

06. COMPUTER SCIENCE / INFORMATION TECHNOLOGY

DETAILS OF SYLLABUS

1. MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

Propositional calculus: Propositions, logical operators, truth tables, equivalence, implication, well-formed formulas, tautologies, disjunctive and conjunctive normal forms, laws of logic, direct and indirect proofs.

Predicate calculus: Predicates, statement functions, variables and quantifiers, predicate formulas, free and bound variables, the universe of discourse, valid formulas and equivalences, theory of inference.

Graphs: Definition and examples of graphs, incidence and degree, isomorphism, subgraphs, walks, paths and circuits. Weighted graphs, shortest path algorithms, Eulerian graphs. Hamiltonian Paths and Circuits, Matrix representation of graphs, incidence and adjacency matrices and their properties.

Trees: Definition and properties of trees, rooted and binary trees, minimum spanning tree algorithms, cut-sets and cut vertices, connectivity and separativity, max-flow min-cut theorems.

Directed graphs: Types of digraphs, directed paths and connectedness, Euler digraphs, directed trees, arborescence, tournaments, acyclic graphs and decyclisation.

Automata, Languages and Grammars: Deterministic and Nondeterministic Finite State Automata, equivalence, minimization of Finite Automata, Formal Automata, Formal languages, Chomsky classification, Recursive and recursively enumerable sets, regular expressions, context free grammars, derivation trees, Turing machines.

2. FUNDAMENTALS OF COMPUTER SYSTEMS

History of computers, Types and generation of computers – Micro, Mini, Mainframe and Super computers.

Basic components of a digital computer (Block Diagram explanation)

CPU – Basic components of CPU – ALU, Control unit, Registers, Clock speed math coprocessor, internal math coprocessor

Memory : **RAM** – SRAM, DRAM, EDORAM, SDRAM, RDRAM

ROM – Mask ROM, EPROM, EEROM, EAROM, Flash RAM, CMOS Memory

Physical memory organization – DIP, SIMM, DIMM, SIPP, memory capacity of the motherboard.

Hard disk – HDD components – disk platter, Read/Write head, head arm/head slider, spindle motor, logic board, air filter, head actuator mechanism

Disk geometry – Sides or heads, track, cylinder, sectors

Disk recording – Data recording method, Writing on and Reading from a magnetic disk.

Data encoding methods – FM, MFM and RLL encoding scheme, Interleave, Skew

Hard disk interfacing – IDE, SCSI controllers

Hard disk formatting – Low level and High level formatting

Other secondary storage devices – Floppy disks, CD-ROM, CD-R, CD-RW, DVD

Expansion Bus/slots – 8 bit ISA, EISA, Local bus (VL bus), PCI, AGP

ROM BIOS and Boot up process – BIOS, POST, Disk booting

Input/Output devices – Working of keyboard, mouse, joystick and trackball. Display devices – working of monochrome and colour CRT, LCD panel.

Printer – Working of dot matrix, laser, inkjet, color thermal and dye-sublimation color printers

Scanner – Flat bed, Sheet-fed and Hand-held scanners

Video basics – Display adapter, memory and video sub system, creating screen image, video display modes, display resolution, the use of color.

Mother board – CPU socket, Add-in bus slots for ISA, EISA, PCI, AGP, Memory and secondary cache sockets or chips, ROM BIOS and BIOS CMOS. Motherboard clock, Back plane I/O ports for serial, parallel, mouse and keyboard ports, USB, On Board connectors for power, IDE bus, SCSI, Floppy, Battery.

Concepts of Network – concepts of Internet, Intranet, LAN, WAN, MAN, VAN, ISDN, PSTN, Client – Server model, Peer to Peer. Uses of networks. Transmission media-Coaxial cables, Twister pair, Fiber optic, Satellite communication. Hardware Network interface card (Ethernet), Hub and connectors.

System Software – An overview of OS, compiler, linker, loader, editor, assembler, interpreter, computer systems Arch. Concepts of multiprogramming, multitasking, time

sharing. Real time, multiprocessing, distributed systems, Network operating system. Brief idea about multimedia

3. DIGITAL CIRCUITS FUNDAMENTALS AND COMPUTER ORGANISATION

Boolean algebra, truth tables. Logic gates and flip-flops. Design of combinational and sequential circuits. Examples of digital components like shift registers, binary counters, adders, decoders and multiplexers.

Data representation: binary, decimal, octal and hexadecimal numbers. Signed magnitude, one's complement and two's complement representation. Floating point representation, Error detection codes.

Register transfer microoperations. Case study of a simple instruction set. Arithmetic and control unit design. Microprogramming

General CPU organization. Instruction format and addressing modes. Instruction types. Traps and interrupts. RISC architecture

Input-Output organization. I/O interface, asynchronous data transfer. Programmed and interrupt-initiated I/O. Priority interrupt. DMA and I/O processors.

Memory organization. Memory hierarchy, RAM and ROM. Cache memory and auxiliary memory. Virtual memory and associative memory. Memory management hardware.

4. OBJECT ORIENTED PROGRAMMING WITH C++

Introduction to programming, concept of programming, concept of an algorithm, introduction to object oriented concepts, Features of OOPS, C++ programming basis, Data types, precedence of operators, loops and decisions, functions, objects and classes, constructors, destructors, objects as functions, friend functions.

Arrays, arrays as class member data, arrays of objects, strings, strings as class members, operator overloading, overloading unary operators, overloading binary operators, function overloading, data conversion.

Inheritance: Derived class and Base class, derived class constructors, class hierarchies, private and public hierarchies, levels of inheritance, Different Types, classes within classes, friend functions, inline functions.

Pointers: memory management, new and delete, pointers to objects, pointers to pointers, Polymorphism, virtual functions, Late Binding, Early Binding, static functions, the this pointer

Files and streams: streams, string I/O, character I/O, object I/O,I/O with multiple objects, file pointer, data I/O with member functions, redirection command line arguments

Templates and Exception handling

5. MS WINDOWS : Logging to Windows, The start button and the task bar, start menu, opening a document, organizing files and folders, copying, moving, deleting and saving documents, installing software, installing new hardware, creating shortcut on the desktop, windows explorer.

6. MS-OFFICE : Introduction to MS-Office : MS WORD – Word basics, Menus, Toolbars, File operation, formatting, editing headers and footers, tabs, tables and sorting, working with graphics, templates and wizards, Tools, Macros, Mail merge, merge documents.

7. EXCEL : Excel basics, Spread sheet features, creating a new worksheet, undoing and repeating actions, entering and formatting numbers , entering and editing formulas, protecting and unprotecting documents and cells.

Rearranging worksheets, Excel formatting tips and techniques – page setup, Auto format, Excel chart features: Instant chart with the chart wizard, Resizing and moving charts, printing and deleting charts.

Working with graphics in Excel – Creating and placing graphics, objects, resizing graphics, Excel command macros – recording macros, Running macros

Using worksheets as Database – Creating an Excel Database, working with Data forms, functions.

8. POWER POINT : Introduction , Menus, toolbar Navigating in power point, working with power point, slide, moving the frames, inserting clip art, Inserting pictures, New slide, moving the text, Organization chart , Design templates, Auto content wizard.

9. DATA AND FILE STRUCTURES

Concept Of Data, Data Representation, Primitive and Composite data types, Arrays and its implementation.

Stacks and Queues, sequential Representations, Applications of Stacks and Queues.

Linked List, Implementation, Doubly Linked List, Circular List, Linked Representation of Stacks and Queues, Dynamic Storage Management, Garbage Collection and Compaction.

Trees, Implementation, Binary trees, Representations, Tree traversals, Binary search Trees, Balanced Trees, Threaded Binary Trees, Applications.

Graphs – terminology and representations, traversals, Connected Components, Spanning Trees, Shortest Path..

Searching and Sorting – Internal and External, Sorting Techniques, Search techniques.

Files – Storage devices, blocks, buffers, Access Time, File Mechanisms, Performance, Measures, Sequential Files, ISAM and VSAM Files, Inverted Files, B- Trees, Hash Files.

10.DESIGN AND ANALYSIS OF ALGORITHMS

Introduction:

Time and space complexity of algorithms, Asymptotic notation as a measure of complexity of algorithms, Profiling.

Divide and Conquer – The General method, Binary Search, Finding the maximum and Minimum , MergeSort, Quick Sort, selection Sort, Strassen’s Matrix multiplication.

Greedy Method – The general method, Optimal Storage on tapes, knapsack problem, job sequencing with deadlines, Optimal merge patterns, Minimum spanning trees, single source shortest path.

Dynamic Programming - The general method, Multistage graphs, all pairs shortest paths, Optimal binary search trees, 0/1 knapsack, reliability design traveling sales persons problem, flow shop scheduling.

Back tacking – The general method, the 8 queens problem, sum of subjects, graph colouring, Hamiltonian Cycles, knapsack problem.

Branch & Bound – The method, 0/1 knapsack problem, traveling sales persons, Efficiency considerations.

Some simple lower bound proofs; the notion NP – completeness

11. OPERATING SYSTEMS AND SYSTEMS SOFTWARE

Evolution of operating systems – Serial Processing, Batch Processing, Multiprogramming. Types of Operating Systems- Batch operating systems, Multi programming operating system, Time – sharing operating systems, Real time operating system, Distributed operating system.

Processor Management – Job and Process concept, Implicit and Explicit tasking, concurrent processes. The operating system’s view of process – process states, process – state transmission diagram, PCB (Process Control Block), system state and process lists, process switch, threads, operating system services for process management.

Scheduling – Types of schedulers, Scheduling and performance criteria, scheduling algorithms.

Interprocess Synchronization and Communication – Concurrent co-operating processes, need for interprocess synchronization, critical section, Mutual exclusion, mutual exclusion algorithms, Dekker’s solution to mutual exclusion. Semaphores - definition, primitives, Busy-wait implementation, hardware implementation of semaphores - Test and set

instruction, queueing implementation of semaphores, monitors, interprocess communication using messages.

Dead Lock – Definition, conditions for dead lock, Resource – Allocation graph, Methods for handling dead lock, Dead lock prevention, Dead Lock Avoidance, Banker’s Algorithm, Deal lock detection and recovery, Dead Lock detection Algorithms.

Memory Management - Single process monitor, protection in single process monitor, Relocation – static and dynamic. Static Partitioned Mem. Allocation (MFT) – Principles of operation, allocation algorithms, Relocation, Protection, sharing fragmentation –Internal and External, swapping Dynamically partitioned mem. Allocation (MVT) – Principles of operation Allocation algorithms, compaction protection and sharing.

Segmentation - Principles of operation , address translation, protection and sharing.

Paging – Principles of operation page allocation, hardware support for paging protection and sharing.

Virtual Memory – Principles of operation, Address translation management of virtual memory. Program behaviour, Page replacement policies, replacement algorithms, page allocation policies, segmentation and paging implementation of virtual mem., hierarchical address translation tables, and MMUs.

File Management – File structure, File Types, File Access, File Attributes, File Operations.

Directories – Flat Directory Systems, Hierarchical Directory Systems, Path Names, Direct Operations, Files System Implementation – Contiguous Allocation, Linked List Allocation , Indexed Allocation.

General Concepts-Distinction between system software and application software. Review of m/c and assembly language programming. Assembly language statements-imperative, declaration and assembler directives.

Assemblers – Two pass and one pass assemblers.

Macros – Macro definition, macro call, macro expansion, nested macro calls, macro processors. Editors and Debuggers.

Linkers and Loaders- Linker: Translated, linked and load time addresses. Relocation and linking concepts. Object module, Loader-Absolute loader, Relocating loader.

Compilers – Different phases of compilers.

(Note: Unix shall be used as the Operating System case study)

12. INTERNET & WEB PAGE DESIGNING

Internet: Introduction, History, Basic Requirements-Hardware Software

Web browsers- Internet explorer & Netscape Navigator.

Features: WWW, E-mail, Outlook Express, Search Engines

Web page designing:

HTML-Simple HTML tags, Forms, Tables, List.

DHTML – Introduction, Styles Sheet, Cascading style sheet, Layers.

MS-Front Page- Front Page Editor, Various forms-Normal, HTML, Preview Menus
Creating Web Pages, with Front Page editor templates, Using Front Page Components,
Forms.

Creating Frame pages with Front Page.

Java Script : introduction to Scripting languages, Variables, expressions, data type
Conversions, Operators, loop, Control structures, Functions, Arrays.
Window and Document Object, Window Properties and methods.
The Image Object, Interchangeable images, precaching images, image rollers.

Graphic Utilities – Adobe Photoshop: Various Graphic File formats, Tools box, Controls,
menus, layers.

Introduction to Web Servers, Server Space, DNS(Domain Name Registration), Web
Hosting FTP.

Arrays, Stacks, Queues, Linked List, Trees, Searching and Sorting

Website Creation Using HTML(MS-FRONT PAGE),DHTML & JAVA SCRIPT.
Use Photoshop as Graphic Utility.
Register the Domain Name and Host the Site

13. DATABASE MANAGEMENT SYSTEMS

Introduction to DBMS : What is a Database? – Why Database Systems?- View of Data-
Data Models-Languages-Administrator-User-E-R Model-Basic Concepts-Mapping-
Reduction of Schema to tables.

Relational Data Base Model : Relational Model-Relational Algebra &Calculus-SQL-Data
Definition Languages-Embedded SQL,QBE-Integrity Constraints-Relational Data Base
Design-Normalization-up to Higher levels.

Object Oriented Data Bases : Object Oriented Languages-Data Bases-Object Relational
Data Base-Comparison-Storage Structure for Object Oriented Data Bases

File Organization: File Organization-Data Dictionary Storage-Indexing and Hashing –B-
Trees-B+ Trees- Indexed Files-Index Definition in SQL-Multiple Key Access-Query
Processing.

Deadlock& Security : Concurrency Control-Protocols-Deadlock-Recovery-Data Base
System Architectures-Distributed Data Bases-Security-Standardization-Performance
Tuning time in Data Bases-Active Data Bases-New Applications-DSS, Multimedia Data
Base, Data mining, www.

14.COMPUTER GRAPHICS

Introduction : A survey of Computer Graphics, Overview of Graphics System display, hard-copy, and input devices, Graphics software.

Two dimensional graphics : Use of TCPP graphics library, Line and circle drawing algorithms, clipping and windowing algorithms, transformations, structures and hierarchical modeling, interactive graphical techniques.

Three dimensional graphics : Concepts, representation of objects with plane faces, transformations, viewing, Visible-surface detection methods-back-face detection, depth-buffer, scan-line, depth-sorting and area-subdivision methods, Illumination and surface-rendering methods – Illumination models, polygon-rendering methods

Animation : Design of Animation sequences, raster animations, computer-animation languages, key-frame systems, motion specification.

Multimedia : Hardware and software components of multimedia. Basics of text processing, audio processing, image processing, animation and video processing, MPEG, and JPEG format.

15. COMPUTER NETWORKS

Data communication- Simplified data communications model. Electric signals-continuous and discrete signals, periodic signals, square wave, frequency components of a square wave frequency spectrum and band width (absolute and effective). Analog and digital data transmissions-data and signals, analog and digital transmission, their comparison, digital data rate and band width, transmission impairments- Attenuation, Delay distortion, noise, channel capacity.

Transmission media – Guided and Unguided media, Twisted pair wires-Unshielded and Shielded twisted pair wires, category 3,4 and 5 UTP, Coaxial cable base band and broadband co-axial cables, Optical fiber. Wireless transmission-Terrestrial microwave, Satellite microwave, Broad cast Radio, Infra-red transmission

Telephone system – Local loop , trunk, Data Encoding-Encoding and Modulation Technique Asynchronous and synchronous transmission, Line configurations, full duplex and half duplex transmission. Trunks and multiplexing-FDM, TDM, statistical TDM, Circuit switching and packet witching networks, packet switching principles and switching techniques-datagram, virtual circuit. Effect of packet size on transmission time, Comparison of circuit switching and Packet switching, Connection oriented and Connection less services.

Networks-Networking concepts-Simplified network model. Classification of networks: LAN, MAN,WAN and the Internet. Protocols and protocol architecture. The OSI reference model, TCP/IP reference model. Comparison of the OSI and TCP/IP reference models.

Data Link Layer – Need for data link control, frame synchronization-flag fields bit stuffing flow control, Stop and Wait, Sliding Window protocols, Error detection-Parity checking CRC, Error control –Stop and wait, ARQ, Go back-N ARQ, HDLC protocol..

Network Layer –Services of the layer, Routing :characteristics, performance criteria, Routing Strategies: fixed routing, flooding, random routing , Adaptive routing, congestion control, X-25 protocol.

LAN-LAN-protocol architecture(IEEE-802 reference model). Topologies- Bus, Tree, Ring and Star.

Medium access control, and Logic link control. **LAN systems: ETHERNET**, Token bus and Token ring. Ethernet and fast Ethernet (**CSMA/CD**) IEEE: 802.3 MAC:- CSMA/CD, IEEE 802.3 MAC frame format, IEEE 802.4 token bus **LAN** and frame format, IEEE 802.5 –token ring LAN and frame format, IEEE 802.5 FDDI token ring **LAN** and frame format. Bridges from 802.x to 802.y.

Transport layer – Services, elements of transport protocol, simple transport protocol.

Application layer – Cryptography, Cryptography principles, Secret key algorithm, Public key algorithms, Domain Name Systems.

16.SOFTWARE ENGINEERING

Define Software, Engineering, Software Engineering. Aims of software Engineering, software crisis, software myths. Software development paradigms. Waterfall model, prototype model, and spiral model, 4GL techniques, software metrics.

System engineering-Information engineering, Product engineering. **Requirement analysis.** Principles, prototyping as analysis tool or method. Different analytical frameworks and their applicability-structured analysis, Object oriented analysis.

Object oriented concepts and principles – paradigm, concepts, identifying the elements of an object model, management of Object oriented software projects. Object oriented analysis, domain analysis, generic components of the **OOA** model, the **OOA** process, the object relationship model, the object behavior model.

Object Oriented Design concepts – Design for object oriented system, generic components of object oriented design model, system design process, object design process, design patterns, object oriented programming.

Object oriented testing – Testing **OOA** and **OOD** models, object oriented testing strategies, test case design for Object Oriented software, testing methods applicable at the class level. Interclass test case design.

Software quality – criteria for software quality, software reliability, software validation, software configuration management.

Software project management – activities, structures, programmer productivity, option analysis, project milestones, work definition, algorithmic cost modeling – **COCOMO** model.

CASE tools and environments – Analysis and design tools, programming tools, Integration and testing tools, Maintenance tools, Integrated **CASE** environment.

17.VISUAL PROGRAMMING USING VISUAL BASIC

Introduction, getting started with Visual Basic 6. Creation, testing and debugging of a Visual Basic program.

Using Visual Basic data types- Variables, constants, string Arrays, program Flow Control, User defined functions & Modules.

Designing user interface, single document interface. Creating controls, Event- driven programming. Text Boxes, Message Boxes, Circles, Ellipses and Pie charts.

Custom controls – Objects in Visual Basic – classes and object creation and manipulation. Graphics- Line, shape, boxes, circles, Ellipses and Pie charts

DDE properties, **DDE** Events, **DDE** Methods, **OLE** properties, Active X Controls. Data base access-data control – file control- data grid. Record set **SQL** to manipulate data.

Using crystal reports, Data Report control, the Visual Basic data control, Creating issues on Visual Basic.

18.SQL SERVER

Introduction to SQL Server and Relational Database. SQL Server Tools and Utilities.

Creating & implementing databases, files and file groups. Using SQL Server Login and User Security, User Permissions.

Backing up and restoring SQL Server Database. Creating tables, data retrieval with queries. Data modification and indexing.

Views – Creation and manipulation. Procedures and Triggers. Programming SQL Server.

Replication, Implementing replication methodologies. SQL Server Automation.

19.JAVA PROGRAMMING AND ORACLE

Application Programming:- Introduction to JDK, Data Types, Control Structures, Methods Exception Handling, Interface and Packages, Multi Threading, I/O Operations, Network programming.

Applet programming:- Introduction to Java Applet, Applet Life Cycle, AWT-Components, Java Foundation Classes (JFC).

Oracle: Introduction to Oracle, SQL, SQL *Plus, Oracle Datatypes, Introduction to DDL, Create table, Altering table, Drop a table, Truncate table, Insert and Create command with query, Update and delete command.

Operators in SQL *Plus, Privilege commands, Integrity constraints, Transaction Control Language, Commit, Rollback, Save point, Nested tables.

SQL Functions, Classes, Set Operators and joins, Subqueries, Database Objects.

Database Programming using JDBC (Java Database Connectivity).

Introduction to PL/SQL, block, expressions and Operators.

20.WEB PAGE PROGRAMMING

Java Servlets: Introduction, Servlet Structure, Servlet Life Cycle, Servlet API, Http Servlet Class, Http servlet Response Interface, HttpGet Request, Http Post request. Servlets and HTML, Server Side Includes, Servlet Chaining, Servlets and JDBC, Servlets and Object Database, Servlet Sessions. Servlet Implementation using Java Web server.

Java Server Pages:

Basic JSP Scripting, Using JSP Scripting Elements, Implicit Objects, JSP Directives, Using Database with JSP, Implementing JSP.

Remote Method Invocation:

Introduction to RMI, Defining the Remote Interface, Implementing the Remote Interface, defining the Client, Compile and Execute the server and the Client.

Java Beans:

Beans Box Overview, Creating a Java Bean, Java Archive file and Jar utility, Connecting beans with events in the Bean box.

21.MICROPROCESSORS AND ASSEMBLY LANGUAGE PROGRAMMING

INTEL 8086/8088

8086/88 architecture, Intel operations, instructions, format, data transfer, arithmetic, branch, stack operations, I/O, loop, flag manipulations, logical shift, rotate instructions, Interrupt control – programmable interrupt controller – 8259, Writing simple programs for 8086- Macro Assembler.

INTERFACING

Interfacing keyboard, printer, stepper motor, seven segment display, A/D and D/A converters, 8255, 8252/8254, 8251 programmable communication interface, 8237 DMA controller

OTHER 16 BIT PROCESSORS

80286 – Important features – Memory management, Motorola 68000/68010 – Important features.

32 BIT PROCESSORS

80386 – Architecture and important features – co-processor – 80386 memory management.

80486 – architecture and important features – memory management, co-processor

OTHER PROCESSORS

RISC and CISC processors, Intel Pentium, Pentium Pro, MMX, Pentium II, Power PCs- important features.

VISUAL C++

Integrated Development Environment of Visual C++: Creating a simple program in VC++, How a program works? Compilation and execution of a program, App Wizard, Class Wizard, adding new classes and functions, Windows programming fundamentals – WinMain – WndProc – Windows dialogs – Buttons.

Microsoft Foundation Classes (MFC) : Introduction to API, Main classes derived from CObject – CcmdTarget – Cwindow – CmainFrame – CchildFrame – Cview – Cdocument, CDC – Graphics Classes – Controls – Data I/O, MFC Exception, Model and model less Dialogs.

Document/View Architecture : What is Document / View Architecture? Cruntime Class Architecture, SDI Document/ View Architecture, The Icon, Menu and Accelerators, message routing in Document/ View Architecture.

Single Document Interface and Multiple Document Interface : SDI and MDI Architecture. Document, View, Frame, Application Classes, Multiple Views and Documents in single application, Printing – Print Preview, Scrolling Applications.

Advanced Programming in VC++ : Concepts of Threads – Programming Examples, Internet Programming – Socket Programming (Basic Concepts), Wininct Classes and simple programs, CHtmlView class in VC++ 6.0, Database Programming using VC++, Simple ActiveX and COM Control creation.