

**Department of Computer Science & I. T**

**Course Structure for M. Sc. [Computer Science] Effective From 2010**

**Semester I:**

| <i>Course Code</i> | <i>Title</i>                           | <i>Credits</i> |
|--------------------|--|----------------|
| MAS 621            | Discrete Mathematics                   | 3(3 – 0 – 0)   |
| COMP 715           | Computer Organization and Architecture | 4(3 – 1 – 0)   |
| COMP 732           | Computer Networks                      | 4(2 – 1 – 1)   |
| COMP 761           | Principles of Programming Languages    | 4(2 – 1 – 1)   |
|                    | <b><i>Credits</i></b>                  | <b>15</b>      |

**Semester II:**

| <i>Course Code</i> | <i>Title</i>                | <i>Credits</i> |
|--------------------|-----------------------------|----------------|
| COMP 723           | Operating System            | 4(3 – 0 – 1)   |
| COMP 733           | Database Management Systems | 5(3 – 1 – 1)   |
| COMP 762           | Object Oriented Systems     | 4(2 – 1 – 1)   |
| COMP 861           | System Softwares            | 3(2 – 1 – 0)   |
|                    | <b><i>Credits</i></b>       | <b>16</b>      |

**Semester III:**

| <i>Course Code</i> | <i>Title</i>                    | <i>Credits</i> |
|--------------------|---------------------------------|----------------|
| MAS 721            | Operations Research             | 4(4 – 0 – 0)   |
| COMP 731           | Design & Analysis of Algorithms | 3(2 – 1 – 0)   |
| COMP 841           | Software Engineering            | 3(2 – 1 – 0)   |
| COMP 852           | Advanced Java Programming       | 4(2 – 0 – 2)   |
| COMP 780           | Seminar                         | 3(0 – 0 – 3)   |
|                    | <b><i>Credits</i></b>           | <b>17</b>      |

**Semester IV:**

| <i>Course Code</i> | <i>Title</i>          | <i>Credits</i> |
|--------------------|-----------------------|----------------|
| COMP 899           | Thesis                | 15(0 – 0 – 15) |
|                    | <b><i>Credits</i></b> | <b>15</b>      |

# Discrete Mathematics

Code: MAS 621

Credits: 3(3+0+0)

## **1. Propositions and logical operations**

- a. Notation, Connections, Normal Forms, Truth Tables
- b. Equivalence and Implications
- c. Theory of inference for statement calculus, predicate calculus
- d. Rules of logic
- e. Mathematical Induction and Quantifiers

## **2. Sets, Relations and Digraphs**

- a. Review of set concepts
- b. Relations and digraphs
- c. Properties of relations
- d. Equivalence relations
- e. Computer representation of relations and digraphs
- f. Manipulation of relation
- g. Partially Ordered Sets (Posets)

## **3. Graph theory**

- a. Definition, paths, circuits, reachability, connectedness
- b. Matrix representation of graphs, trees, spanning trees
- c. List structures and graphs, PERT related techniques
- d. Transitive closure, Warshall's Algorithms
- e. Eulerian and Hamiltonian graphs

## **4. Groups and applications**

- a. Monoids, semigroups
- b. Product and quotients of algebraic structures
- c. Isomorphism, homomorphism, automorphism
- d. Normal subgroups, codes and group codes

### **Books:**

1. Discrete Mathematical Structure: Tremblay and Manohar, McGraw Hill
2. Discrete Mathematical Structure: Kolman, Busby and Ross, PHI, Edition 3
3. Elements of Discrete Structures: C.L. Liu

# Computer Organization & Architecture

Code : COMP-715

Credits: 4(3+1+0)

## Unit-1

**Introduction:** Types of computers: Analog, Digital and Hybrid Computers, Modern Digital Computer.

**Digital logic circuits and Components:** Logic gates, Boolean Algebra, K-Map Simplification, Half Adder, Full Adder, Decoder, Encoders, Multiplexers, Demultiplexer, Flip Flops, Registers, Binary Counters.

## Unit-II

**Register Transfer & Micro operation:** Register Transfer Language, Bus and Memory Transfer, Bus Architecture, Arithmetic Micro operations: Binary Adder, Binary Subtractor, Binary Adder-Subtractor, Binary Increment and Binary Decrement.

## Unit-III

**Memory Organization:** Memory Hierarchy, Main Memory (RAM and ROM), Associative Memory, Cache Memory, Auxiliary Memory.

**I/O Organization:** I/O interface, Modes of transfer, Interrupt handling, Direct Memory Access, Input/ Output processor, Serial Communication.

## Unit-IV

**Processor Design:** General Register Organization, Stack Organization, Addressing Modes, Instruction Formats, Data Transfer & manipulation, Program Control, Reduced Instruction Set Computer and Complex Instruction Set Computer.

## Unit-V

### Parallel Processing

Introduction, Linear and Nonlinear Pipeline Processors, Super Scalar and Super Pipeline Design, Vector Processing, Array Processors, Super Computer.

### Text Book:

1. Mano M., "Computer System Architecture"

### References:

1. William Stallings, "Computer Organization and Architecture", PHI
2. Mano M., "Digital Logic and Computer Design"
3. Kai Hwang, "Advanced Computer Architecture", McGraw Hill.

# Computer Networks

Code : COMP 732

Credit : 4(2+1+1)

## ***Introduction***

Concepts of Computer Network, Network hardware: LAN, WAN, MAN  
Network software : Protocol hierarchies, Design issues for the layers,  
Connection – oriented and connection less services  
Reference Models : OSI and TCP/IP reference models, comparison of the OSI and  
TCP/IP model, Example Networks: Novell NetWare, Arpanet, and Internet

## ***Physical layer***

Theoretical basis for data communication, Transmission Media: Twisted pair, Coaxial,  
Optical Fiber, Wireless Transmission, Multiplexing: FDM, TDM, WDM  
Switching: Circuit switching, Packet switching, Message Switching

## ***Data link Layer***

Data link Layer design Issues, Error detection and correction, Sliding Window protocols,  
Data Link Protocols (HDLC, PPP)  
MAC: Channel allocation problem, multiple access protocols, IEEE standard 802.X for  
LAN (Ethernet, Token Bus, Token Ring), high speed LANs, Wireless LANs

## ***Network Layer***

Network layer design issues, routing algorithms, congestion control algorithms  
  
(Leaky Bucket and Token Bucket), internetworking, the network layer in the internet,  
Protocols - IP, ICMP, ARP  
  
Internetworking devices: repeaters, Bridge, Router, Gateway

## ***Transport Layer***

Transport service, elements of the transport protocols, the Internet transport protocol  
(UDP & TCP)

## ***Application Layer:***

Application layer Protocols – FTP, HTTP, SMTP, TELNET  
Introduction to Network security issues

## ***References:***

A.S. Tanenbaum, “Computer Networks”  
Forouzan, “Data Communication and Networks”

# Principles of Programming Languages

Code : COMP 761

Credit : 4 (2+1+1)

## Unit -I

**Introduction:** Characteristics of programming Languages, Factors influencing the evolution of programming language, developments in programming methodologies, desirable features and design issues. Programming language processors: Structure and operations of translators, software simulated computer, syntax, semantics, structure, virtual computers, binding and binding time.

## Unit -II

**Elementary and Structured Data Types:** Data object variables, constants, data types, elementary data types, declaration, assignment and initialization, enumeration, characters, strings. Structured data type and objects: Specification of data structured types, vectors and arrays, records, variable size data structure, pointers and programmer constructed data structure, Sets files. Sub Program and programmer defined data types: Evolution of data types, abstractions, encapsulations, information hiding, sub programs, abstract data types.

## Unit -III

**Sequence Control;** Implicit and Explicit sequence control, sequence control with and within expression and statements, recursive sub programs, exception handling, co routines, Scheduled sub programs, concurrent execution.

## Unit -IV

**Storage Management:** Major run time requirements, storage management phases, static storage management, stack based, heap based storage management.

**Syntax and translation:** General syntactic criteria, syntactic elements of a language, stages in translation, formal syntax and semantics.

## Unit -V

**Programming Environment:** Embedded system requirements, Theoretical models, Introduction to Functional Programming, Lambda calculus, Data flow language and Object Oriented language.

## References:

1. Terrance W Pratt, "Programming Languages: Design and Implementation" PHI
2. Sebesta, "Concept of Programming Language", Addison Wesley
3. E Horowitz, "Programming Languages", 2nd Edition, Addison Wesley

# Operating System

Code: COMP – 723

Credit: 4 (3 + 0 + 1)

## UNIT – I

**Definition and Types of Operating Systems** – Batch, Multiprogramming, Time Sharing, Parallel, Distributed and Real Time Operating System. Structure of Operating Systems. Operating System Components and Services, System Calls, Systems Programs.

## UNIT – II

**Process Management** - Process Concept, Process Scheduling, Cooperating Processes, Threads. CPU Scheduling - Criteria, Scheduling Algorithms, Multiple-processor Scheduling, Real Time Scheduling. Process Synchronization - The Critical - Section Problem, Synchronization Hardware, Semaphores, Classical problems of Synchronization, Critical Regions, Monitors, Interprocess Communication, Deadlocks - System Model, Deadlock Characterization, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

## UNIT – III

**Memory Management** - Logical and Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation, Segmentation with Paging. Virtual Memory - Demand Paging, Page Replacement Algorithms, Allocation of Frames, Thrashing, Other Considerations.

## UNIT-IV

**File System** - File Concept, Access Methods, Directory Structure. File System Implementation – File System Structure, Allocation Methods, Directory Implementation, Efficiency and performance, Recovery. Secondary Storage Structure - Disk Structure, Disk Scheduling methods, Disk Management, Swap Space Management, Disk Reliability.

## UNIT – V

Introduction to Distributed Operating Systems, Client / Server Operating Systems, Network Operating Systems. History of UNIX / Linux, Basic Commands, Shell Programming

### Text Books:

1. Abraham Silberschatz & Galvin, “Operating System Concepts”, Wiley J. Publication

### References:

1. Operating Systems Concepts and Design - Milan Milenkovic, TMH.
2. Linux: The Complete Reference – Richard Peterson, Osborne TMH.

### Practical List

1. Getting started with Linux (Boot, Shutdown, Login, vi Editor, Linux Commands).
2. Linux Shell Programming.
3. System Calls (open, read, write, close, lseek, stat, getdents )
4. Process Creation and Execution (fork, exec, wait, exit)
5. Thread Creation and Execution (PThreads).
6. Process / Thread Synchronization (Mutex and Condition Variables).
7. Inter-process Communication (Pipes & Signals).

## Database Management Systems

**Code: COMP 733**

**Credits: 5(3+1+1)**

### *UNIT- I*

**Introduction:** An overview of database management system, database system Vs file system, Database system concepts and architecture, data models, schema and instances, data independence and data base languages, Data definitions language, DML, Overall Database Structure.

**Data Modeling using the Entity Relationship Model:** ER model concepts, notation for ER diagram, mapping constraints, keys, Concepts of Super Key, candidate key, primary key, Generalization, aggregation, reduction of an ER diagrams to tables, extended ER model.

### *UNIT- II*

**Relational Data Model and Languages:** Relational data model concepts, integrity constraints: entity integrity, referential integrity, Keys constraints, Domain constraints, relational algebra, relational calculus, tuple and domain calculus,

**Introduction to SQL:** Characteristics of SQL, Advantages of SQL, SQL data types and literals, Types of SQL commands, SQL operators and their procedure, Tables, Views and Indices, Queries and sub queries, Aggregate functions, Insert, update and delete operations. Set Operations: Union, Intersection, Minus. Join Operations, Cursors in SQL.

### *UNIT- III*

**Data Base Design & Normalization:** Need of Normalization, Various Functional dependencies, Normal forms: first, second, third normal forms, BCNF, inclusion dependences, loss less join decompositions, normalization using MVD, and JDs, alternative approaches to database design.

### *UNIT- IV*

**Transaction Processing Concepts:** Transaction system, Testing of serializability, Serializability of schedules, conflict & view serializable schedule, recoverability, Recovery from transaction failures, log based recovery, checkpoints, deadlock handling.

### *UNIT- V*

**Concurrency Control Techniques:** Concurrency control, locking Techniques for concurrency control, Time stamping protocols for concurrency control, validation based protocol, multiple granularity, Multi version schemes, Recovery with concurrent transactions.

#### **Text book:**

1. Korth, Silbertz, Sudarshan, "Database Concepts", McGraw Hill
2. Elmasri, Navathe, "Fundamentals Of Database Systems", Addison Wesley

#### **Reference books:**

1. Date C J, "An Introduction To Database System", Addison Wesley
2. Bipin C. Desai, "An introduction to Database Systems", Galgotia Publication
3. Majumdar & Bhattacharya, "Database Management System", TMH
4. Ramakrishnan, Gehrke, "Database Management System", McGraw Hill

#### **Practical list**

**MS-Access :** Creating and Querying tables , Generating forms and reports

#### **Oracle / MS-SQL**

1. Write the queries for Data Definition and Data Manipulation language.
2. Write SQL queries using Logical operators (=,<,>,etc.).
3. Write SQL queries using SQL operators (Between.... AND, IN(List), Like, ISNULL and also with negating expressions ).
4. Write SQL query using character, number, date and group functions.
5. Write SQL queries for Relational Algebra (UNION, INTERSECT, and MINUS, etc.).
6. Write SQL queries for extracting data from more than one table (Equi-Join, Non-Equi-Join , Outer Join)
7. Write SQL queries for sub queries , nested queries.
8. Write programs by the use of PL/SQL.
9. Practice on ROLL BACK, COMMIT & CHECK POINTS statements.
10. Create VIEWS, CURSORS, and TRIGGERS & write ASSERTIONS.

# Object Oriented Systems

Code : COMP 762

Credit : 4(2+1+1)

## Unit I

**Introduction to OOP** : Object Orient themes- Abstraction, Encapsulation, Polymorphism and Inheritance.

**Basic C<sup>++</sup> Concepts**: - Keywords, Data Types, Operators, Expressions, Input-Output Statements, Decision and Looping Statements, Functions and Arrays.

## Unit II

**Classes & Objects**: Basic concepts, Constructor and Destructors, Inline and Friend function, Function Overloading and Operator Overloading.

## Unit III

Introductory Concepts of Inheritance, Derived class Definition, Public, Private and Protected Derivation Modes. Types of inheritance

## Unit IV

Introduction to Polymorphism, Compile Time and Run time Polymorphism, Virtual functions, Virtual Base Classes.

Introduction to Exception Handling and Templates.

## Unit V

**Modeling Concepts** : Introduction to Object Modeling, Dynamic Modeling and Functional Modeling

### Text Books:

1. Balagurusamy E, "Object Oriented Programming with C++", TMH
2. Rambaugh James et. al., "Object Oriented Design and Modeling", PHI-

### References

1. Bjarne Stroustrup, "C++ Programming Language", Addison Wesley

2. Dillon and Lee, "Object Oriented Conceptual Modeling", New Delhi PHI-1993
3. Mercer, "Computing Fundamental with C++", Palgrave Macmillan
4. Practical World of C++, Sumita Arora, Dhanpat Rai & Co

## System Softwares

**Code : COMP 861**

**Credit : 3(2+1+0)**

### **Unit- I**

Introduction: System software and Machine architecture, traditional (CISC) machines, RISC machines.

### **Unit- II**

Assemblers: Basic assembler functions, machine dependent and machine independent assembler features, one pass assemblers, multi pass assemblers, MASM assembler, SPARC assemblers.

### **Unit- III**

Loaders and Linkers: Basic loader functions, machine dependent and machine independent loader features, linkage editors, dynamic linking and bootstrap loaders.

### **Unit – IV**

Macro processors: Basic macro processor functions, machine dependent and machine independent macro processor features, macro processor design options.

### **Unit- V**

Compilers: Basic compiler features, machine dependent compiler features, machine independent compiler features, compiler design option, the YACC compiler-compiler.

### **References:**

1. Leland L Black, System Software, 3<sup>rd</sup> Edition, Pearson Education
2. A.V Aho et. Al., Compilers- Principle, Techniques and Tools, Pearson Education
3. D.M Dhamdhere, System Programming and Operating Systems, Tata McGraw Hill
4. Santanu Chattopadyay, Compiler Design, PHI

## **Operations Research**

**Code: MAS 721**

**Credit : 4(4+0+0)**

- Linear Programming
- Simplex Method
- Duality
- Assignment Problem
- Transportation Problem
- Inventory Models
- Simulation

### **References:**

Hamdy A. Taha, "Operations Research : An Introduction", PHI

## **DESIGN & ANALYSIS OF ALGORITHMS**

**Course Code: COMP-731**

**Credit: 3(2+1+0)**

### **Unit -I**

Introduction to Algorithms, Analysis of algorithms, Growth of Functions, Recurrences: Master's Theorem and Substitution Method. Analysis of sorting algorithms: Merge Sort, Heap Sort and Quick Sort, Sorting in Linear time.

### **Unit -II**

**Advanced Data Structure:** Red-Black Trees, Augmenting Data Structures. B-Trees, Binomial Heaps, Fibonacci Heaps, Hash tables.

### **Unit -III**

**Advanced Design and Analysis Techniques:** Dynamic programming, Greedy Algorithms, Backtracking, Branch and Bound, Amortized Analysis.

### **Unit -IV**

**Graph Algorithms:** Elementary Graphs Algorithms, Minimum Spanning Trees, Single-source Shortest Paths, All-Pairs Shortest Paths, Traveling Salesman Problem.

### **Unit -V**

**Selected Topics:** String Matching, Randomized Algorithms, NP-Completeness, and Approximation Algorithms.

### **Text Book :**

Coreman, Rivest, Lisserson, : "Introduction to Algorithms", PHI.

## References:

1. Basse, "Computer Algorithms: Introduction to Design & Analysis", Addison Wesley.
2. Horowitz & Sahani, "Fundamental of Computer Algorithm", Galgotia.

## SOFTWARE ENGINEERING

COMP 841

3(2+1+0)

### Unit-I

**Introduction:** Introduction to software engineering, Importance of software, The evolving role of software, Software Characteristics, Software Components, Software applications, Software Crisis, Software engineering problems, Software Development Life Cycle, Software Process.

### Unit-II

**Software Requirement Specification:** Analysis Principles, Water Fall Model, The Incremental Model, Prototyping, Spiral Model, Role of management in software development, Role of matrices and Measurement, Problem Analysis, Requirement specification, Monitoring and Control.

**Software-Design:** Design principles, problem partitioning, abstraction, top down and bottom up-design, Structured approach, functional versus object oriented approach, design specifications and verification, Monitoring and control, Cohesiveness, coupling, Fourth generation techniques, Functional independence, Software Architecture, Transaction and Transform Mapping, Component – level Design, Fourth Generation Techniques

### Unit-III

**Coding:** Top-Down and Bottom –Up programming, structured programming, information hiding, programming style and internal documentation.

**Testing:** Testing principles, Levels of testing, functional testing, structural testing, test plane, test case specification, reliability assessment, software testing strategies, Verification & validation, Unit testing, Integration Testing, Alpha & Beta testing, system testing and debugging.

### Unit-IV

**Software Project Management:** The Management spectrum- (The people, the product, the process, the project), cost estimation, project scheduling, staffing, software configuration management, Structured Vs. Unstructured maintenance, quality assurance, project monitoring, risk management.

### Unit-V

**Software Reliability & Quality Assurance:** Reliability issues, Reliability metrics, Reliability growth modeling, Software quality, ISO 9000 certification for software industry, SEI capability maturity model, comparison between ISO & SEI CMM.

**CASE (Computer Aided Software Engineering):** CASE and its Scope, CASE support in software life cycle, documentation, project management, internal interface, Reverse Software Engineering, Architecture of CASE environment.

### Textbook:

1. Pressman, Roger S., "Software Engineering: A Practitioner's Approach, McGraw Hill, 2001

### References

1. Jalote, Pankaj, "Software Engineering Ed.2", New Delhi: Narosa 2002
2. Schaum's Series, "Software Engineering", TMH
3. Ghezzi, Carlo and Others, "Fundamentals of Software Engineering", PHI
5. Sommerville, Ian, "Software Engineering", AWL, 2000
6. Fairly, "Software Engineering", New Delhi: TMH

## ADVANCED JAVA PROGRAMMING

**COMP 852**

**4(2-0-2)**

### **UNIT I:**

**INTRODUCTION TO BASICS OF JAVA :** Features of Java, Object oriented concepts, Data types, Variables, Arrays, Operators, Control statements  
Classes,. Objects, Constructors, Overloading method, Access control, Static and final methods, Inner Classes, Inheritance, Overriding methods, super abstract class, String class, String objects, String buffer, Char Array

### **UNIT II:**

**PACKAGES, INTERFACES & THREADS:** Packages , Access protection , Importing packages, Interfaces , Exception handling , Throw and throws , Thread , Synchronization, Messaging, Runnable interfaces , Inter thread communication , Deadlock , Suspending, Resuming and stopping threads , Multithreading

### **UNIT III:**

**APPLETS:** Java Utilities, Applets, Working with windows using AWT Classes, AWT Controls, Layout Managers and menus

### **UNIT IV:**

**INPUT/OUTPUT & NETWORKING:** I/O streams, File streams, Networks basics, Socket programming, TCP/IP

### **UNIT V:**

#### **ADVANCED TOPICS**

**SERVLETS:** Introduction – Overview of Servlet Technology, Downloading the Java Servlet Development Kit, Handling HTTP GET Requests – Handling HTTP POST Requests, Session Tracking

**REMOTE OBJECTS :** Introduction to Remote method invocations. Settling up RMI, Parameter passing in remote Methods – Using RMI with Applets – Java IDL and CORBA

#### **TEXT BOOKS**

- Naughton and H.Schildt - "**Java 2 - The complete reference**" - Fourth edition.-2002.
- S. Horstmann, Gary Cornell – “Core Java 2 Volume II – Advanced Features” Addison Wesley.( Chapters : 2,3,5,8)
- Java – How to Program Deitel & Deitel., Third Edition - Pearson Education Asia.- 1999(Chapters :19)

## REFERENCE BOOKS

- S.Horstmann, Gary Cornell - "**Core Java 2 Volume I - Fundamentals**" - Addison Wesley – 2001
- Arnold and J.Gosling - "**The java programming language**" - Second edition
- Art Gittleman – "**Ultimate Java Programming**" –Wiley Publications-2002

## Seminar

**Code: COMP 780**

**Credit: 3(0+0+3)**

### **Objective:**

It is devised to enhance the communication skills as well as to enable the students to be updated with the emerging trends. Students are required to research on approved topic and submit their report to concerned faculty member and for presentation. Development of creativity and innovation in an industry is crucial for making it competitive in the wake of globalization. Young professionals are expected to work proactively and pragmatically. They need to relish challenges, explore strategic ways to advance the organization's bottom line, manage mature products for profitability and transfer the existing competencies to new products. The only way this can be done is by continuously upgrading professional knowledge, skills and attitudes. Therefore, it is imperative for today's practitioners to have some understanding of the emerging trends in the field of Information Technology and their potential strategic relevance. Provision and promotion of such an understanding is the purpose of this Seminar. The seminar will thus lead to widening the mental horizon and exposure of students to different working environments in the industry.

