instantaneous Description, Transition Diagrams, Some Formal Definitions, Observations, Turing Machine as a Computer of Functions.

**ALGORITHMICALLY UNSOLVABLE PROBLEMS:** Decidable and Undecidable Problems, The Halting Problem, Reduction to Another Undecidable Problem, Undecidability of Post Correspondence Problem, Undecidable Problems for Context Free Languages, Other Undecidable Problems.

**COMPLEXITY OF ALGORITHMS:** Notations for the Growth Rates of Functions, The Constant Factor in Complexity Measure, Asymptotic Considerations, Well Known Asymptotic Growth Rate Notations, The Notation  $O$ , The Notation  $\omega$ , The Notation  $\theta$ , The Notation  $o$ , The Notation  $w$ , Classification of Problems, Reduction, NP-Complete and NP-Hard Problems, Establishing NP-Completeness of Problems.

## 1.22 MCA-E9 (Computer Graphics)

Introduction to Computer Graphics, Display Technologies, Random and Raster Scan, frame buffer, bit plane, input Devices, Graphics Standards, Graphics Hardware. Line and Circle Drawing Algorithms, Scan Conversion, filling algorithms, clipping, Two and Three Dimensional transformations, Homogeneous Coordinates, Rigid Body and Affine transformations, Parallel and perspective projections, vanishing points, viewing transformation, Hidden line removal method, Curve and Surface : Cubic Spline, Bezier curve, B-Spline Curves, Parametric Surface, Surface of revolution, Sweep surface, Fractal Curves and surfaces. Introduction to Multi-media Technology, Audio System, Image Compression, Data Compression, Digital Motion Video, Authoring tools, Multimedia Applications, Multimedia DBMS.

## 1.23 MCA-E10( Operations Research)

### Introduction to Operations Research

**Operation Research – An Overview:** History, Approach, Techniques and Tools, Relationship Between O.R. specialist and Manager, Applications of OR., Phases and Processes of O.R., Study, Limitations of operation Research,

**Decision and Loop Control Statements:** Review of Probability and Statistics Random Experiment and Probability, Random variable, Probability distribution, Standard Discrete Probability distributions, Continuous Probability Distributions.

### Programming Techniques – Linear Programming and Applications:

**Linear Programming – Graphical Method:** Formulation of a linear programming problem, Formulation with Different types of constraints, Graphical Analysis, Graphical Solution, Multiple, unbounded solution and infeasible problems, Application of linear programming in Business and Industry, self-Assessment Exercises.

**Linear Programming – Simplex Method:** Principle of Simplex Method, Computational Aspect of simplex Method, Simplex Method with Several Decision Variables, Two phase and M-Method, Multiple, unbounded solutions and infeasible problems, sensitivity Analysis, Dual Linear Programming problem.

**Transportation Problem:** Basic Feasible solution of a transportation problem (The North West Corner Rule, Matrix Minimum Method, Vogel Approximation Method (VAM), Modified Distribution (MODI) Method stepping store Method, Unbalanced Transportation problem, Degenerate Transportation problem, Transshipment problem, Maximization in a transportation problem,

**Assignment problem:** Unbalance Assignment problem, Problem with some infeasible Assignments, Maximization in an Assignment problem. Crew Assignment problem.

### Programming Techniques Further Applications

**Goal Programming:** Concepts of Goal Programming, Goal Programming Model Formulation, Graphical Method of goal programming, the simplex Method of Goal Programming, Application Area of Goal Programming,

**Integer Programming:** Integer Programming Formulation Techniques, Unimodularity, cutting plane method, Branch and Bound.

**Dynamic Programming:** Dynamic Programming Methodology, Definitions and Notations, D.P. Applications.

**Non-Linear Programming:** Solution of a Non-linear Programming problem, Convex and Concave function, KUHN TUCKER conditions for Constrained optimization, Quadratic Programming, Separable Programming.

### **Inventory and Waiting Line Models**

**Inventory Control – Deterministic Models:** Inventory: An Essential Requirement, objectives of inventory, Functions of inventory, Classifications of inventory, Factors Affecting inventory, Inventory Modelling, Deterministic single item inventory models Deterministic Multi item inventory Models.

**Inventory Control : Probabilistic Models:** Inventory Model with probabilistic Demand, Single period probabilistic Models, Multi-period probabilistic Models, Inventory Control systems, Fixed Order, Quantity system, Periodic Review System, other variants of probabilistic Models.

**Queueing Models:** Characteristics of A Queueing Model, Notations and symbols, Statistical Methods, in Queueing, The M/M/I System, The M/M/C system, The M/E<sub>k</sub>/I System, Decision Problems in Queueing.

### **Game Theory and Simulation**

**Competitivesituations: Game Theory:** Definitions and Explanation of some important terms saddle points, dominance, mixed strategies: Games without saddle points, 2 x n Games, Exploiting an Opponents and Mistakes.

**Simulation:** Reasons for using simulation, limitations of simulation, steps in the simulation process, Practical Applications of simulation, Hospital Simulation, Simulation and Inventory Control, Computer Simulation.

### **Case Studies:**

**Case 1:** Insulator India Limited.

**Case 2:** Use of Operations Research Techniques: A Case Study of ECS Corporation.

## **1.24 MCA-E11 (Object Oriented Analysis and Design)**

**INTRODUCTION TO OBJECT ORIENTED MODELING:** Introduction, Objectives, Object Oriented Modeling, Basic Philosophy of Object Orientation, Characteristics Object Oriented Modeling, Class and Objects, Links and Association, Generalization and Inheritance, An Object Model, Benefits of OO Modeling, Introduction to OOA& Design Tools.

**OBJECT ORIENTED ANALYSIS:** Introduction, Objectives, Object Oriented Analysis, Problem Statement: An Example, Differences between Structured Analysis and Object Oriented Analysis, Analysis Techniques t, Object Modeling, Dynamic Modeling, Functional Modeling, Adding Operations, Analysis Iteration, Refining the Ratio Analysis, Restating the Requirements

**USING UML:** Introduction, Objectives, UML: Introduction, Object Modeling Notations: Basic Concepts, Structural Diagram, Class Diagram, Object Diagram, Component Diagram, Deployment Diagram, Behavioral Diagrams, Use Case Diagram, Interaction Diagram, Activity Diagram, Statechart Diagram, Modeling with Objects, Summary.

**SYSTEM DESIGN:** Introduction, Objectives, System Design: An Object Oriented Approach, Breaking into Subsystems, Concurrency identification, Management of a Data Store, Controlling Events Between Objects, Handling Boundary Conditions

**OBJECT DESIGN:** Introduction, Objectives, Object Design for Processing, Object Design Steps, Choosing Algorithms, Selecting Data Structure, Defining Internal Classes and Operations, Assigning Responsibility for Operation, Design Optimization, implementation of Control, State as Location within a Program, State Machine Engine, Control as Concurrent Tasks, Adjustment of Inheritance, Rearranging Classes and Operations, Abstracting Out Common Behavior, Design of Associations, Analyzing Association Traversal, One-way Associations, Two-way Associations

**ADVANCE OBJECT DESIGN:** Introduction, Objectives, Control and its Implementation, Control as a Stake within Program, Control as a State Machine Engine, Control as Concurrent Task, Inheritance Adjustment, Association: Design, Object Representation, Design Optimization, Design Documentation.

**OBJECT MODELING:** Introduction, Objectives, Advanced Modeling Concepts, Aggregation, Abstract Class Multiple Inheritance, Generalization and Specialisation, Meta Data and Keys, Integrity Constraints, An Object Model

**DYNAMIC MODELING:** Introduction, Objectives, Events, State and State Diagram, Elements of a State Diagram, Advanced Concepts in Dynamic Modeling, Concurrency - A Dynamic Model.

**FUNCTIONAL MODELING:** Introduction, Objectives, Functional Models, Data Flow Diagrams, Features of a DFD, Processes, Data Flows, Actors, Data Stores, Constraints, Control Flows, Design Flaws in DFD, A Sample Functional Model, Relation of Functional to Object and Dynamic Model

**IMPLEMENTATION STRATEGIES:** Introduction, Objectives, Implementation Associations, Unidirectional Implementations, Optional Associations, One-to-One Associations, Associations with Multiplicity 'Many', Bi-directional Implementations, One-to-One and Optional Associations, One-to-Many Associations, Immutable Associations, Implementing Associations as Classes, Implementing Constraints, Implementing State Charts, Persistency.

**OBJECT MAPPING WITH DATABASE:** Introduction, Objectives, Relational Database Schema for Object Models, General DBMS Concepts, Relational DBMS Concepts, RDBMS Logical Data Structure, Object Classes to Database Tables, Extended Three Schema Architecture for Object Models, The use of Object IDs, Mapping Object Classes to Tables, Mapping Associations to Tables, Mapping Binary Associations to Tables, Mapping Many-to-Many Association to Tables, Mapping Ternary Associations to Tables, Mapping Generalizations to Tables, Interfacing to Databases,

**CASE STUDY: INVENTORY CONTROL SYSTEM:** Introduction, Objectives, Class Diagram, Object Diagram, Generalization and Association Diagram, Collaboration Diagram, Activity Diagram and Events, Use Case Diagram, Deployment Diagram.

## 1.25 MCA-E12(Information and Network Security)

Book: Cryptography and Network Security, by, William Stallings Or Book by, Atul Kahate

- Overview
- Classical Encryption Techniques
- Block Ciphers
- Finite Fields
- Advanced Encryption Standard
- Confidentiality Using Symmetric Encryption
- Number Theory
- Public-Key Cryptography and RSA
- Other Public-Key Cryptosystems
- Hash Algorithms
- Digital Signatures
- Authentication Applications
- Electronic Mail Security
- IP Security
- Web Security
- Intruders
- Malicious Software
- Firewalls