



# **Yashwantrao Chavan Maharashtra Open University**

DNYANGANGOTRI NEAR GANGAPUR DAM, NASHIK, PIN CODE-422222,  
MAHARASHTRA (INDIA)

SYLLABUS

OF

## **MASTER OF COMPUTER APPLICATIONS (MCA)**

in collaboration with



**INDIRA GANDHI NATIONAL OPEN UNIVERSITY,  
NEW DELHI - 110 068**

## MCA (Master of Computer Applications)

Programme Code: P144

Sr. No	Course Code	Course Name	Book number	Book Name
<b>Semester 1</b>				
1.	MCA011	Problem Solving and Programming	Book 1	An Introduction To C
2.			Book 2	Control Statements, Arrays And Functions
3.			Book 3	Structures, Pointers And File Handling
4.	MCA012	Computer Organization and Assembly language Programming	Book 1	Introduction To Digital Circuits
5.			Book 2	Basic Computer Organisation
6.			Book 3	The Central Processing Unit
7.			Book 4	Assembly Language Programming
8.	MCA013	Discrete Mathematics	Book 1	Elementary Logic
9.			Book 2	Basic Combinatorics
10.	MCA014	Systems Analysis and Design	Book 1	Introduction To Systems Development
11.			Book 2	Planning And Designing Systems
12.			Book 3	More Design Issues And Case Tools
13.			Book 4	Implementation And Security of Systems & MIS
14.	MCA015	Communication Skills	Book 1	Skills Needed At The Work Place-I
15.			Book 2	Skills Needed At The Work Place-II
16.	MCAL016	Lab: Internet Concepts and Web Design	Book 1	Scripting Languages
17.			Book 2	Lab Manual
18.	MCAL017	Lab: C and Assembly Language Programming		Lab Manual
<b>Semester 2</b>				
19.	MCA021	Data and File Structures	Book 1	Introduction To Algorithms And Data Structures
20.			Book 2	Stacks, Queues And Trees
21.			Book 3	Graph Algorithms And Searching Techniques
22.			Book 4	File Structures And Advanced Data Structures
23.	MCA022	Operating System Concepts and Networking Management	Book 1	Operating System Fundamentals Networking
24.			Book 2	Linux Operating System
25.			Book 3	Windows 2000
26.			Book 4	Security And Management
27.	MCA023	Introduction to Database Management Systems	Book 1	The Database Management System Concepts
28.			Book 2	Structured Query Language And Transaction Management
29.			Book 3	Application Development: Development of A Hospital Management System (An Hms)
30.			Book 4	Study Centre Management System: A Case Study
31.	MCA024	Object Oriented Technologies and Java Programming	Book 1	Object Oriented Technology And Java
32.			Book 2	Object Oriented Concepts And Exceptions Handling
33.			Book 3	Multithreading, IO And String Handling
34.			Book 4	Applets Programming And Advanced Java Concepts
35.	MCAL025	Lab: (based on MCA021, MCA022, MCA023 & MCA024)		Lab Manual -Data Structures using C WINDOWS 2000 LINUXUNIX JAVA and MS ACCESS MY SQL
<b>Semester 3</b>				
36.	MCA031	Design and Analysis of Algorithms	Book 1	Introduction To Algorithmic
37.			Book 2	Design Techniques-I
38.			Book 3	Design Techniques-II
39.			Book 4	Complexity & Completeness

40.	MCA032	Object Oriented Analysis and Design	Book 1	Object Oriented Modeling And UML
41.			Book 2	Object Oriented Design
42.			Book 3	Modeling
43.			Book 4	Implementation
44.	MCA033	Advanced Discrete Mathematics	Book 1	Recurrences
45.			Book 2	Graph Theory
46.	MCA034	Software Engineering	Book 1	Overview Of Software Engineering
47.			Book 2	Software Project Management
48.			Book 3	Advanced Software Engineering
49.	MCA035	Accountancy and Financial Management	Book 1	Accounting System
50.			Book 2	Understanding and Analysis of Financial Statements
51.			Book 3	Financial Management and Decisions
52.			Book 4	Working Capital Management
53.	MCAL036	Lab: (based on MCA032, MCA034 and MCA035)		Lab Manual
<b>Semester 4</b>				
54.	MCA041	Operating Systems	Book 1	Introduction to Operating Systems, Process Management
55.			Book 2	Memory Management, File Management and Security
56.			Book 3	Advanced Topics and Case Studies
57.	MCA042	Data Communication and Computer Networks	Book 1	Introduction to Data Communication and Computer Network Concepts
58.			Book 2	Media Access Control and Data Link Layer
59.			Book 3	Network Layer
60.			Book 4	Transport Layer and Application Layer Services
61.	MCA043	Advanced Database Management Systems	Book 1	Database Design and Implementation
62.			Book 2	DBMS Advanced Features and Distributed Database
63.			Book 3	Enhanced Database Models
64.			Book 4	Emerging Trends and Example DBMS Architectures
65.	MCA044	Mini Project		Elements Of Project Development
66.	MCAL045	Lab: (UNIX & Oracle)		Lab manual (UNIX & DBMS)
<b>Semester 5</b>				
67.	MCA051	Advanced Internet Technologies	Book 1	Servlets and JSP Programming
68.			Book 2	EJB and XML
69.			Book 3	Web Security and Case Study
70.	MCA052	Principles of Management and Information Systems	Book 1	Management Systems
71.			Book 2	Information Systems
72.	MCA053	Computer Graphics and Multimedia	Book 1	Raster Graphics and Clipping
73.			Book 2	Transformations
74.			Book 3	Modeling and Rendering
75.			Book 4	Multimedia and Animation
76.	MCAL054	Lab: (based on MCA051 & MCA053)		LAB MANUAL (Advanced Internet Technologies and Computer Graphics)
77.	MCAE003	Artificial Intelligence and Knowledge Management	Book 1	Problem Solving & Search Techniques
78.			Book 2	Knowledge Representation
79.			Book 3	Handling Uncertainty
80.			Book 4	Applications of Artificial Intelligence
81.	MCAE004	Numerical and Statistical Computing	Book 1	Numerical Computing-I
82.			Book 2	Numerical Computing-II
83.			Book 3	Statistical Computing

84.	MCAE011	Parallel Computing	Book 1	Elements of Parallel Computing and Architecture
85.			Book 2	Parallel Algorithm & Parallel Programming
86.			Book 3	Advanced Topics
<b>Semester 6</b>				
87.	<b>MCAP060</b>	<b>Project</b>		<b>Project Guidelines</b>

# MCA SYLLABUS

The following is the syllabus for the first to fifth semesters of MCA programme. The sixth semester is completely spared for project work.

## MCA011: Problem-Solving and Programming

3 Credits

### Objectives

The course is aimed to develop problem-solving strategies, techniques and skills that can be applied to computers and problems in other areas which give students an introduction to computer and analytical skills to be used in their subsequent course work and professional development. Emphasis of this course is to act as an introduction to the thinking world of computers, to help students develop the logic, ability to solve the problems efficiently using C programming. Knowledge in a programming language is prerequisite to the study of most of computer science courses. This knowledge area consists of those skills and concepts that are essential to problem-solving and programming practice independent of the underlying paradigm. Student will learn various concepts and techniques for problem-solving and will implement those ideas using C programming.

### Syllabus

#### BOOK 1: An Introduction to C

##### Unit 1: Problem Solving

- Problem - Solving Techniques
  - Steps for Problem - Solving
  - Using Computer as a Problem-Solving Tool
- Design of Algorithms
  - Definition
  - Features of Algorithm
  - Criteria to be followed by an Algorithm
  - Top Down Design
- Analysis of Algorithm Efficiency
  - Redundant Computations
  - Referencing Array Elements
  - Inefficiency Due to Late Termination
  - Early Detection of Desired Output Condition
  - Trading Storage for Efficient Gains
- Analysis of Algorithm Complexity
  - Computational Complexity
  - The Order of Notation
  - Rules for using the Big - O Notation
  - Worst and Average Case Behavior
- Flowcharts
  - Basic Symbols used in Flowchart Design

##### Unit 2: Basics of C

- What is a Program and what is a Programming Language?

- C Language
  - History of C
  - Salient Features of C
- Structure of a C Program
  - A Simple C Program
- Writing a C Program
- Compiling a C Program
  - The C Compiler
  - Syntax and Semantic Errors
- Link and Run the C Program
  - Run the C Program through the Menu
  - Run from an Executable File
  - Linker Errors
  - Logical and Runtime Errors
- Diagrammatic Representation of Program Execution Process

##### Unit 3: Variables and Constants

- Character Set
- Identifiers and Keywords
  - Rules for Forming Identifiers
  - Keywords
- Data Types and Storage
- Data Type Qualifiers
- Variables
- Declaring Variables
- Initialising Variables
- Constants
  - Integer Constants
  - Floating Point Constants

- Character Constants
- String Constants
- Symbolic Constants

#### **Unit 4: Expressions and Operators**

- Assignment Statements
- Arithmetic Operators
- Relational Operators
- Logical Operators
- Comma and Conditional Operators
- Type Cast Operator
- Size of Operator
- C Shorthand
- Priority of Operators

### **BOOK 2: Control Statements, Arrays and Functions**

#### **Unit 5: Decision and Loop Control Statements**

- Decision Control Statements
  - The *if* Statement
  - The *switch* Statement
- Loop Control Statements
  - The *while* Loop
  - The *do-while* Statement
  - The *for* Loop
  - The Nested Loop
- The *Goto* Statement
- The *Break* Statement
- The *Continue* Statement

#### **Unit 6: Arrays**

- Array Declaration
  - Syntax of Array Declaration
  - Size Specification
- Array Initialization
  - Initialization of Array Elements in the Declaration
  - Character Array Initialization
- Subscript
- Processing the Arrays
- Multi-Dimensional Arrays
  - Multi-Dimensional Array Declaration
  - Initialization of Two-Dimensional Arrays

#### **Unit 7: Strings**

- Declaration and Initialization of Strings
- Display of Strings Using Different Formatting Techniques
- Array of Strings

- Built-in String Functions and Applications
  - *Strlen* Function
  - *Strcpy* Function
  - *Strcmp* Function
  - *Strcat* Function
  - *Strlwr* Function
  - *Strrev* Function
  - *Strspn* Function
- Other String Functions

#### **Unit 8: Functions**

- Definition of a Function
- Declaration of a Function
- Function Prototypes
- The Return Statement
- Types of Variables and Storage Classes
  - Automatic Variables
  - External Variables
  - Static Variables
  - Register Variables
- Types of Function Invoking
- Call by Value
- Recursion

### **BOOK 3: Structures, Pointers and File Handling**

#### **Unit 9: Structures and Unions**

- Declaration of Structures
- Accessing the Members of a Structure
- Initializing Structures
- Structures as Function Arguments
- Structures and Arrays
- Unions
- Initializing an Union
- Accessing the Members of an Union

#### **Unit 10: Pointers**

- Pointers and their Characteristics
- Address and Indirection Operators
- Pointer Type Declaration and Assignment
  - Pointer to a Pointer
  - Null Pointer Assignment
- Pointer Arithmetic
- Passing Pointers to Functions
  - A Function Returning More than One Value
  - Function Returning a Pointer
- Arrays and Pointers
- Array of Pointers
- Pointers and Strings

#### **Unit 11: The C Preprocessor**

- *#define* to Implement Constants

- *# define* to Create Functional Macros
  - Reading from Other Files using *# include*
  - Conditional Selection of Code using *#ifdef*
    - Using *#ifdef* for different computer types
    - Using *#ifdef* to temporarily remove program statements
  - Other Preprocessor Commands
  - Predefined Names Defined by Preprocessor
  - Macros vs Functions
- Unit 12: Files**
- File Handling in C Using File Pointers
- Open a file using the function *fopen( )*
  - Close a file using the function *fclose( )*
  - Input and Output using file pointers
    - Character Input and Output in Files
    - String Input / Output Functions
    - Formatted Input / Output Functions
    - Block Input / Output Functions
  - Sequential Vs Random Access Files
  - Positioning the File Pointer
  - The Unbuffered I/O - The UNIX like File Routines

**MCA012: Computer Organisation and Assembly Language Programming 4 Credits**

**Objectives**

In the modern era, computer system is used in most aspects of life. You may use many different types of software on a computer system for particular applications ranging from simple document creation to space data processing. But, how does the Software is executed by the Computer Hardware? The answer to this basic question is contained in this Course. This course presents an overview of the Computer Organisation. After going through this course, you will not only acquire the conceptual framework of Computer Organisation and Architecture but also would be able to use the concepts in the domain of Personal Computers. In specific, you will be able to design Digital Circuits; describe the functions of various components of Computers and their construction; and write simple Assembly Programs.

**Structure**

**BOOK 1: Introduction to Digital Circuits**

**Unit 1: The Basic Computer**

- The von Neumann Architecture
- Instruction Execution: An Example
- Instruction Cycle
  - Interrupts
  - Interrupts and Instruction Cycle
- Computers: Then and Now
  - The Beginning
  - First Generation Computers
  - Second Generation Computers
  - Third Generation Computers
  - Later Generations

**Unit 2: The Data Representation**

- Data Representation
- Number Systems
- Decimal Representation in Computers
- Alphanumeric Representation
- Data Representation For Computation
  - Fixed Point Representation
  - Decimal Fixed Point Representation
  - Floating Point Representation

- Error Detection And Correction Codes

**Unit 3: Principles of Logic Circuits I**

- Logic Gates
- Logic Circuits
- Combinational Circuits
  - Canonical and Standard Forms
  - Minimization of Gates
- Design of Combinational Circuits
- Examples of Logic Combinational Circuits
  - Adders
  - Decoders
  - Multiplexer
  - Encoder
  - Programmable Logic Array
  - Read Only Memory ROM

**Unit 4: Principles of Logic Circuits I**

- Sequential Circuits: The Definition
- Flip Flops
  - Basic Flip-Flops
  - Excitation Tables

- o Master Slave Flip Flops
- o Edge Triggered Flip-flops
- Sequential Circuit Design
- Examples of Sequential Circuits
  - o Registers
  - o Counters – Asynchronous Counters
  - o Synchronous Counters
  - o RAM
- Design of a Sample Counter

## **BOOK 2: Basic Computer Organisation**

### **Unit 1: The Memory System**

- The Memory Hierarchy
- RAM, ROM, DRAM, Flash Memory
- Secondary Memory and Characteristics
- Hard Disk Drives
  - o Optical Memories
  - o CCDs, Bubble Memories
- RAID and its Levels
- The Concepts of High Speed Memories
  - o Cache Memory
  - o Cache Organisation
  - o Memory Interleaving
  - o Associative Memory
- Virtual Memory
- The Memory System of Micro-Computer
  - o SIMM, DIMM, etc., Memory Chips
  - o SDRAM, RDRAM, Cache RAM
- Types of Memory

### **Unit 2: The Input/Output System**

- Input / Output Devices or External or Peripheral Devices
- The Input Output Interface
- The Device Controllers and its Structure
  - o Device Controller
  - o Structure of an Input /Output Interface
- Device Drivers
- Input Output Techniques
  - o Programmed Input /Output
  - o Interrupt-Driven Input /Output
  - o Interrupt-Processing
  - o DMA (Direct Memory Access)
- Input Output Processors
- External Communication Interfaces

### **Unit 3: Secondary Storage Techniques**

- Secondary Storage Systems
- Hard Drives
  - o Characteristics: Drive Speed, Access Time, Rotation Speed

- o Partitioning & Formatting: FAT, Inode
- o Drive Cache
  - o Hard Drive Interface: IDE, SCSI, EIDE, Ultra DMA & ATA/66
- Removable Drives
  - o Floppy Drives
  - o CD-ROM & DVD-ROM
- Removable Storage Options
  - o Zip, Jaz & Other Cartridge Drives
  - o Recordable CDs & DVDs
  - o CD-R vs CD-RW
  - o Tape Backup

### **Unit 4: I/O Technology**

- Keyboard
  - o Keyboard Layout
  - o Keyboard Touch
  - o Keyboard Technology
- Mouse
- Video Cards
  - o Resolution
  - o Colour Depth
  - o Video Memory
  - o Refresh Rates
  - o Graphic Accelerators and 3-D Accelerators
  - o Video Card Interfaces
- Monitors
  - o Cathode Ray Tubes
  - o Shadow Mask
  - o Dot Pitch
  - o Monitor Resolutions
  - o DPI
  - o Interlacing
  - o Bandwidth
- Liquid Crystal Displays (LCD)
- Digital Camera
- Sound Cards
- Printers
  - o Classification of Printers
  - o Print Resolutions
  - o Print Speed
  - o Print Quality
  - o Colour Management
- Modems
- Scanners
  - o Resolution
  - o Dynamic Range/Colour Depth
  - o Size and Speed
  - o Scanning Tips
- Power Supply
  - SMPS (Switched Mode Power Supply)



## **BOOK 3: The Central Processing Unit**

### **Unit 1: Instruction Set Architecture**

- Instruction Set Characteristics
- Instruction Set Design Considerations
  - Operand Data Types
  - Types of Instructions
  - Number of Addresses in an Instruction
- Addressing Schemes
  - 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
  - Instruction Length
  - Allocation of Bits Among Opcode and Operand
  - Variable Length of Instructions
- Example of Instruction Format

### **Unit 2: Registers, Micro-Operations and Instruction Execution**

- Basic CPU Structure
- Register Organization
  - Programmer Visible Registers
  - Status and Control Registers
- General Registers in a Processor
- Micro-operation Concepts
  - Register Transfer Micro-operations
  - Arithmetic Micro-operations
  - Logic Micro-operations
  - Shift Micro-operations
- Instruction Execution and Micro-operations
- Instruction Pipelining

### **Unit 3: ALU Organisation**

- ALU Organisation
  - A Simple ALU Organization
  - A Sample ALU Design
  - Arithmetic Processors

### **Unit 4: The Control Unit**

- The Control Unit
- The Hardwired Control
- Wilkes Control
- The Micro-Programmed Control
- The Micro-Instructions

- Types of Micro-Instructions
- Control Memory Organisation
- Micro-Instruction Formats
- The Execution of Micro-Program

### **Unit 5: Reduced Instruction Set Computer Architecture**

- Introduction to RISC
  - Importance of RISC Processors
  - Reasons for Increased Complexity
  - High Level Language Program Characteristics
- RISC Architecture
- The Use of Large Register File
- Comments on RISC
- RISC Pipelining

## **BOOK 4: Assembly Language Programming**

### **Unit 1: Microprocessor Architecture**

- Microcomputer Architecture
- Structure of 8086 CPU
  - The Bus Interface Unit
  - Execution Unit (EU)
- Register Set of 8086
- Instruction Set of 8086
  - Data Transfer Instructions
  - Arithmetic Instructions
  - Bit Manipulation Instructions
  - Program Execution Transfer Instructions
  - String Instructions
  - Processor Control Instructions
- Addressing Modes
  - Register Addressing Mode
  - Immediate Addressing Mode
  - Direct Addressing Mode
  - Indirect Addressing Mode

### **Unit 2: Introduction to Assembly Language Programming**

- The Need and Use of the Assembly Language
- Assembly Program Execution
- An Assembly Program and its Components
  - The Program Annotation
  - Directives
- Input Output in Assembly Program
  - Interrupts
  - DOS Function Calls (Using INT 21H)
- The Types of Assembly Programs
  - COM Programs

- o EXE Programs
- How to Write Good Assembly Programs
- Unit 3: Assembly Language Programming (Part – I)**
- Simple Assembly Programs
  - o Data Transfer
  - o Simple Arithmetic Application
  - o Application Using Shift Operations
  - o Larger of the Two Numbers
- Programming With Loops and Comparisons
  - o Simple Program Loops
  - o Find the Largest and the Smallest Array Values
  - o Character Coded Data
  - o Code Conversion
- Programming for Arithmetic and String Operations
  - o String Processing

- o Some More Arithmetic Problems

**Unit 4: Assembly Language Programming (Part – I)**

- Use of Arrays in Assembly
- Modular Programming
  - o The stack
  - o FAR and NEAR Procedures
  - o Parameter Passing in Procedures
  - o External Procedures
- Interfacing Assembly Language Routines to High Level Language
- Programs
  - o Simple Interfacing
  - o Interfacing Subroutines With Parameter Passing
- Interrupts
- Device Drivers in Assembly

**MCA013: Discrete Mathematics**

**2 Credits**

**Objectives**

Discrete mathematics, sometimes called finite mathematics, is the study of mathematical structure that are fundamentally discrete, in the sense of not supporting notion of continuity. A study of discrete sets has become more and more necessary because of many application of computer science and various areas of engineering. In computer science, discrete mathematics are useful to study or express objects or problems in computer algorithm and programming languages. For instance, to improve the efficiency of a computer programs, we need to study its logical structure, which involves a finite number of steps each requiring a certain amount of time. Using the theory of combinatory and graph theory, major areas of discrete mathematics we can do this. Therefore, a study of these areas would complement and improve the understanding of courses based on algorithm and problem solving.

This Course is designed to give basic concepts of Propositions, Predicates, Boolean Algebra, Logic Circuit, Sets, Relations, Functions, Combinatorics, Partitions and Distributions.

**Syllabus**

**BOOK 1: Elementary Logic Unit**

**1: Propositional Calculus**

- Propositions
- Logical Connectives
  - o Disjunction
  - o Conjunction
  - o Negation
  - o Conditional Connectives
  - o Precedence Rule
- Logical Equivalence
- Logical Quantifiers

- o Direct Proof
- o Indirect Proofs
- o Counter Examples
- Principle of Induction

**Unit 3: Boolean Algebra and Circuits**

- Boolean Algebras
- Logic Circuits
- Boolean Functions

**BOOK 2: Basic Combinatorics**

**Unit 1: Sets, Relations and Functions**

- Introducing Sets
- Operations on Sets
  - o Basic Operations

**Unit 2: Methods of Proof**

- What is a Proof?
- Different Methods of Proof

- Properties Common to Logic and Sets
- Relations
  - Cartesian Product
  - Relations and their types
  - Properties of Relations
- Functions
  - Types of Functions
  - Operations on Functions

#### **Unit 2: Combinatorics – An Introduction**

- Multiplication and Addition Principles
- Permutations
  - Permutations of Objects not Necessarily Distinct
  - Circular Permutations
- Combinations
- Binomial Coefficients
- Combinatorial Probability

#### **Unit 3: Some More Counting Principles**

- Pigeonhole Principle
- Inclusion-Exclusion Principle
- Applications of Inclusion – Exclusion
  - Application to Surjective Functions
  - Application to Probability
  - Application to Derangements

#### **Unit 4: 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

### **MCA014: Systems Analysis and Design**

**3 Credits**

#### **Objectives**

The objectives of the Course include the enabling of learner to identify the Software projects in an organization after studying various functionalities in the organization. Also, they should be able to structure various requirements, do the design and select the best method to develop the system. They should be able to implement and maintain the system . The learners should also get acquainted with different quality standards as well as learn about Management Information Systems.

#### **Syllabus**

##### **BOOK 1: Introduction to Systems Development**

##### **Unit 1: Introduction to SAD**

- Fundamentals of System
  - Important Terms related to Systems
  - Classification of Systems
  - Real Life Business Subsystems
- Real Time Systems
- Distributed Systems
- Development of a successful System
- Various Approaches for development of Information Systems
  - Structured Analysis and Design Approach
  - Prototype
  - Joint Application Development

##### **Unit 2: Systems Analyst-A Profession**

- Why do Businesses need 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 Analyst
- Qualifications of a Systems Analyst
  - Analytical Skills
  - Technical Skills
  - Management Skills
  - Interpersonal Skills

##### **Unit 3: Process of System Development**

- Systems Development Life Cycle
- Phases of SDLC
  - Project Identification and Selection
  - Project Initiation and planning
  - Analysis
  - Logical Design

- Physical Design
- Implementation
- Maintenance
- Product of SDLC Phases
- Approaches to Development
  - Prototyping
  - Joint Application Design
  - Participatory Design
- Case Study

**Unit 4: Introduction to Documentation of Systems**

- Concepts and process of Documentation
- Types of Documentation
  - System Requirements Specification
  - System Design Specification
  - Test Design Document
  - User Manual
- Different Standard for Documentation
- Documentation and Quality of Software
- Good Practices for Documentation

**BOOK 2: Planning and Designing Systems**

**Unit 5 : Process of System Planning**

- Fact finding Techniques
  - Interviews
  - Group Discussion
  - Site Visits
  - Presentations
  - Questionnaires
- Issues involved in Feasibility Study
  - Technical Feasibility
  - Operational Feasibility
  - Economic Feasibility
  - Legal Feasibility
- Cost Benefit Analysis
- Preparing Schedule
- Gathering Requirements of System
  - Joint Application Development
  - Prototyping

**Unit 6: Modular and Structured Design**

- Design Principles
  - Top Down Design
  - Bottom Up Design
- Structure Charts
- Modularity
  - Goals of Design
  - Coupling
  - Cohesion

**Unit 7: System Design and Modelling**

- Logical and Physical Design
- Process Modeling
  - Data Flow Diagrams
- Data Modeling
  - E-R Diagrams
- Process Specification Tools
  - Decision Tables
  - Decision Trees
  - Notation Structured English
- Data Dictionary

**BOOK 3: More Design Issues and CASE Tools**

**Unit 8: Forms and Reports Design**

- Forms
  - Importance of Forms
- Reports
  - Importance of Reports
- Differences between Forms and Reports
- Process of Designing Forms and Reports
- Deliverables and Outcomes
- Design Specifications
  - Narrative Overviews
  - Sample Design
  - Testing and Usability Assessment
- Types of Information
  - Internal Information
  - External Information
  - Turnaround Document
- General Formatting Guidelines
  - Meaningful Titles
  - Meaningful Information
  - Balanced Layout
  - Easy Navigation
- Guidelines for Displaying Contents
  - Highlight Information
  - Using Colour
  - Displaying Text
  - Designing Tables and Lists
- Criteria for Form Design
  - Organization
  - Consistency
  - Completeness
  - Flexible Entry
  - Economy
- Criteria for Report Design
  - Relevance
  - Accuracy
  - Clarity
  - Timeliness

- Cost

### **Unit 9: Physical File Design and Data base Design**

- Introduction to Database design
  - Flat files vs. Database
  - Steps in Database Design
  - E-R model to Database Design
  - Inputs to Physical Database Design
  - Guidelines for Database Design
- Design of Data Base Fields
  - Types of Fields
  - Rules for Naming Tables and Fields
- Design of Physical Records
- Design of Physical Files
  - Types of Files
  - File Organization
- Design of Database
- Case Study

### **Unit 10: CASE Tools for Systems Development**

- Use of CASE tools by organizations
  - Definition of CASE Tools
  - Use of CASE tools by Organizations
  - Role of CASE Tools
  - Advantages of CASE Tools
  - Disadvantages of CASE Tools
- Components of CASE
  - Types of CASE Tools
  - Classification of CASE Tools
  - Reverse and Forward Engineering
- Visual and Emerging CASE tools
  - Traditional systems development and CASE based systems development
  - CASE environment
  - Emerging CASE Tools
  - Objected oriented CASE tools
  - Creating documentation and reports using CASE tools
  - Creating and executable prototype using Object Oriented CASE tools
  - Sequence Diagrams

## **BOOK 4: Implementation and Security of Systems & MIS**

### **Unit 11: Implementation and Maintenance of Systems**

- Implementation of Systems
  - Conducting System Tests

- Preparing Conversion Plan
- Installing Databases
- Training the end users
- Preparation of User Manual
- Converting to the new System

- Maintenance of Systems
  - Different Maintenance activities
  - Issues involved in Maintenance

### **Unit 12: Audit and Security of Computer Systems**

- Definition of Audit
  - Objectives of Audit
  - Responsibility and Authority of the System Auditor
  - Confidentiality
  - Audit Planning
- Audit of Transactions on Computer
  - Transaction Audit
  - Audit of Computer Security
  - Audit of Application
  - Benefits of Audit
- Computer Assisted Audit Techniques
  - Audit Software
  - Test Data
  - Audit Expert Systems
  - Audit Trail
- Computer System and Security issues
  - Analysis of Threats and Risks
  - Recovering from Disasters
  - Planning the contingencies
  - Viruses
- Concurrent Audit Techniques
  - Need for Concurrent Audit Techniques
  - An Integrated Test Facility Techniques
  - The Snapshot Techniques
  - SCARF
  - Continuous and Intermittent Simulation Technique

### **Unit 13: Management Information Systems**

- Role of MIS in an organization
- Different kinds of Information Systems
  - Transaction Processing System
  - Management Information System
  - Decision Support System
  - Expert System

**Objectives**

This Course is aimed to develop the communication skills at the work place. In this Course, we concentrate on English at the workplace. You are probably wondering whether business English (as it is also called) is a separate language to general English. Certainly not, business English is not a separate language. It is English used at the workplace using specific vocabulary, and in certain situations having a different discourse. Every profession uses a certain 'jargon' and the business context is no different. While business English is firmly rooted in general English, nevertheless there are certain distinguishing features which are evident. In this Course, you will learn some theoretical inputs into the process of communication, its different types, the difference between written and oral communication. We then concentrate on the structure of conversation – its characteristics and conventions, effectively speaking over the telephone, preparing Curriculum Vitae for jobs and interviews, preparing and participating in the Group Discussions, Presentation Skills, Negotiations and many more.

**Syllabus****BOOK 1: Skills Needed at the Work Place - I****Unit 1: The Process of Communication**

- Introduction: What is Communication?
- The Process of Communication
- Barriers to Communication
- Different Types of Communication
- Written vs. Oral Communication
- Different Types of Face-to-Face Interactions
- Characteristics and Conventions of Conversation
- Conversational Problems of Second/Foreign Language Users
- Difference between Conversation and Other Speech Events

**Unit 2: Telephone Techniques**

- Warm Up
- Speaking and Listening: Commonly Used Phrases in Telephone Conversations
- Reading: Conference Calls
- Vocabulary
- Writing and Listening: Leaving a Message
- Grammar and Usage: The Perfect Tenses
- Pronunciation: Contracted Forms

**Unit 3: Job Applications and Interviews**

- Warm up
- Reading
- Vocabulary: Apply for a Job
- Curriculum Vitae
- Language Focus: Some Useful Words
- Study Skills: Preparing for an Interview
- Listening
- Speaking

- Writing

**Unit 4: Group Discussions**

- Reading
- Writing Skills
- Listening: How to be Successful in a Group Discussion
- Study Skills
- Language Focus
- Vocabulary
- Speaking
- Grammar: Connectives
- Pronunciation

**Unit 5: Managing Organisational Structure**

- Warm Up: Ability to Influence and Lead
- Reading: The Role of a Manager
- Vocabulary: Leadership
- Speaking and Listening
- Language Focus: Degree of Probability
- Grammar: Modals
- Writing: Reports
- Pronunciation

**BOOK 2: Skills Needed at the Work Place - II****Unit 6: Meetings**

- Reading: A Successful Meeting
- Speaking: One to One Meetings
- Language Focus: Opening, Middle and Close
- Study Skills: Editing
- Listening: Criteria for Successful Meetings
- Vocabulary
- Grammar: Reporting Verbs
- Writing: Memos

- Pronunciation: Stress According to Part of Speech

**Unit 7: Taking Notes and Preparing Minutes**

- Taking Notes
  - The Note-taking Skill: The Essential Components
  - The Note-taking Skill: An Example
- Preparing Minutes
  - Format of Minutes
  - Language and Style of Minutes
- Grammar: Using the Passive Voice

**Unit 8: Presentation Skills – I**

- Reading: Presentation Skills
- Grammar: Verbs often Required in Presentations
- Language Focus
- Listening: Importance of Body Language in Presentations
- Speaking: Preparing an Outline of a Presentation

- Pronunciation

**Unit 9: Presentation Skills – II**

- Reading: Structure of Presentation
- Study Skills: Visual Aids
- Ending the Presentation
- Language Focus: Talking about Increase and Decrease
- Grammar: Prepositions
- Listening: Podium Panic
- Speaking
- Pronunciation: Emphasizing the Important Words in Context

**Unit 10: Negotiation Skills**

- Language Focus: Idiomatic Expressions
- Study Skills: Process of Negotiations
- Grammar: Phrasal Verbs
- Listening: Effective Negotiations
- Speaking
- Writing

**MCAL016: Internet Concepts and Web Design**

(Lab Course)

2 Credits

**Objectives**

The main objective of the Course is to introduce the whole range of web technologies starting from HTML, DHTML, Java Script, VBScript, and Dreamweaver. It also gives a brief description on Internet. Through various examples, the Course will describe how to design specific page, dynamic web page, forms and frames. It also focuses on the practical aspects of these technologies.

**Syllabus**

**BOOK 1: Scripting Languages**

**Unit 1: The Internet**

- Classification of Networks
- Networking Models
- What is Packet Switching
- Accessing the Internet
- Internet Protocols
  - Internet Protocol (IP)
  - Transfer Control Protocol (TCP)
- Internet Address
  - Structure of Internet Servers Address
  - Address Space
- How does the Internet work
- Intranet & Extranet
- Internet Infrastructure
- Protocols and Services on Internet
  - Domain Name System
  - SMTP and Electronic Mail
  - HTTP and World Wide Web

- Usenet and Newgroups
- FTP
- Telnet
- Internet Tools
- Search Engines
- Web Browser

**Unit 2: Introduction to HTML**

- What is HTML
- Basic Tags of HTML
  - HTML Tag
  - TITLE Tag
  - BODY Tag
- Formatting of Text
  - Headers
  - Formatting Tags
  - PRE Tag
  - FONT Tag
  - Special Characters
- Working with Images
- META Tag

### **Unit 3: Advanced HTML**

- Links
  - Anchor tag
- Lists
  - Unordered Lists
  - Ordered Lists
  - Definition Lists
- Tables
  - TABLE, TR and TD Tags
  - Cell Spacing and Cell Padding
  - Colspan and Rowspan
- Frames
  - Frameset
  - FRAME Tag
  - NOFRAMES Tag
- Forms
  - FORM and INPUT Tag
  - Text Box
  - Radio Button
  - Checkbox
  - SELECT Tag and Pull Down Lists
  - Hidden
  - Submit and Reset
- Some Special Tags
  - COLGROUP
  - THREAD, TBODY, TFOOT
  - \_blank, \_self, \_parent, \_top
  - IFRAME
  - LABEL
  - Attribute for <SELECT>
  - TEXTAREA

### **Unit 4: Introduction to JavaScript**

- JavaScript Variables and Data Types
  - Declaring Variables
  - Data Types
- Statements and Operators
- Control Structures
  - Conditional Statements
  - Loop Statements
- Object-Based Programming
  - Functions
  - Executing Deferred Scripts
  - Objects
- Message box in Javascript
  - Dialog Boxes
  - Alert Boxes
  - Confirm Boxes
  - Prompt Boxes
- Javascript with HTML
  - Events
  - Event Handlers
- Forms
  - Forms Array

### **Unit 5: VB Script**

- What is VBScript
- Adding VBScript Code to an HTML Page
  - VB Script Basics
  - VBScript Data Types
  - VBScript Variables
  - VBScript Constants
  - VBScript Operators
- Using Conditional Statements
- Looping Through Code
- VBScript Procedures
- VBScript Coding Conventions
- Dictionary Object in VBScript
  - Methods: VBScript Dictionary Object
  - VBScript Dictionary Object Properties
- Err Object
  - Methods: VBScript Err Object
  - Properties: VBScript Err Object

### **Unit 6: Dreamweaver**

- Using Dreamweaver
- Create a Site Home Page
- Design a Page in Layout View
- Insert Images
- Insert Text
- Work in Standard View
- View the Site Files
- Link your Documents

### **BOOK 2: Lab Manual**

#### **Section 1: HTML (Hypertext Markup Language)**

- Basic of HTML
- How to Create HTML Document
- Steps for Creating a Simple HTML Program

#### **Section 2: Advanced HTML**

- Advanced Topics of HTML

#### **Section 3: JavaScript**

- Script Basics
- Incorporating JavaScript into a Web Page

#### **Section 4: VBScript**

- VBScript Basics
- Incorporating VBScript into HTML Page

#### **Section 5: Dreamweaver**

- How to Work in Dreamweaver??



- How to save your file?
- Adding Layers to the Timeline and Giving Motion to the Layer
- Inserting Scripts
- Inserting External Media in the Web Page
- Adding SSI(Server-side include to the Page)
- Adding CSS Style to your Page
- Adding XML Files to your Page
- To Export a Dreamweaver Document as XML File, checking entries, working in frames, windows control, the Java script URL.

**MCAL017: Lab (C and Assembly Language Programming) (Lab Course)**

**2 Credits**

**Objectives**

This lab Course is completely based on MCA011 and MCA012 courses. The basic objective of the Course is to provide hands on experience on C Programming and Assembly Language Programming and improve the practical skill. Also to apply all the concepts that have been covered in the theory courses MCA011 and MCA012. The learner will try to apply the alternate ways to provide the solution to a given problem. The learner will be able to develop the logic for the given problem, recognize and understand the syntax and construction of C code, gains experience of C and Assembly Language Programming, know the steps involved in compiling, linking and debugging C code, feel more confident about writing the C functions, including the writing of some complex programs.

**Syllabus**

**Section 1: C Programming Lab**

- Salient Features of C
- C Programming Using Borland Compiler
- Using C with UNIX
- Running C Programs using MS Visual C++
- Program Development Life Cycle
- List of Lab Assignments – Session wise

**Section 2: Digital Logic Circuits**

- Logic Gates Circuit Simulation Program
- Making a Logic Circuit Using Logic

- A Revisit of Steps of Logic Circuit Design
- Session-wise problems

**Section 3: Assembly Language Programming**

- Assemblers
  - Turbo Assembler (TASM)
  - MASM
  - Emu 8086
  - The DEBUG Program
- Assembly Programming File
- Session-wise List of Programs

**MCA021: Data and File structures**

**4 Credits**

**Objectives**

The learner should be well versed with the fundamentals of Algorithms, learn various data structures, should be able to use them appropriately as per need during development of programs. Also, the learner should know different sorting and searching techniques so that correct techniques can be used in different programs so that the complexity of the program does not increase due the sorting/search technique employed. The learner should have the knowledge about file structures and finally, s/he should also know the concepts of advanced data structures.

**Syllabus**

**BOOK 1: Introduction to Algorithms and Data Structures**

**Unit 1: Analysis of Algorithms**

- Mathematical Background

- Process of Analysis
- Calculation of Storage Complexity
- Calculation of Run Time Complexity

**Unit 2 Arrays**

- Arrays and Pointers
- Sparse Matrices

- Polynomials
- Representation of Arrays
  - Row Major Representation
  - Column Major Representation
- Applications

### Unit 3: Lists

- Abstract Data Type-List
- Array Implementation of Lists
- Linked Lists-Implementation
- Doubly Linked Lists-Implementation
- Circularly Linked Lists-Implementation
- Applications

## BOOK 2: Stacks, Queues and Trees

### Unit 4: Stacks

- Abstract Data Type-Stack
- Implementation of Stack
  - Implementation of Stack using Arrays
  - Implementation of Stack using Linked Lists
- Algorithmic Implementation of Multiple Stacks
- Applications

### Unit 5: Queues

- Abstract Data Type-Queue
- Implementation of Queue
  - Array Implementation
  - Linked List Implementation
- Implementation of Multiple Queues
- Implementation of Circular Queues
  - Array Implementation
  - Linked List Implementation of a circular queue
- Implementation of DEQUEUE
  - Array Implementation of a *dequeue*
  - Linked List Implementation of a *dequeue*

### Unit 6: Trees

- Abstract Data Type-Tree
- Implementation of Tree
- Tree Traversals
- Binary Trees
- Implementation of Binary Tree
- Binary Tree Traversals
  - Recursive Implementation of Binary Tree Traversals
  - Non Recursive Implementations of Binary Tree Traversals

- Applications

## BOOK 3: Graph Algorithms and Searching Techniques

### Unit 7: Advanced Trees

- Binary Search Trees
  - Traversing a Binary Search Trees
  - Insertion of a node into a Binary Search Tree
  - Deletion of a node from a Binary Search Tree
- AVL Trees
  - Insertion of a node into an AVL Tree
  - Deletion of a node from an AVL Tree
  - AVL tree rotations
  - Applications of AVL Trees
- B-Trees
  - Operations on B-Trees
  - Applications of B-Trees

### Unit 8: Graphs

- Definitions
- Shortest Path Algorithms
  - Dijkstra's Algorithm
  - Graphs with Negative Edge costs
  - Acyclic Graphs
  - All Pairs Shortest Paths Algorithm
- Minimum cost Spanning Trees
  - Kruskal's Algorithm
  - Prim's Algorithm
  - Applications
- Breadth First Search
- Depth First Search
- Finding Strongly Connected Components

### Unit 9: Searching

- Linear Search
- Binary Search
- Applications

## BOOK 4: File Structures and Advanced Data Structures

### Unit 10 Sorting

- Internal Sorting
  - Insertion Sort
  - Bubble Sort
  - Quick Sort
  - 2-way Merge Sort
  - Heap Sort
- Sorting on Several Keys

### Unit 11: Advanced Data Structures

- Splay Trees
  - Splaying steps
  - Splaying Algorithm
- Red-Black trees
  - Properties of a Red-Black tree
  - Insertion into a Red-Black tree
  - Deletion from a Red-Black tree
- AA-Trees

- Terminology
- File Organisation
- Sequential Files
  - Structure
  - Operations
  - Disadvantages
  - Areas of use
- Direct File Organisation
- Indexed Sequential File Organisation

### Unit 12: File Structures

## MCA022: Operating System Concepts and Networking Management

4 Credits

### Objectives

This Course is intended to introduce the concepts, structure, features, trends and design mechanism of Operating System. The Operating System has seen consistent innovations and developments like other fields of computer science. In this Course efforts have been to capture these changes. The trend is towards GUI based free, platform independent, secure and network-based operating system. Linux and Windows 2000 have got very wide coverage in the Course. Security and network management, a part of modern Operating System design, have also been taken up.

### Syllabus

#### BOOK 1: Operating System Fundamentals Networking

##### Unit 1: Graphical User Interface

- What is Graphical User Interface
- Evolution of Human and Machine Interaction
- Common Graphical User Interfaces
- Functionality of Graphical User Interface
- GUI Design Consideration: psychological factors
- GUI Design Consideration: standards
- GUI Example
  - Microsoft Windows
  - Macintosh Toolbox
  - X-windows
  - NeXT

##### Unit 2: Introduction to Operating System

- What is an Operating System?
- Evolution of Operating System
  - Serial Processing
  - Batch Processing
  - Multiprogramming
- Operating System Structure
  - Layered Structure Approach
  - Virtual Machine
  - Client-Server Model
  - Kernel Approach

- Classification of Advanced Operating System
  - Architecture Driven Operating System
  - Application Driven Operating System
- Characteristics of Modern Operating System
  - Microkernel Architecture
  - Multithreading
  - Symmetric Multiprocessing

##### Unit 3: Introduction to Networking Concepts

- Why Computer Networks
- The Topologies
- Characteristics of the OSI Layers
- OSI Models and Communication between Systems
- Interaction between OSI Model Layers
- Protocols Types of Networks
  - Local Area Network (LANs)
  - Metropolitan Networks (MANs)
  - Wide Area Network (WANs)
- Medium
- Data Flow
- Physical Connection
- Transmission Media
- Connecting Devices
  - Repeaters

- Hubs
- Bridges
- Routers
- Gateways

#### **Unit 4: Internetworking: Concept, Architecture and Protocols**

- History of internetworking
- Packet Switching
- Internetworking Concepts
- Internet Addresses Object-Based Programming
- Configuring IP Addresses
- TCP/ IP
- Additional TCP/ IP – Related Protocols
- Application Layer Protocols
  - File Transfer Protocols
  - Trivial File Transfer Protocol (TFTP)
  - TELNET
  - Remote login
  - Electronic Mail (Email)
- World Wide Web
- Domain Name System
- SNMP and UDP

### **BOOK 2: Linux Operating System**

#### **Unit 1: Introduction to Linux Operating System**

- Features of Linux
- Drawbacks of Linux
- Components of Linux
  - Memory Management Subsystems
  - Linux Process and Thread Management
  - File Management System
  - Device Drivers

#### **Unit 2: Linux Commands and Utilities**

- Entering the Machine
  - User Names and Groups
  - Logging In
  - Correcting Typing Mistakes
  - Format of Linux Commands
  - Changing Your Password
  - Characters with Special Meanings
  - Linux Documentation
- The File System
  - Current Directory
  - Looking at the Directory Contents
  - Absolute and Relative Pathnames
  - Some Linux Directories and Files

#### **Unit 3: Linux Utilities and Editor**

- Some Useful Commands
- Permission Modes and Standard Files
- Pipes, Filters and Redirection
- Shell Scripts
- Graphical User Interface
- Editor

#### **Unit 4: User-to-User Communication**

- On-Line Communication
- Off-Line Communication
- Apache Server Settings
- Network Server Settings
  - Domain Name Server
  - Network File Server

#### **Unit 5: Unix System Administration**

- System Administration
- Installing Linux
  - Choosing an Installation Method
  - Choosing an Installation Class
  - Pre-installation checks
  - Installation
- Booting the System
- Maintaining User Accounts
- File Systems and Special Files
- Backups and Restoration

### **BOOK 3: Windows 2000**

#### **Unit 1: Windows 2000 Networking**

- Windows 2000 Operating System Architecture
  - Peer-To-Peer Network
  - Domains
  - Network Protocols
  - File Services
  - Shared Folders
  - Distributed File System
  - Print Services
- Using the Mapped Drive
  - Printing a Mapped Drive
  - Disconnecting a Mapped Drive
  - Viewing Directory Information
  - Creating a Shared Folder
  - Logging off a Client
- A Few Important Facts About Windows 2000 Usages

#### **Unit 2: Managing Windows 2000 Server**

- Using Windows 2000 and Client
- Logging on to the Network

- Browsing Network Resources
- Accessing Network Resources Using My Network Places
- Mapping a Folder

### **Unit 3: Advanced Windows 2000 Networking**

- Windows 2000 Domains, Workgroups & Trusted Relationships
  - Concept of Domains
  - Trust Relationships
  - Building Domains
- User Administration
- Remote Access

### **Unit 4: Windows XP Networking**

- Introduction to Windows XP Networking
  - TCP/IP Protocol Setting for Windows XP
  - To Select a Network Protocol
  - Virtual Private Networks and Remote Networking
- Windows XP in File System
- Sharing Network Resources in Windows XP
  - Sharing Files in Windows XP
  - Sharing Folders in Windows XP
  - Sharing Drives in Windows XP
- Enabling Offline File Features

## **BOOK 4: Security and Management**

### **Unit 1: Security Concepts**

- Goals of Computer Security
  - Integrity
  - Confidentiality
  - Availability
- Security Problem and Requirements
  - Identifying the Assets
  - Identifying the Threats
  - Identifying the Impact
- Threat and Vulnerabilities
- User Authentication
- Security System and Facilities
  - System Access Control
  - Password Management
  - Privileged User Management
  - User Account Management
  - Data Resource Protection
  - Sensitive System Protection
- Cryptography
- Intrusion detection
- Computer-Security Classifications

### **Unit 2: Computer Security**

- Hardening Operating System and Application Code
- Hardening File System Security
- Hardening Local Security Policies
- Hardening Services
- Hardening Default Accounts
- Hardening Network Activity
  - Malicious Code
  - Firewall
- Fault Tolerant System
- BACKUP and UPS

### **Unit 3: Security and Management-I**

- Main Issues In Windows Security Management
  - Physical Security Management
  - Logon Security Management
  - Users and Groups Management
  - Managing Local and Global Groups
  - Managing User Accounts
  - Windows NT Domain Management
- Domain Controller
  - The Primary Domain Controller (PDM)
  - Backup Domain Controller (BDC)
- Windows Resources Management
- Registry Management
  - Removing Registry Access
  - Managing Individual Keys
  - Audit Registry Access
- Printer Management
- Managing Windows 2000 Operating System
- Active Directory
  - Logical Structure
  - Physical Structure
- Windows 2000 DNS Management
- Managing Group Policy

### **Unit 4: Security and Management-II**

- User Authentication Management
  - Subsystems Component Management
  - Kerberos Management
- User and Group Management
  - Configuring User Accounts
  - Creating Domain User Accounts
  - Managing Logon Hours
  - Managing Expiry Date for a User Account
  - Windows 2000 Groups Management
  - Default Group Types

- Security Configuration Management Tool
- Resource Management
  - Files and Folder Management
  - Files and Folder Permission
  - Inheritances and Propagation
  - Moving Data and Permission
  - Shared Resources Management
  - The NULL Session
  - Registry Management
  - Default Registry Configurations
  - Registry Backup Managements
- Printer Security Management
- Windows 2000 Network – Security and Management
  - NAT and ICS
  - RRAS, RADIUS and IAS
  - IPSec
- Encrypting File System Management
  - Encrypting File System (EFS)
  - EFS and Users Management
  - Data Recovery Management
  - EFS Cryptography Management

**MCA023: Introduction to Database Management Systems**

**3 Credits**

**Objectives**

Database systems are pervasive. They are present in every segment of commercial, academic and virtual world. They are required as the backbone of any information system, enterprise resource planning, research activities and other activity that require permanence of data storage. This Course provides the basic introduction to database system technologies; and concurrency, security and recovery issues of database management systems.

This Course also provides the basic conceptual background necessary to design and develop simple database systems. The major focus in this Course is the relational database model; however, it also discusses about the ER model and distributed databases. This Course enables you to write good queries using a standard query language called SQL.

**Syllabus**

**BOOK 1: The Database Management System Concepts**

**Unit 1: The Basic Concepts**

- Need for a Database Management System
  - The file based system
  - Limitations of file based system
  - The Database Approach
- The Logical DBMS Architecture
  - Three level architecture of DBMS or logical DBMS architecture
  - Mappings between levels and data independence
  - The need for three level architecture
- Physical DBMS Architecture
  - DML Precompiler
  - DDL Compiler
  - File Manager
  - Database Manager
  - Query Processor
  - Database Administrator
  - Data files indices and Data Dictionary
- Commercial Database Architecture
- Data Models

**Unit 2: Relational And ER Models**

- The Relational Model
  - Domains, Attributes, Tuple and Relation
  - Super keys Candidate keys and Primary keys for the Relations
- Relational Constraints
  - Domain Constraint
  - Key Constraint
  - Integrity Constraint
  - Update Operations and Dealing with Constraint Violations
- Relational Algebra
  - Basic Set Operation
  - Cartesian Product
  - Relational Operations
- Entity Relationship (ER) Model
  - Entities

- o Attributes
- o Relationships
- o More about Entities and Relationships
- o Defining Relationship for College Database
- E-R Diagram
- Conversion of E-R Diagram to Relational Database

### **Unit 3: Database Integrity and Normalisation**

- **Relational Database Integrity**
  - o The Keys
  - o Referential Integrity
  - o Entity Integrity
- **Redundancy and Associated Problems**
- Single-Valued Dependencies
- Single-Valued Normalisation
  - o The First Normal Form
  - o The Second Normal Form
  - o The Third Normal Form
  - o Boyce Codd Normal Form
- Desirable Properties of Decomposition
  - o Attribute Preservation
  - o Lossless-join Decomposition
  - o Dependency Preservation
  - o Lack of redundancy
- Rules of Data Normalisation
  - o Eliminate Repeating Groups
  - o Eliminate Redundant Data
  - o Eliminate Columns Not Dependent on Key

### **Unit 4: File Organisation in DBMS**

- Physical Database Design Issues
- Storage of Database on Hard Disks
- File Organisation and Its Types
  - o Heap files (Unordered files)
  - o Sequential File Organisation
  - o Indexed (Indexed Sequential) File Organisation
  - o Hashed File Organisation
- Types of Indexes
- Index and Tree Structure
- Multi-key File Organisation<sup>99</sup>
  - o Need for Multiple Access Paths
  - o Multi-list File Organisation
  - o Inverted File Organisation
- Importance of File Organisation in Databases

## **BOOK 2: Structured Query Language and Transaction Management**

### **Unit 1: The Structures Query Language**

- What is SQL?
- Data Definition Language
- Data Manipulation Language
- Data Control
- Database Objects: Views, Sequences, Indexes and Synonyms
  - o Views
  - o Sequences
  - o Indexes and Synonyms
- Table Handling
- Nested Queries

### **Unit 2: Transactions and Concurrency Management**

- The Transactions
- The Concurrent Transactions
- The Locking Protocol
  - o Serialisable Schedules
  - o Locks
  - o Two Phase Locking (2PL)
- Deadlock and its Prevention
- Optimistic Concurrency Control

### **Unit 3: Database Recovery and Security**

- What is Recovery?
  - o Kinds of failures
  - o Failure controlling methods
  - o Database errors
- Recovery Techniques
- Security & Integrity
  - o Relationship between Security and Integrity
  - o Difference between Operating System and Database Security
- Authorization

### **Unit 4: Distributed and Client Server Databases**

- Need for Distributed Database Systems
- Structure of Distributed Database
- Advantages and Disadvantages of DDBMS
  - o Advantages of Data Distribution
  - o Disadvantages of Data Distribution
- Design of Distributed Databases
  - o Data Replication
  - o Data Fragmentation
- Client Server Databases

- o Emergence of Client Server Architecture
- o Need for Client Server Computing
- o Structure of Client Server Systems
- o Advantages of Client Server Systems

**BOOK 3: Application Development: Development of a Hospital Management System (An HMS)**

- Need to Develop the Hospital Management System (An HMS)
- Creating a Database for HMS

- Developing Front End Forms
- Reports
- Using Queries and Record set

**BOOK 4: Study Centre Management System: A Case Study**

- Software Development Process: Analysis
- System Designing
- Issues relating to Software Development, Testing and Maintenance

**MCA024: Object Oriented Technology and Java Programming**

**3 Credits**

**Objectives**

Today almost every branch of computer science is feeling presence of object-orientation. Object oriented technology is successfully incorporated in various fields of computer science. Since its arrival on the scene in 1995, the Java has been accepted as one of the primary programming language.

This Course is designed to give you exposure to basic concepts of object-oriented technology. It will help in learning to 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.

**Syllabus**

**BOOK 1: Object Oriented Technology and Java**

**Unit 1: 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
- Introduction to Common OO Language
- Applications of OOPs

- o Character and Boolean Types
- o Declaring and Initialization Variables

- Java Operators

**Unit 4: Expressions, Statements and Arrays**

- Expressions
- Statements
- Control Statements
- Selection Statements
- Iterative Statements
- Jump Statements
- Arrays

**Unit 2: Object Oriented Methodology-2**

- Classes and Objects
- Abstraction and Encapsulation
- Inheritance
- Method Overriding and Polymorphism

**BOOK 2: Object Oriented Concepts and Exceptions Handling**

**Unit 1: Class and Objects**

**Unit 3: Java Language Basics**

- Introduction To Java
  - o Basic Features
  - o Java Virtual Machine Concepts
  - o A Simple Java Program
- Primitive Data Type And Variables
  - o Java Keywords
  - o Integer and Floating Point Data Type

- Class Fundamentals
  - o Creating objects
  - o Assigning object reference variables
- Introducing Methods
  - o Static methods
  - o Constructors
- Overloading constructors
  - o This Keyword



- Using Objects as Parameters
- Argument passing
- Returning objects
- Method Overloading
- Garbage Collection
- The Finalize ( ) Method

### **Unit 2: Inheritance and Polymorphism**

- Inheritance Basics
- Access Control
- Multilevel Inheritance
- Method Overriding
- Abstract Classes
- Polymorphism
- Final Keyword

### **Unit 3: Packages and Interfaces**

- Package
  - Defining Package
  - CLASSPATH
  - Package naming
- Accessibility of Packages

## **BOOK 3: Multithreading, I/O and String Handling**

### **Unit 1: Multithreaded Programming**

- Multithreading: An Introduction
- The Main Thread
- Java Thread Model
- Thread Priorities
- Synchronization in Java
- Interthread Communication

### **Unit 2: I/O in Java**

- I/O Basics
- Streams and Stream Classes
  - Byte Stream Classes
  - Character 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

### **Unit 3: Strings and Characters**

- Fundamentals of Characters and Strings
- The String Class
- String Operations
- Data Conversion using Value Of ( ) Methods
- String Buffer Class and Methods

### **Unit 4: Exploring Java I/O**

- Java I/O Classes and Interfaces

- I/O Stream Classes
  - Input and Output Stream
  - Input Stream and Output Stream Hierarchy
- Using Package Members
- Interfaces
- Implementing Interfaces
- Interface and Abstract Classes
- Extends and Implements Together

### **Unit 4: Exceptions Handling**

- Exception
- Handling of Exception
  - Using try-catch
  - Catching Multiple Exceptions
  - Using finally clause
- Types of Exceptions
- Throwing Exceptions
- Writing Exception Subclasses
- Text Streams
- Stream Tokenizer
- Serialization
- Buffered Stream
- Print Stream
- Random Access File

## **BOOK 4: Applets Programming and Advance Java Concepts**

### **Unit 1: Applets**

- The Applet Class
- Applet Architecture
- An Applet Skeleton: Initialization and Termination
- Handling Events
- HTML Applet Tag

### **Unit 2: Graphics and User Interfaces**

- Graphics Contexts and Graphics Objects
  - Color Control
  - Fonts
  - Coordinate System
- User Interface Components
- Building User Interface with AWT
- Swing-based GUI
- Layouts and Layout Manager
- Container

### **Unit 3: Networking Features**

- Socket Overview
- Reserved Parts and Proxy Servers
- Internet Addressing: Domain
- Naming Services (DNS)
- JAVA and the net: URL

- TCP/IP Sockets
  - Datagrams
- Unit 4: Advance Java**
- Java Database Connectivity
    - Establishing A Connection
    - Transactions with Database
  - An Overview of RMI Applications
    - Remote Classes and Interfaces
- RMI Architecture
  - RMI Object Hierarchy
  - Security
  - Java Servlets
    - Servlet Life Cycle
    - Get and Post Methods
    - Session Handling
  - Java Beans

**MCAL025: Lab (Data Structures using C, WINDOWS 2000, LINUX / UNIX, Java and MS-ACCESS, My SQL)**

**4 Credits**

**Objectives**

This Lab Course is based on the courses MCA021, MCA022, MCA023 and MCA024. It involves the development of the practical skills in Data structures using C programming, Networking, DBMS and Java Programming. Theoretical aspects were already covered in the respective theory courses. This course is an attempt to upgrade and enhance your theoretical skills and provide the hands on experience. By the end of these practical sessions of this Course, you will be able to write programs using basic data structures such as Arrays etc. as well as advanced data structures such as trees etc.

**Syllabus**

**SECTION 1: Data and File Structures Lab Manual**

- Arrays
- Structures
- Linked Lists
- Stacks
- Queues
- Trees
- Advanced Trees
- Graphs
- Searching
- Sorting

- LINUX administration
- Unix Networking
- Installation and Configuration of the networking services like TCP/IP, DNS, DHCP, FTP, SMTP

**SECTION 3: DBMS Lab**

- Introduction to MS-Access
- Database Creation
- Use of DBMS Tools/ Client-Server Mode
- Forms and Procedures

**SECTION 2: Operating Systems and Networking Lab**

- Overview of Windows 2000
- Unix and Linux
- Advanced concepts of Local Area Network
- Network administration of Windows 2000

**SECTION 4: Java Programming Lab**

- Programming with Java
- PATH and CLASSPATH Setting
- Example Programs
- List of Lab Assignments

**MCA031: Design and Analysis of Algorithms**

**4 Credits**

**Objectives**

Algorithm is the central concept of computer science. Whole of computer science can be thought of as revolving around the concept of algorithm - the machines are designed and fabricated to execute algorithms; the programming languages are defined to describe algorithms so that the machines can understand and execute programs written in programming languages; the foundation/theory of Computer Science is the

study of the limits of algorithmic methods, i.e., the study tells whether a particular task is accomplishable by a computer or not, etc.

Hence, the study of the Design and Analysis of Algorithm has to be an essential part of any Computer Science/Engineering curriculum. Even if, software for solving all types of problems may become available in the future and the user/student may not be required to write an algorithm to solve any problem, still training the students in the skills of designing and analyzing the algorithms will remain essential, because these constitute the fundamental skills for solving problems with computers. It is like teaching of geometry to instill in students the skills of logical reasoning.

The objectives of the Course is to make the students aware of and well-groomed in the use of the tools & Techniques of designing and analyzing algorithms.

## **Syllabus**

### **BOOK 1: Introduction to Algorithmics**

#### **Unit 1: Elementary Algorithmics**

- Example of an Algorithm
- Problems and Instances
- Characteristics of an Algorithm
- Problems, Available Tools & Algorithms
- Building Blocks of Algorithms
- Outline of Algorithms

#### **Unit 2: Some pre-requisites and Asymptotic Bounds**

- Some Useful Mathematical Functions & Notations
- Mathematical Expectation
- Principle of Mathematical Induction
- Concept of Efficiency of an Algorithm
- Well Known Asymptotic Functions & Notations

#### **Unit 3: Basics of Analysis**

- Analysis of Algorithm – Simple Example
- Well Known Sorting Algorithms
- Best-Case and Worst-Case Analyses
- Analysis of Non-Recursive Control Structures
- Recursive Constructs
- Solving Recurrences
- Average-Case & Amortized Analyses

### **BOOK 2: Design Techniques-I**

#### **Unit 1: Divide-and-Conquer**

- General Issues in Divide-And Conquer
- Integer Multiplication
- Binary Search
- Sorting
- Finding the Median
- Matrix Multiplication
- Exponentiation

#### **Unit 2: Graphs Algorithms**

- Examples
- Traversing Trees
- Depth-First Search
- Breadth-First Search
- Best-First Search & Minimax Principle
- Topological Sort

### **BOOK 3: Design Techniques - II**

#### **Unit 1: Dynamic Programming**

- The Problem of Making Change
- The Principle of Optimality
- Chained Matrix Multiplication
- Matrix Multiplication Using Dynamic Programming

#### **Unit 2: Greedy Algorithms**

- Some Examples
- Formalization of Greedy Technique
- Minimum Spanning Trees
- Prim's Algorithm
- Kruskal's Algorithm

- Dijkstra's Algorithm

**Unit 3: Models for Executing Algorithms –I: FA**

- Regular Expressions
- Regular Languages
- Finite Automata

**Unit 4: Models for Executing Algorithms –II PDFA & CFG**

- Formal Language & Grammar
- Context Free Grammar(CFG)
- Pushdown Automata (PDA)

**BOOK 4 : Complexity & Completeness**

**Unit 1: Models for Executing Algorithms – III :TM**

- Prelude to Formal Definition

- Turing Machine: Formal Definition and Examples
- Instantaneous Description and Transition Diagram
- Some Formal Definitions
- Observations
- Turing Machine as a Computer of Functions

**Unit 2: Algorithmically Unsolvable Problems**

- Decidable And Undecidable Problems
- The Halting Problem
- Reduction to Another Undecidable Problem
- Undecidable Problems for CFL
- Other Undecidable Problems

**Unit 3: Complexity of Algorithms**

- Notations for the Growth Rates of Functions

**MCA032: Object Oriented Analysis and Design**

**3 Credits**

**Objectives**

Object oriented analysis and design has emerged as a new paradigm of analysis and design of the systems. This Course is designed to help in learning object oriented analysis and design concepts. This Course is having coverage of UML diagrams and will help in developing understanding in the area of system analysis and design concepts using object-oriented approach. This Course will cover different aspects of OOAD with explaining object modeling dynamic modeling and functional modeling.

**Syllabus**

**BOOK 1: Object Oriented Modeling and UML**

**Unit 1: Introduction to Object Oriented Modelling**

- Object Oriented Modeling
- Characteristics Object Oriented Modeling
  - Class and Objects
  - Links and Association
  - Generalization and Inheritance
- An Object Model
- Benefits of OO Modeling
- Introduction to OOAD tools

**Unit 2: Object Oriented Analysis**

- Object Oriented Analysis
- Problem Statement: an Example
- Differences between Structured Analysis and Object Oriented Analysis
- Analysis Techniques
  - Object Modeling

- Dynamic Modeling
- Functional Modeling
- Adding Operations
- Analysis Iteration

**Unit 3: Using UML**

- UML: Introduction
- Object Model Notations:
  - Basic Concepts
  - Structural Diagrams
    - Class
    - Object
    - Composite
    - Package
    - Component
    - Deployment
  - Behavioral Diagrams:
    - Use Case
    - Communication
    - Sequence
    - Interaction Overview

- Activity
- State
- Modeling with Objects

## **BOOK 2: Object Oriented Design**

### **Unit 4: System Design**

- System Design: An Object Oriented Approach
- Breaking into Subsystems
- Concurrency Identification
- Management of data store
- Controlling events between Objects
- Handling Boundary Conditions

### **Unit 5: Object Design**

- Object Design for Processing
- Object Design Steps
- Designing a Solution
- Choosing Algorithms
- Choosing Data Structures
- Defining Classes and delegation of Responsibilities to Methods

### **Unit 6: Advance Object Design**

- Control and its Implementation
  - Control as a State within Program
  - Control as State Machine Engine
  - Control as Concurrent Task
- Inheritance Adjustment
- Association: Design
- Object Representation
- Design Optimization
- Design Documentation

## **BOOK 3: Modeling**

### **Unit 7: Object Modeling**

- Advance Modeling Concepts
  - Aggregation
  - Abstract Class
- Multiple Inheritance
- Generalization as an Extension
- Generalization as a Restriction
- Metadata
- Constraints
- An Object Model

### **Unit 8: Dynamic Modeling**

- Events
- State and State Diagram
- Elements of State Diagrams
- Examples of State Diagrams
- Advance Concepts in Dynamic Modeling
- Concurrency
- A Dynamic model

### **Unit 9: Functional Modeling**

- Functional Models
- Data Flow Diagrams
- Features of a DFD
- Design flaws in DFD
- A Functional model
- Relationship between Object, Dynamic, and Functional Models

## **BOOK 4: Implementation**

### **Unit 10: Implementation Strategies**

- Implementation
  - Using Programming Languages
  - Using Database System
- Unidirectional Implementation
- Bi-directional Implementation
- Implementing associations
- Implementing Constraints
- Implementing Statecharts
- Persistency

### **Unit 11: Object Mapping with Databases**

- Relational Database Schema for Object Modes
- Object Classes to Database Tables
- Mapping Associations to Tables
- Mapping Generalizations to Tables
- Interfacing to Database
- Object Mapping with Databases: an Example

### **Unit 12: Case Study**

- This unit will cover all the OOAD aspects Covered in previous 11(eleven) units of this course.

**MCA033 Advanced Discrete Mathematics**

**2 credits**

### **Objectives**

This Course assumes the knowledge of the course MCA013, “Discrete Mathematics”. In the two books of this Course, we discuss recursion and graph theory, respectively. The first Book is aimed at developing the

understanding of a very important tool for analyzing recursive programmes, namely, recurrence relations. In the second Book we aim to develop a basic understanding of graph theory, which is a very useful modeling tool for computer programming.

## Syllabus

### BOOK 1: Recurrences

#### Unit 1: Recurrence Relations

- The Fibonacci Sequences, The Tower of Hanoi, Catalan Numbers
- Related Definitions
- Divide and Conquer Methods

#### Unit 2: Generating Functions

- Definitions and Constructions
- Applications for Finding the Number of Integers Solutions of Linear Equations
- Exponential Generating Functions
- Solving Recurrence Relations using Generating Functions
- Applying Generating Functions for Combinatorial Identities and Partitions

#### Unit 3: Solving Recurrences

- Linear Homogeneous Recurrences
- Linear Non- Homogeneous Recurrences
- Methods of Inspection, Telescoping Sums, Iteration, Substitution

### BOOK 2: Graph Theory

#### Unit 1: Basic Properties of Graphs

- What Graphs are
- Degree, Regularity and Isomorphism
- SubGraphs

#### Unit 2: Connectedness

- Connected Graphs
  - Paths, Circuits and Cycles
  - Components
  - Connectivity
- Bipartite Graphs

#### Unit 3: Eulerian and Hamiltonian Graphs

- Eulerian Graphs
- Hamiltonian Graphs
- Travelling Salesperson Problem

#### Unit 4: Graph Colourings

- Vertex Colouring
- Edge Colouring
- Planar Graphs
- Map Colouring Problem

## MCA034: Software Engineering

3 Credits

### Objectives

The objectives of the Course is to make the learner efficiently work as software engineer. S/he should be well acquainted with all the phases of Software Development Life Cycle. The learner should be able to apply the concepts learned for doing research.

## Syllabus

### BOOK 1 : Overview of Software Engineering

#### Unit 1 Software Engineering and its models

- Evolution of Software Engineering
- Software development models
- Capability maturity models
- Software process technology

#### Unit 2: Principles of Software Requirements Analysis

- Engineering the product
- Modeling the system architecture
- Software prototyping and specification

#### Unit 3: Software Design

- Data design
- Architectural design
- Interface design
- HCI design
- Modular design

#### Unit 4: Software testing

- Testing techniques
- Testing for specialized environments
- Debugging

### BOOK 2: Software Project Management

#### Unit 5: Software Project Planning

- Different types of project metrics
- Software project estimation
- Models for estimation
- Automated tools for estimation

**Unit 6: 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

**Unit 7 Software Quality Assurance**

- Formal technical reviews
- Software reliability
- Software quality standards

**Unit 8 Software change management**

- Baselines
- Version control
- Change control\
- Auditing and reporting

**BOOK 3: Advanced Software Engineering**

**Unit 9: Web Software Engineering**

- Different layers
- Issues of management of web based projects
- Metrics
- Analysis
- Design
- Testing

**Unit 10: Mobile Software Engineering**

- Transition from design to coding of mobile applications
- Elements of mobile applications
- Approaches to the development of mobile applications

**Unit 11: CASE tools**

- Analysis tools
- Design tools
- SQA tools
- UI design tools
- Software testing tools
- Web engineering tools

**Unit 12: Advanced Software Engineering**

- Clean room Software engineering
- Component based Software engineering
- Re-engineering
- Reverse engineering

**MCA035: Accountancy and Financial Management**

**3 Credits**

**Objectives**

This Course aims at introducing the basic accounting procedures and financial management processes. It also focuses on the computerised implementation of the various accounting principles discussed at different levels.

**Syllabus**

**BOOK 1: Accounting System**

**Unit 1: Accounting and its Functions**

- Scope of Accounting
- Emerging Role of Accounting
- Accounting as an Information System
- Role and Activities of an Accountant
- Accounting Personnel
- Nature of Accounting Function
- Organisation Chart for Accounting and Finance

**Unit 2: Accounting Concepts and Standards**

- Accounting Framework
- Accounting Concepts
- Accounting Standards
- Changing Nature of Generally Accepted Accounting Principles (GAAP)
- Attempts towards Standardisation
- Accounting Standards in India

**Unit 3: Basic Accounting Process: Preparation of Journal, Ledger and Trial Balance**

- Accounting Equation
- Classification of Accounts
- Definitions of Journal and

- Ledger
  - Journalising Process
  - Ledger Posting
  - Balancing an Account

- Trial Balance
- Objectives of Preparing Trial Balance
  - Total Method of Preparing the Trial Balance
  - Balance Method of Preparing the Trial Balance
  - Limitations of Trial Balance
- Accounting Cycle

**BOOK 2: Understanding and Analysis of Financial Statements**

**Unit 1: Preparation and Analysis of Final Accounts**

- Trading Account
  - Opening/Closing Stock
  - Net Purchases
  - Direct Expenses
  - Net Sales
- Profit And Loss Account
- Difference between Trading and Profit & Loss Account
- Balance Sheet
- Constructing a Balance Sheet
- Classification of Balance Sheet's Items
- Adjustment Entries
  - Closing Stock
  - Depreciation
  - Bad Debts
  - Provision for Bad and Doubtful Debts
  - Salaries and Wages
  - Outstanding Expenses
  - Prepaid Expenses
  - Accrued Income
  - Income Received in Advance

**Unit 2: Funds Flow and Cash Flow Statements**

- Statements of changes in Financial Positions
- Fund Flow Statement
- Analysing Changes in Working Capital
- Sources of Funds
- Uses (Applications) of Funds
- Cash Flow Statement
- Sources and Uses of Cash

**Unit 3: Ratio Analysis**

- Categories of Ratios

- Long-term Solvency Ratios
- Short-term Solvency Ratios
- Activity or Turnover Ratios
- Profitability Ratios
- Market Test Ratios

**BOOK 3: Financial Management and Decisions**

**Unit 1: Introduction to Financial Management**

- Evolution of Financial Management
- Significance of Financial Management
- Principles of Financial Management
- Economic Value Added
- Agency Relationship
- Changing Financial Landscape

**Unit 2: Time Value of Money and Investment Decisions**

- Determining The Future Value
  - Shorter Compounding Period
  - Effective versus Nominal Rates
  - Continuous Compounding
- Annuity

**Unit 3: Working Capital Decisions**

- Characteristics of Current Assets
- Operating Cycle Concepts
- Factors Influences Working Capital Environment
- Estimating working capital Requirement

**BOOK 4: Working Capital Management**

**Unit 1: Cash and Treasury Management**

- Treasury Management
  - Treasury Risk Management
  - Functions of Treasury Department
- Facets of Cash Management
  - Motives for Holding Cash
  - Cash Planning
  - Determining the Optimum Cash Balance
- Methods of Cash Flow Budgeting
- Investing Surplus Cash
- Cash Collection and Disbursements

**Unit 2: Receivables Management**

- Terms of Payment
- Credit Policy Variables
- Credit Evaluation
- Monitoring Receivables
- Factoring

**Unit 3: Inventory Management**



- Reasons for Holding Inventory
- Objectives of Inventory Management
- Techniques of Inventory Control
- Modern Techniques
- Traditional Techniques

**MCAL036: Lab (MCA032 MCA034& MCA035)**

**3 credits**

**Objectives**

This Course is based on three courses namely MCA032 (Object Oriented Analysis and Design), MCA034 (Software Engineering) and MCA035 (Accountancy and Financial Management). The prime objectives of this Course are (i) To help in learning the use of the computer for object oriented analysis and design concepts, making of UML diagrams with the help of software tools. (ii) to use Software tools for different phases of software development like cycle (iii) to familiarise with the use of software for basic accounting procedures and financial management.

This lab course is based on the courses MCA032, MCA034 and MCA035

**MCA041: Operating Systems**

**4 Credits**

**Objectives**

In the second semester student will get exposed to the fundamental concepts of Operating Systems in MCA022. But that course completely provides knowledge from the implementation, networking and from the practical point of view. This is the core Course on Operating Systems and the main objective of this course is to provide core knowledge of Operating Systems features, functions and techniques. Each and every Operating System function is discussed in detailed. This Course also provides an attempt to throw some light on the advanced topics in O/S like Multiprocessors Systems and Distributed O/S. Case studies of WINDOWS and LINUX are organized at the end of this Course so as to provide the support what ever they had pursued theoretically.

**Syllabus**

**BOOK 1: Introduction to Operating Systems, Process Management**

**Unit 1 Operating System-An Overview**

- What is an Operating System (OS)?
- Goals of an Operating System
- Generations of Operating Systems
- Types of Operating Systems
- Desirable Qualities of OS
- Operating Systems : Some Examples
- Functions of OS

**Unit 2 Processes**

- Concept of Process
- System Calls for Process Management
- Process Scheduling
- Scheduling Algorithms
  - First Come First serve (FCFS)
  - Shortest Job First (SJF)
  - Round Robin (RR)
  - Shortest remaining time next (SRTN)

- Priority Based Scheduling or Event Driven (ED) scheduling
- Performance evaluation of the Scheduling Algorithms

**Unit 3: Interprocess Communication and Synchronization**

- Interprocess Communication
- Interprocess Synchronization
- Semaphores
- Classical problems in concurrent programming
- Locks
- Monitors and Conditional Variables
- Summary

**Unit 4: Deadlocks**

- Deadlocks
- Characterization of a Deadlock
- A Resource Allocation Graph
- Dealing with Deadlock Situations
  - Deadlock Prevention
  - Deadlock Avoidance
  - Deadlock Detection and Recovery

- Deadlock detection and recovery
- Deadlock Prevention
  - Havender's Algorithm
- Deadlock Avoidance
  - Banker's Algorithm

## **BOOK 2: Memory Management, File Management and Security**

### **Unit 1: 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

### **Unit 2: Virtual Memory**

- 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 3: 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 4: Security and Protection**

- Security Threats
- Security Policies and Mechanisms
- Authentication
  - Passwords
  - Alternative Forms of Authentication
- Protection in Computer Systems
- Security Models
  - Access-Control Matrix
  - Mandatory Access Control
  - Discretionary Access Control
  - Rule-Based Access Control
  - Role-Based Access Control
  - The Take-grant Model
  - Multilevel Models

## **BOOK 3: Advanced Topics and Case Studies**

### **Unit 1: Multiprocessor Systems**

- Multiprocessor and Processor Coupling
- Multiprocessor Interconnections
  - Bus-Oriented Systems
  - Crossbar-Connected systems
  - Hypercubes
  - Multistage Switch-based systems
- Types of Multiprocessor Operating System
  - Separate Supervisors
  - Master/Slave
  - Symmetric
- Multiprocessor OS Functions and Requirements
- Multiprocessor Synchronization
  - Test and set
  - Compare and swap
  - Fetch and Add

### **Unit 2: 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

**Unit 3: Case Study - UNIX**

**Unit 4: Case Study – WINDOWS 2000**

**MCA042: Data Communication and Networks**

**3 Credits**

**Objectives**

The main objective of the Course is to deal with fundamental issues of computer network. The Course is designed around the TCP/IP Model. Some of the important topics discussed in the Course are: Data Encoding Techniques, MAC Protocols, Routing Techniques, Transport Services, Mechanism and Network Security.

**Syllabus**

**BOOK 1: Introduction to Data Communication and Computer Network Concepts**

**Unit 1: Introduction to Computer Networks**

- What is computer Network
- Network Goals / Motivation
- Application of Networks
- Point to Point or Switched Networks
  - Circuit Switched Networks
  - Packet-Switched Networks
- Broadcast Networks
  - Packet Radio Networks
  - Satellite Networks
  - Local Area Networks
- Network Protocols
- Networking Model
- Examples of Some Networks

**Unit 2: Data Transmission**

- Transmission Terminology
  - Simplex, Half duplex & full duplex spectrum and Bandwidth, frequency
- Serial & Parallel Communication
- Analog and Digital Data Transmission
- Bandwidth & Data Rate Throughout
- Transmission Impairments
  - Attenuation and Distortion
  - Delay Distortion
  - Noise
  - Concept of Delays
  - How to reduce delays
- Transmission Media and its Characteristics
  - Twisted Pair
  - IBM Cable
  - Coaxial Cable
  - Twin Axial Cable
  - Optical Fiber
  - Terrestrial Microwave
  - Satellite Microwave
- Wireless Transmission

- Radio
- Infra red
- Wireless LAN

**Unit 3: Data Encoding & Communication Technique**

- Pulse Code Modulation (PCM)
- Amplitude Modulation
- Frequency and Phase Modulation
- Asynchronous Transmission
- Synchronous Transmission

**Unit 4: Multiplexing and Switching**

- Frequency Division Multiplexing
- Synchronous Time Division Multiplexing
- Statistical Time Division Multiplexing
- Modems
- Switching

**BOOK 2: Media Access Control and Data Link Layer**

**Unit 1: Data Link Layer Fundamentals**

- Framing
- Basics of Error Detection
- Forward Error Correction
- Cyclic Redundancy Check codes for Error Detection
- Flow Control

**Unit 2: Retransmission Strategies**

- Stop-&-Wait ARQ
- Go-Back-NARQ
- Selective Repeat ARQ
- Pipelining

**Unit 3: Contention-based Media Access Protocols**

- The advantages of Multiple-Access Sharing of Channel Resource
- Pure ALOHA
- Slotted ALOHA

- Carrier Sense Multiple Access (CSMA)
- CSMA with Collision Detection (CSMA/CD)

#### **Unit 4: Polling-based Media Access Control Protocols**

- Token Ring
- Token Bus

#### **Unit 5: Media Access Control Protocols for High Speed Networks**

- FDDI-I and FDDI-H
- DQDB with Bandwidth Balancing for Fair Access
- Asynchronous Transfer Mode (ATM)

### **BOOK 3: Network Layer**

#### **Unit 1: Introduction to Layer Functionality and Design Issues**

- Connection Oriented Vs Connectionless Services
- Addressing
- Concept of Congestion
- Routing
- Network Layer in ATM Protocols
- Network Layer Design Issues

#### **Unit 2: Routing Algorithms**

- Shortest Path Routing
- Flooding
- Distance Vector Routing
- Link State Routing
- Hierarchical Routing
- Broadcast Routing
- Multicast Routing

#### **Unit 3: Congestion Control Algorithms**

- General Principles of Congestion Control
- Congestion Prevention Policies
- Congestion Control in Virtual Circuit Subnets
- Load Shedding
- Jitter Control

#### **Unit 4: Internetworking & Network Layer in the Internet**

- Tunneling
- Internetworking Routing

- Fragmentation
- IP Protocol
- IP Addresses
- Internet Control Protocols
- OSPF – The Interior Gateway Routing Protocol
- BGP – The Exterior Gateway Routing Protocol
- Internet Multicasting
- Mobile IP
- IPv6

### **BOOK 4: Transport Layer and Application Layer Services**

#### **Unit 1: Transport Services and Mechanism**

- Type of Services
- Quality of Services
- Data Transfer
- Connection Management Transport Control Mechanism
- Addressing
- Multiplexing
- Flow Control and Buffering
- Connection Establishment
- Crash Recovery

#### **Unit 2: TCP/UDP**

- Introduction to UDP
- Remote procedure Call
- The Real-Time Transport Protocol
- Introduction to TCP
- TCP Service Model
- TCP Protocol
- TCP Segment Header
- TCP Connection Establishment
- TCP Connection Release
- Modeling TCP Connection Management
- TCP Transmission Policy
- TCP Congestion Control
- TCP Timer Management

#### **Unit 3: Network Security I**

- Cryptography
- Symmetric Key Algorithms
- Public Key Algorithms

#### **Unit 4: Network Security II**

- Digital Signatures
- Management of Public Keys
- Communication Security
- Web Security

**Objectives**

This Course will help the students to acquire the theoretical foundation of Database Management Systems. It includes concepts relating to various advanced database models, and concepts like database mining and warehousing. This Course also describes in major details about the advanced concepts of relation database management systems. Additionally, the Course also provides sample database management system architecture. Thus, this is an advanced course, which will further develop the knowledge and skill acquired by the students at the basic level.

**Structure****BOOK 1: Database Design and Implementation****Unit 1: Relational Database Design**

- Features of good database design
- Enhanced ER tools
  - Subclasses, Super class, and Inheritance
  - Specialization and Generalization
  - Constraints and Characteristics of Specialization and Generalization
- Converting EER diagram to tables
- Functional dependency theory and normalization
- Multi value dependency and 4NF
- Join Dependency and 5NF
- Inclusion Dependencies and Template Dependency
- PJNF/DKNF
- Modeling temporal data

**Unit 2: Database implementation and Tools**

- Information system and organization
- Data Design and Implementation in an Organization
- Use of UML and its support for database design specifications
- Representing specialization and generalization in UML Class diagram.
- UML based design tools
- Automated database design tools.

**Unit 3: Advanced SQL**

- Assertion and views
- Cursors, triggers and stored procedures
- Embedded SQL, dynamic SQL, SQLJ,
- Advanced Features of SQL
- Examples of above in Oracle

**Unit 4: Database System Catalog**

- Catalogs for relational DBMS
- System Catalog in Oracle
- Data dictionary and data repository system
- Catalog in Distributed database and object oriented database systems
- Role of system catalog in administration

**BOOK 2: DBMS Advanced Features and Distributed Database****Unit 1: Query Processing and Evaluation**

- Measures of Query Cost
  - Selection Operation,
  - Sorting
  - Join Operation
  - other Operations
- Evaluation of Expression
- Transformation of Relational Expressions
- Role of Relational Algebra and Relational Calculus in query optimisation
- Estimating Statistics of Expression
- Choice of Evaluation Plans
- Views and query processing
- Storage and query optimization

**Unit 2: Transaction Management and Recovery**

- Advanced feature of Transactions
- Enhanced Lock Based and timestamp based Protocols
- Multiple Granularity
- Multi-version Schemes
- Deadlock Handling
- Weak Levels of Consistency
- Concurrency in Index Structures
- Recovery and Atomicity
- Recovery with Concurrent Transaction

- Buffer Management
- Advanced Recovery Techniques
- Remote Backup Systems
- Use of SQL in recovery
- Examples of e-transactions

### **Unit 3: Database Security and Authorization**

- Levels of database security
- Access control
- Multilevel security
- Statistical database security
- Audit trails in the databases
- Examples of e security

### **Unit 4: Distributed Databases**

- Centralised versus non centralized Databases
- Homogeneous and Heterogeneous DDBMS and their comparison
- Functions and Architecture
- Distributed database design, query processing in DDBMS
- Distributed concurrency management, deadlock management
- Distributed Commit Protocols: 2 PC and 3 PC
- Concepts of replication servers

## **BOOK 3: ENHANCED DATABASE MODELS**

### **Unit 1: Object Oriented Database**

- Limitations of Relational databases
- The need of Object oriented databases
- Complex Data Types
- Structured Types and Inheritance in SQL
- Table Inheritance
- Data types (arrays, multi-set etc) and structure in Object oriented databases using SQL
- Object-Identity and Reference Types in SQL
- ODL and OQL
- Implementing O-R Features
- Persistent Programming Languages
- Object-Oriented versus Object-Relational
- An Example of Object oriented and object relational database implementation

### **Unit 2: Database and XML**

- Structured Semi structure and unstructured data
- XML hierarchical tree data model
- Documents DTD and XML schema
- XML Documents & Database
- XML query and transformation
- Storage of XML data
- XML database applications

### **Unit 3: Introduction to data warehousing**

- What is Data Warehousing, DSS and EIS?
- Characteristics and functioning and architecture of Data Warehousing
- Data marts
- Data warehousing Life Cycle
- Data modeling (Multidimensional Database) for data warehousing
- Building of data warehouse
- OLAP, MOLAP, ROLAP
- Data warehouse and views
- Future open issue for data warehouse

### **Unit 4: Introduction to Data Mining**

- What is data mining Technology and its relationship to Data warehousing
- Association rules
- Classification
- Clustering
- Approaches to data mining problems
- Applications of Data mining problem
- Commercial tools of data mining
- Knowledge Discovery

## **BOOK 4: Emerging Trends and Example DBMS Architectures**

### **Unit 1: Emerging Database Models, Technologies and Applications I**

- Multimedia database
- Geography databases, Gnome databases
- Knowledge databases, deductive databases and semantic databases
- Spatial database
- Information visualization

### **Unit 2: Emerging Database Models, Technologies and Applications II**

- Mobile databases
- Web databases (JDBC, ODBC)
- Personal databases
- Digital libraries
- Data grids

- Wireless networks and databases

### Unit 3: PostgreSQL

- Important features and brief architecture
- User Interfaces
- SQL Variations and Extensions
- Transaction Management
- Storage and Indexing
- Query Processing and evaluation and optimization

### Unit 4: Oracle

- Features and basic architecture
- Database Design and Querying Tools
- SQL Variations and Extensions
- Storage and Indexing
- Query Processing, evaluation and Optimization
- Concurrency Control and Recovery
- Distributed Oracle
- Database administration and other advanced tools

## MCA044: Mini Project

4 Credits

### Objectives

The project work constitutes a major component in most of the professional programmes and it is to be carried out with due care and should be executed with seriousness by the students. The objective of the project is to motivate them to work in emerging/ latest technologies, help the student to develop ability to apply theoretical and practical tools/techniques to solve real life problems related to industry, academic institutions and research laboratories. This project will help the student make ease and provide enough experience to carry out the larger project in the sixth semester. You will receive a book containing the guidelines for the mini project along with the list of project specifications, category-wise.

## MCAL045: Lab (UNIX & DBMS)

2 Credits

### Objectives

This lab Course is based on MCA041(Operating Systems) and MCA043(Advanced Database Management Systems) courses. The basic objective of the Course is to provide the hands on experience to improve the practical skills on UNIX Operating System and Oracle DBMS and also to apply the concepts that been covered in the courses MCA041 and MCA043. This Course is divided into 2 Sections: Section – 1 covers the Unix Lab and Section – 2 covers the DBMS Lab. At the end of each Section, lists of exercises are given for your practice.

## MCA051: Advanced Internet Technologies

3 Credits

### Objectives

The Major Objectives of the Course is to introduce concepts, tools/technologies and programming to rapidly develop Internet based distributed, secure, reliable and scalable application. The discussion in the course is centered around Servlet and JSP (Java Server Pages) Programming, JDBC APIs, Server Side component architecture (Enterprise Java Beans), and XML. It also introduces Web Security and its implementation.

### Syllabus

#### BOOK 1: Servlet and JSP Programming

##### Unit 1: Introduction to Servlet

- Servlet life Cycle
- HTTP Servlet Class
- Request Interface
- Response Interface
- Session Tracking (Cookies VRL)
- Database Connectivity from Servlet

- Interservlet Communication
- Handling Servlet
- Servlet Collaboration

##### Unit 2: Database Connection

- JDBC Drivers
- JDBC APIs
- JDBC Techniques
- Statements & its Types
- Record Sets

- Various Operations (Insertion, Deletion & update)

### Unit 3: JSP-I

- Overview of JSP
- Relation of Applets and Servlets with JSP
- Scripting Elements
- JSP Expressions
- JSP Scriptlets
- JSP Declarations
- Predefined Variables
- Creating Custom JSP Tag Libraries Using Nested Tags

### Unit 4: JSP-II

- Structuring Generated Servlet in JSP Pages
- Including Files and Applets in JSP Documents
- Integrating Servlet and JSP

## BOOK 2: EJB and XML

### Unit 1: Introduction to Beans

- Types of Beans
- Session Beans
- Counting Beans
- Message Beans
- Context and Naming Convention

### Unit 2: Creating Beans

- How to Create Beans

- Create Web Application
- Create Application Client

### Unit 3: Deploying Beans

- Deploying J2EE Applications

### Unit 4: XML

- Overview of XML
- Overview of SGML
- Differentiate Between SGML and XML
- XML Development Goal
- Structure of XML Document
- Using DTD
- XML Parser
- Using XML Introduction
- XML Entities

## BOOK 3: Web Security and Case Study

### Unit 1: Web Security Concepts

- HTTP Authentication
- Compare and Contrast
- Application Types (BASIC, DIGEST, FORM and Client CERT)

### Unit 2: Security Implementation

- Retrieving Authentication Information
- Security in Servlet
- Form Based Custom Authorisation
- Retrieving SSL Authentication

### Unit 3: Case Study

## MCA052: Principles of Management and Information Systems

2 Credits

### Objectives

The Course objective is to provide the use and function of management information systems. It describes and evaluates information systems development processes and techniques.

### Syllabus

## BOOK 1: Management Systems

### Unit 1: Organisational Overview

- Organisation Types
  - Service, Business, Government, Social
  - Industry Types
- Organisational Structure
- Organisational Characteristics
  - Size
  - Location

- Others
- Organisation functions
- Life cycle of organisation
- Vertical and horizontal organisations

### Unit 2: Management Functions and Business Processes

- Overview of management Levels
- Business Processes
  - Sale and orders
  - Finance



- Human resource
- Production
- Marketing
- Information systems requirements
- Requirement analysis
- Tools and methods for requirement analysis

### **Unit 3: Management Systems**

- Management Systems Types
- Management Systems Requirements
- Levels of management activities
- Strategic level
- Management level
- Middle Management Level

### **Unit 4: Business values of Information System**

- Impact of Information Systems
- Empirical studies
- Cost Value Performance
- Total cost of ownership
- Culture for Information Systems
- Decision management with Information Systems

## **BOOK 2: Information Systems**

### **Unit 5: Portfolio Management and IT applications**

- What is portfolio management
- Portfolio management methods
- Design and implementation of portfolio management
- Risk Management
- Disaster Management
- Portfolio management issues and challenges
- Tools and techniques

## **MCA053: Computer Graphics and Multimedia**

**4 Credits**

### **Objectives**

The Aim & Objective of the Course is to enable the learner's thinking process in the field of Computer Graphics, Animation, Simulation and Multimedia. After going through the Course the learner will be able to understand the abilities required to develop the graphical tools. The understanding of the learned concepts will help the learner in executing the practical component i.e. Lab component of the Computer Graphics

### **Syllabus**

- Emerging technologies

### **Unit 6: Enterprise Information Systems**

- Evolution of enterprise information Systems
- Enterprise Resource Planning
- Resource planning management
- ERP Market
- Supply Chain Management
- Customer Relationship Management
- E-CRM Systems
- Emerging technologies

### **Unit 7: Intelligence Information Systems**

- Knowledge Management in organization
- Creating, developing & sharing Knowledge
- Artificial intelligence in business
- Business Analytics
- Business Intelligence
- Role of Business Intelligence
  - Sale and orders
  - Finance
  - Human resource
  - Marketing
- Business Intelligence Tools
- Business Intelligence reports

### **Unit 8: Social, Ethical and Legal Aspects**

- Society in information age
- Moral dimensions and information age
- Technology trends and ethical issues
- Ethical principal and dilemma
- Responsibility, accountability and liability
- Information right and acts

## **BOOK 1: Raster Graphics and Clipping**

### **Unit 1: Introduction to Computer Graphics**

- What is Computer Graphics?
- Application of Computer Graphics
  - Presentation Graphics
  - Painting and Drawing
  - Photo Editing
  - Scientific Visualization
  - Image Processing
  - Digital Art
  - Education, training, Entertainment and CAD
    - Simulation
    - Animation and Games
- Graphics Hardware
- Input and Output Devices
  - Touch Panel
  - Light Pens
  - Graphic Tablets
  - Plotters
  - Film Recorders
- Display Devices
- Refreshing Display Devices
  - Raster-Scan
  - Random-Scan
- Plasma Panel and LCD panels

### **Unit 2: Graphics Primitives**

- Points and Lines
- Line-drawing Algorithms
  - DDA Algorithm
  - Bresenham's line Algorithm
- Circle-generating Algorithm
  - Properties of Circles
  - Midpoint Circle of Algorithm
- Polygon Filling Algorithm: Scan-Line

### **Unit 3: 2-D Viewing and Clipping**

- Point Clipping
- Line Clipping
  - Cohen-Sutherland Line Clippings
  - Cyrus-Beck Line Clipping Algorithm
- **Polygon Clipping: Sutherland Hodgman Algorithm**
- Windowing Transformation

## **BOOK 2: Transformations**

### **Unit 4: 2-D and 3-D Transformations**

- Basic Transformations
  - Translation
  - Rotation
  - Scaling
  - Shear
- **Composite Transformations**
  - Rotations about a point
  - Reflection about a line
- Homogeneous Coordinate Systems
- 3-D Transformations

### **Unit 5: Viewing Transformation**

- Projections
  - Parallel Projection
  - Orthographic & Oblique Projections
  - Isometric Projections
- Perspective Projections

## **BOOK 3: Modeling & Rendering**

### **Unit 6: Curves and Surfaces**

- Polygon Representation Methods
  - Polygon Surfaces
  - Polygon Tables
  - Plane Equations
  - Polygon Meshes
- Bezier Curves and Surfaces
  - Bezier Curves
  - Properties of Bezier Curves
  - Bezier Surfaces
- Surface of Revolution

### **Unit 7: Visible – Surface Detection**

- Depth Buffer Method
- Scan-Line Method
- Area-Subdivision Method

### **Unit 8: Polygon Rendering and Ray Tracing Methods**

- Illumination Model
  - Ambient Reflection
  - Diffuse Reflection
  - Specular Reflection
- Shading
  - Gouraud Shading
  - Phong Shading
- Ray Tracing
  - Basic Ray-Tracing Algorithm

## **BOOK 4: Multimedia and Animation**

### **Unit 9: Computer Animation**

- Basic of Animation
- Types of Animation
- Simulating Accelerations
- Computer Animation Tools
- Applications

### **Unit 10: Multimedia Concepts and Applications**

- Concepts of Hypertext/Hypermedia
- Multimedia Applications
  - o Education
  - o Video Conferencing
  - o Training
  - o Entertainment
  - o Electronic Encyclopedia
- Images
- Audio and Video
  - o Analog and Digital Sound and Video
  - o Mpeg, mpi, wav, etc.
- Multimedia Tools

## **MCAL054: Lab (Advanced Internet Technologies and Computer Graphics)**

**2 Credits**

## **MCAE003: Artificial Intelligence and Knowledge Management**

**3 Credits**

### **Objectives**

One of the ways of looking at Artificial Intelligence (AI) is as the study concerned with solving hard and insolvable problems using reasonable amount of time, by exploiting the knowledge of the problem domain. In view of the significance of knowledge in AI, in this course, a number of knowledge representation formalisms are introduced. The formalisms discussed include Propositional Logic, First Order Predicate Logic, Rule-based systems, Semantic Networks and Frames. In order to encode knowledge structures obtained using these formalisms, the syntax of each of the two well-known AI programming languages LISP and PROLOG is discussed along with explanation of how the language can be to encode proposed solutions. Finally, as applications/ products of AI, the topics on Expert Systems and Intelligent Agents are discussed briefly.

MCAE003 is a 4-credit course and the course material consists of 4 books. The pre-requisites for the course include Design and Analysis of Algorithms, Discrete Mathematics and programming and problem solving experience.

### **Syllabus**

#### **BOOK 1: Problem Solving & Search Techniques**

##### **Unit 1: Introduction**

- Concepts & definitions of AI
- Brief history of AI
- AI and related fields
- Problems
- Techniques
- Characteristics and underlying assumption of AI
- Turing test Uninformed searches
- Informed searches: generate and test
- Hill-climbing
- best-first search

##### **Unit 2: State Space Representation & Search Techniques**

- A\* algorithm
- Problem reduction
- Constraint satisfaction

##### **Unit 3: Game Playing**

- Overview of One & Two Player Game
- The Min-Max Search Procedure
- Alpha-Beta Cutoffs

#### **BOOK 2: Knowledge Representation**

##### **Unit 1: Propositional & Predicate Logic**

- Syntax and semantics for propositional logic
- Syntax & semantics of First Order Predicate Logic (FOPL)

- Properties of well-formed formula (wff)
- Conversion to clausal form
- Inference rules
- The resolution principle
- Non-deductive inference methods

### **Unit 2: Structured Knowledge Representations**

- Production Rules
- Semantic Nets
- Frames
- Conceptual Dependencies and Scripts

### **Unit 3: AI Programming Languages**

- Introduction to LISP
- Syntax and Numeric Functions
- Basic List Manipulation Functions in LISP Functions
- Predicates and Conditionals
- Input, Output, and Local Variables
- Iteration and Recursion
- Property Lists and Arrays
- PROLOG: List, Operators, Arithmetic
- Cut & Fail
- Backtracking

### **BOOK 3: Handling Uncertainty**

#### **Unit 1: Handling Inconsistent and Incomplete Knowledge**

- Truth Maintenance Systems

- Reasoning Techniques
- Concept of Uncertainty
- Bayes' Theorem
- Certainty Factors and Rule-Based Systems
- Bayesian Networks
- Dempster-Shafter Theory

#### **Unit 2: Fuzzy Logic**

- Fuzzy Sets
- Fuzzy Operators & Arithmetic
- Membership Functions
- Fuzzy Relations

### **BOOK 4: Applications of Artificial Intelligence**

#### **Unit 1: Expert Systems**

- Introduction and Concept of Planning
- Representing and Using Domain Knowledge
- Expert System Shells
- Knowledge Acquisition

#### **Unit 2: Intelligent Agents**

- Agents and environments
- Rationality and other performance measures
- Nature of environments
- Structure of agents

### **MCAE004 : Numerical and Statistical Computing**

**3 Credits**

#### **Objectives**

The main objective of this course is to prepare the firm footing of learners in the domain of numerical and statistical computation. Understanding the concepts covered in the course, will make the learner to realize the need of Numerical and statistical components in computer science. Further, the concepts covered in this course will enable the analytical skill of the learner, and s/he may appreciate the need of this course in various domain of computer science viz. Software Reliability, Software Quality Assurance , Software Testing and many more.

#### **Syllabus**

#### **BOOK-1: Numerical Computing-I**

- Sources of Errors
- Propagated Errors

#### **Unit 1 Floating Point Arithmetic and Errors**

- Floating Point Representation

#### **Unit 2 Solution of Non-Linear Equations**

- Bisection Method
- Regula-Falsi Method
- Secant Method
- Newton-Raphson Method
- Successive Iteration Method

### Unit 3 Solution of Linear Algebraic Equations

#### Direct Method

- Gauss Elimination Method (without and with Pivoting)
- LU-Decomposition Method

#### Iterative Method

- Jacobi Method
- Gauss Seidel Method
- Successive Over Relaxation Method

### BOOK-2: Numerical Computing-II

#### Unit 1: Interpolation

- Differences – Forward and Backward Differences
  - Newton's – Forward and Backward Difference Formulas
  - Lagrange's Interpolation

#### Unit 2: Numerical Integration

- Newton – Cotes Formulas
- Composite Formulas
- Gaussian Quadrature

#### Unit 3: Numerical Solution of ODE

- Euler's Method

### MCAE011: Parallel Computing

**3 Credits**

#### Objectives

In view of the limitations of the sequential paradigms in respect of solving difficult problems; over the years, a number of parallel/ concurrent paradigms have emerged that include parallel computer architectures, parallel operating systems, parallel algorithms and parallel programming languages. Based on these paradigms, parallel computer systems have been designed, developed and studied in depth. The purpose of the course is to equip students with skills for solving difficult problems using these paradigms, architectures etc.

MCAE011 is a 3-credit course and the course material consists of three books. The pre-requisites for the course include knowledge of computer architecture, operating system, design and analysis of algorithm and problem solving and programming experience.

#### Syllabus

- Runge Kutta Method

### BOOK-3: Statistical Computing

#### Unit 1 Probability Distribution

- Discrete Distribution
- Binomial Distribution
- Poisson Distribution

#### Continuous Distribution

- Uniform Distribution
- Exponential Distribution
- Normal Distribution
- Chi-square Distribution

#### Unit 2 Pseudo Random Number Generation

- Uniform Distribution
  - Method of Generation (Discrete Case)
  - Inversion Method (Exponential Distribution)
  - Acceptance and Rejection

#### Unit 3: Regression

- Linear Regression Model
  - Least Square for Parameter Estimation
  - Goodness-of-Fit
  - Residual Analysis
- Non-Linear Regression

## **BOOK -1 : Elements of Parallel Computing and Architecture**

### **Unit 1 Introduction to Parallel Computing**

- Basic concepts about program/process/ thread concurrent Execution Parallel Execution, granularity, Potential of Parallelism
- Need of Parallel Computation
- Levels of parallel processing
- Parallel processing Vs. Parallel computing
- Dataflow Computing concept
- Applications of parallel processing
  - Scientific Applications / Image processing
  - Engineering Application
  - Database query / Answering applications
  - A I Applications
  - Mathematical simulations and modeling

### **Unit 2: Classification of Parallel Computers**

- Types of Classification
- Flynn's/ Handler classification
- UMA / NUMA /COMA
- Loosely coupled / tightly coupled
- Classification based grain size and Instruction level parallelism

### **Unit 3: Interconnection Network**

- Need of Interconnection Network
- Concept Bandwidth Nod degree diameter bisection bandwidth, In degree and Out degree
- Static and Dynamic Interconnection network
- Omega, Parallel Shifter, Bens, permutation, hypercube, butterfly,
- Shuffle exchange Network

### **Unit 4: Parallel Computer Architecture**

- Introduction to various computer architecture
- Pipeline processing
- Vector / Array processing
- VLIW and Super scalar architecture
- Associative architecture
  - Multithreaded architecture

## **BOOK- 2: Parallel Algorithm & Parallel Programming**

### **Unit 1: Parallel Algorithm**

- Introduction to Parallel Algorithms
- Analysis of Parallel Algorithms
- Different models of computation
  - Combinational circuit
  - Permutation Circuit
  - Sorting circuit
  - Matrix computation

### **Unit 2: PRAM Algorithms**

- Message passage programming
  - Shared memory
  - Message passing libraries
  - Data Parallel programming
- Data Structures for parallel algorithms
  - Link list
  - Arrays pointers
  - Hypercube network

### **Unit 3: Parallel Programming**

- Introduction to Parallel Programming
- Types of parallel programming
  - Programming based on message passing
  - Programming based on data parallelism
  - Programming for shared memory systems
  - Example programs for parallel systems

## **BOOK -3: Advanced Topics**

### **Unit 1: Operating System for Parallel Computers**

- Basic issues of Operating Systems for Parallel Computers
- Process Management
- Resource Management
- Memory management
- I/O Management
- Inter-Processor Communication
- Vectorisation Compiler

### **Unit 2 : Performance Evaluation**

- Introduction to performance evaluation
- Metric of Parallel overhead
- Law Speedup
- Measurement Tools

### **Unit 3: Recent Trends for Parallel Computer**

- Development of last 3 years
- Multicomponent CPU
- Apex architecture IA 64
- Hyperthreading

### **MCAP060: Project**

**16 Credits**

The objective of the MCA project work is to develop quality software solution by following the software engineering principles and practices. It is only possible when a learner goes about with the task independently. During the development of the project the students should involve in all the stages of the software development life cycle like requirements engineering, systems analysis, systems design, software development, testing strategies and documentation with an overall emphasis on the development of reliable software systems. The primary emphasis of the project work is to understand and gain the knowledge of the principles of software engineering practices, so as to participate and manage a large software engineering projects in future.

Students are encouraged to spend at least six man-months working on a project preferably in a software industry or any research organization. Topics selected should be complex and large enough to justify as a MCA project. The courses studied by the students during the MCA programme provide them the comprehensive background to work on diverse application domains. Student will receive Project Guidelines along with their 5<sup>th</sup> semester course material. Students should strictly follow and adhere to the MCAP060 project guidelines.

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