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H/O D  
Dept. of comp. Sc.  
D

**UNIVERSITY OF CALCUTTA**

**Notification No. CSR / 24 / 11**

It is notified for the information of all concerned that on the recommendation of the Council for U.G. Studies in Arts, Science, etc. dated 11.04.2011, the Vice-Chancellor has, by an order dated 03.05.2011, been pleased to approve **revision to the existing syllabi for the B.Sc.(Honours and General) Courses of Studies in Computer Science** under this University, as laid down in the accompanying pamphlet, for being implemented from the Academic Session 2011-2012.

SENATE HOUSE  
KOLKATA - 700 073  
The 3<sup>rd</sup> May, 2011

*Handwritten signature and date:*  
03-05-11

(Prof. Basab Chaudhuri)

Registrar

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# UNIVERSITY OF CALCUTTA

*Three-year B.Sc. (Honours & General) Courses of Studies in  
Computer Science effective from the Academic Session 2011-2012*

## **Computer Science Honours Course Course Structure**

| Paper           | Type/Marks         | Group | Title  | Periods   |
|-----------------|--------------------|-------|--|-----------|
| <b>Part-I</b>   |                    |       |  |           |
| I               | Theoretical<br>100 | A     | Computer Fundamentals  | 30        |
|                 |                    | B     | Introduction to Basic Electronics                                    | 35        |
|                 |                    | C     | Digital System Design  | 45        |
|                 |                    | D     | Computer Organization-I  | 40        |
| II              | Theoretical<br>50  | A     | Section-I: System Software Fundamentals and<br>Operating Systems     | 50        |
|                 | Practical<br>50    | B     | Section-II : Data Structure-I<br>Hardware                            | 25<br>150 |
| <b>Part-II</b>  |                    |       |  |           |
| III             | Theoretical<br>100 | A     | Discrete Mathematical Structures                                     | 75        |
|                 |                    | B     | Numerical Methods and Algorithms                                     | 45        |
|                 |                    | C     | Formal Languages and Automata Theory                                 | 30        |
| IV              | Theoretical 50     | A     | Section-I : Data Structure-II  | 30        |
|                 | Practical 50       | B     | Section-II : Programming through C Language<br>Software : C Language | 45<br>150 |
| <b>Part-III</b> |                    |       |  |           |
| V               | Theoretical<br>100 | A     | Microprocessor   | 50        |
|                 |                    | B     | Computer Organization- II  | 50        |
|                 |                    | C     | Computer Networks  | 50        |
| VI              | Theoretical<br>100 | A     | Object-Oriented Programming  | 30        |
|                 |                    | B     | Software Engineering   | 30        |
|                 |                    | C     | Computer Graphics  | 30        |
|                 |                    | D     | Database Management System   | 60        |
| VII             | Practical<br>100   | A     | Hardware : Microprocessor Programming & I/O<br>Interfacing           | 100       |
|                 |                    | B     | Software: RDBMS  | 50        |
| VIII            | Practical<br>100   | A     | Object-Oriented Programming  | 100       |
|                 |                    | B     | UNIX Shell Programming   | 50        |



## PART – I

### PAPER – I (THEORETICAL): 100 Marks

#### Group A: Computer Fundamentals

(30 Periods)

*Introduction to Computer and Problem Solving:* Information and Data.

*Hardware:* CPU, Primary and Secondary storage, I/O devices

*Software:* Systems and Application.

*Generation of Computers:* Super, Mainframe, Mini and Personal Computer.

*Introduction to Programming Languages:* Machine Language, Assembly Language, High Level Language.

*Problem Solving:* Flow Charts, Decision Tables and Pseudo codes. (8)

*Number Systems and Codes:*

Number representation: Weighted Codes, Non-weighted codes, Positional, Binary, Octal, Hexadecimal, Binary Coded Decimal (BCD), Conversion of bases. Complement notions. Binary Arithmetic, Binary Codes: Gray, Alphanumeric, ASCII, EBCDIC; Parity Bits. Single Error-Detecting and Correcting Codes, Hamming Codes, Fixed and Floating Point Arithmetic: Addition, Subtraction, Multiplication and Division. (12)

*Boolean Algebra:*

Fundamentals of Boolean Algebra, Switches and Inverters, Functionally Complete Gates (AND, OR, NOT), NAND, NOR. Switching function and Boolean function. De Morgan's theorem, Minterm and Maxterm, Truth table and minimization of switching function up to four variables, Algebraic and K-map method of logic circuit synthesis: Two level and Multi level. (10)

#### Group B: Introduction to Basic Electronics

(35 Periods)

*Elementary circuit theory:* Kirchoff's Laws with simple applications, Statement and illustration of Thevenin's & Norton's theorems (without proof) in resistive network only & its simple applications. (2)

*Elementary Physics of semi-conductors:* Intrinsic and Extrinsic semiconductors, P & N type, Diode & its applications: Types of diodes, P-N Junction diodes, Biasing of a junction diode, Depletion region & its effect, Zener diodes & its applications, Diode as a rectifier, LED. (7)

*Bipolar Junction Transistor:* Principle of junction transistor, current components of transistor, modes of a transistor (CB, CE and CC) and their properties, I/O characteristics of a transistor in CE mode. Relation between  $\alpha$  &  $\beta$ -parameters of transistor, biasing of a transistor: Q point, load line, Self-bias, fixed bias & collector to base bias and stability factors. Transistor as an amplifier (8)

*Inverters using Transistors:* Transfer characteristics and threshold voltages. Switching characteristics of diodes and transistors-SCR. (2)

*Unipolar Junction Transistor:* Principle of FET and MOSFET, Depletion and Enhanced modes of operations, Characteristics and definition of different parameters, Symbols and Application for switching functions. Concept of NMOS, PMOS and CMOS switch. (8)

*Operational Amplifier :* Principle of differential amplifiers, CMRR of differential amplifiers, properties of ideal Op-amp, transfer characteristics of op-amp, concept of virtual ground, offset parameters and its uses as an inverting, non-inverting amplifiers, adder/subtractor, differentiator, integrator and scale changer, Schmitt trigger. Principle of Multi-vibrators, applications of Multi-vibrators – Monostable, Bistable and Astable multivibrators. (8)

#### Group C: Digital System Design

(45 Periods)

*Combinational Circuits:* Realization of AND and OR Gates using diodes and NOT Gate using transistors, Standard Gate Assemblies, IC chips packaging nomenclature, Half and Full Adder(3 bits), Multi-bit adders – Ripple carry and Carry Look Ahead Adder, Adder/subtractor, BCD-Adder, Data selectors/multiplexers –



expansions, reductions, function realization, universal function realization, multi-function realization, Decoders/Demultiplexers: function realization, De-multiplexer and function realization, Encoder, Priority Encoder, Parity bit Generator/checker, Gray Code Generator, Code Converters, I/O features of BCD to 7- segment LED decoder/driver(7447/7448), Seven segment display unit, Comparators. (16)

*Sequential Circuits:* Model of Sequential computing, Difference between Combinational and Sequential circuit, RS-Latch: using NAND and NOR Gates, RS Latch as a Static RAM Cell, Problems of Basic Latch circuits, Digital Clock – Duty Cycle, Rising time, Falling time, Clocked Flip Flops - SR, JK, D, T, Level Trigger and Edge Trigger, Excitation Functions of each flip-flops, Flip-flops with Preset and Clear, Application of Flip-flops: Asynchronous Counter(UP/DOWN) up to 4 bit counter, Mod – n Counter, Synchronous Counters – different mod counters, Ring counter, Registers: Registers with serial and parallel load, Shift Registers. (17)

*Data Converter:* D/A Conversion principle using basic circuit, R-2R Ladder circuit, Counter based A/D converter, Successive approximation method for A/D conversion. DTL and TTL NAND gate circuits and its operations, Fan in & Fan out. Noise margin. SSI, MSI, LSI, and VLSI classifications. (12)

#### **Group – D: Computer Organization – I**

**(40 Periods)**

*Basic Computer Organization* - IAS Computer, Von Neumann Computer, System Bus. Instruction Cycle, Data Representation, Machine instruction and Assembly Language, CPU Organization, Arithmetic and Logic Unit, Control Unit, CPU Registers, Instruction Registers, Program Counter, Stack Pointer. (10)

*Instruction:* Operation Code and Operand. Zero, One, Two and Three address instruction. Instruction types. Addressing modes. Stack organization. (15)

*Memory:* Types of Memory, RAM, ROM, EPROM, EEPROM. Different storage technologies. I/O system organization and interfacing, Tri State Devices. (15)

#### ***Distribution of questions/Marks:***

Q1. (Compulsory 10 short questions for 2 marks each). Five more questions to be answered from the remaining taking at least one from each group. There has to be at least eight questions other than question 1, two from each of the Groups.

(All questions other than question 1 are of 16 marks; questions may have subdivisions).

#### **Text Books :**

1. Introduction to Computer Science by P.K.Sinha, P. Sinha, (PHI)
2. Computer Fundamentals by Anita Goel, Pearson
3. Principles of Electronics by V.K. Mehta, S. Chand & Company Ltd.
4. Electronics Fundamentals and Applications by D.Chattopadhyay and P.C.Rakshit., New Age Intl (P)
5. Digital Circuits, Combinational Circuit, Vol 1 by D. Roy Choudhuri, Platinam Publication.
6. Digital Circuits, Sequential Circuit, Vol 2 by D. Roy Choudhuri, Platinam Publication.
7. Digital Logic and Computer Design by M.Morris Mano, PHI
8. Digital Principle and Applications by Malvino & Leach, TMH
9. Digital Systems Principles and Applications by Ronal J. Tocci and Neal S. Widmer, PHI
10. Digital Fundamentals by Floyd, Pearson Education
11. Computer Architecture and Organizations, J. P. Hayes, TMH
12. Computer System Architecture by M. Morris Mano
13. Computer Organization and Architecture by William Stallings, Pearson Education
14. Electronics Devices and Circuit Theory by Boylestad, Nashelsky, PHI
15. Integrated Electronics: Analog and Digital Circuits and Systems, J. Millman & C.C. Halkias, McGRAW Hill.
16. Electronics Principles, by A.P. Malvino, TMH.
17. Digital circuits by Sullivanan, Vikas Publication.



**PAPER – II: 100 MARKS**

**Group – A (THEORETICAL): 50 Marks**

**Section - I: System Software Fundamentals and Operating Systems (50 periods)**

*System Software Fundamentals:* Different System Software: A brief introduction to Operating Systems, Assemblers, Loaders, Linkers, Interpreters, Compilers, various phases of compilation. (10)

*Introduction to Operating Systems:* What is OS? Multiprogramming, Multitasking OS, Concepts of processes, Files, Shell, System Calls; Structures: Monolithic, Layered, Virtual, Client Server and Distributed Model. (4)

*Concepts of Synchronization:* Semaphores, Critical Regions, Monitor Inter Process Communication Mechanism.

*Processor Management:* Scheduling and its types. (7)

*I/O Management:* Device and Device Controllers, Interrupt Handlers and Device drivers. (4)

*Memory Management:* Real & Virtual memory, Swapping, Paging, Segmentation, Page Replacement Techniques. (3)

*File Systems:* Files and Directories, File Servers, Security and Protection, Disk Management. (7)

*Dead Lock:* Introduction, Prevention, Avoidance, Detection, Recovery. (4)

*Case Study:* UNIX/LINUX, WINDOWS. (4)

**Section II: Data Structure-I (25 Periods)**

*Introduction:* Concepts of Data types, Elementary structures, Data types and their interpretation. (2)

*Arrays:* Types, Memory Representation, Address Translation, Functions of single and multi-dimensional arrays with examples. (5)

*Linked Structures:* Singly and doubly linked list (non-circular and circular), List manipulation with pointers: Searching, Insertion and deletion of elements. (6)

*Stacks and Queues:* Representation, Uses and Applications, Infix, Prefix & Postfix notations, Infix to postfix: conversion and evaluation; Application of queues. (10)

*Recursion:* Divide and Conquer, elimination of recursion. (2)

***Distribution of Questions/marks:***

Q1. (Compulsory 4 short questions of 2 mark each). Three more questions are to be answered from the remaining taking two from Section I and one from Section II. There has to be six questions other than question 1, four from section I and two from section II.

(All questions other than question 1 are of 14 marks; questions may have subdivisions).

**Text Books:**

1. System Programming by John J. Donovan, TMH
2. Compilers Principles, Techniques and Tools, by Alfred V. Aho, Ravi Sethi and Jeffrey D. Ullman, Pearson Education
3. System Software - An Introduction to System Programming by Leland L. Beck, Pearson Ed., 3<sup>rd</sup> Ed.
4. Data Structure by Liptsuitz, S. Outline Series
5. Data Structure by Ellis Horowitz, Sartaz Sahani, Galgotia
6. Data Structure Using C by S. K. Bandyopadhyay and K. N. Dey, Pearson Education
7. Data Structures and Algorithm Analysis in C by Mark Allen Weiss, 2<sup>nd</sup> Edition, Pearson Education
8. Data Structure and Program Design in C by R. L. Kruse, C. L. Tondo and B. P. Luig, Pearson Education.
9. Operating Systems by H. M. Deitel, Pearson Education
10. Operating System Concepts by A. Silberschatz, P. B. Galvin, G. Gagne, John Wiley & Sons, Inc.



**Group-B ( Hardware Practical): 50 Marks****(150 Periods)***Pre-requisites:*

Study of IC Data Books – Linear and Digital. Familiarity with breadboard, LED, 7 segment display etc. Observe the output waveform of a function generator in a CRO. Mean Time Period, Peak Voltage, Frequency and comparison with function generator readings, Study of basic logic functions like AND, OR, NOT, NAND etc. Ideas of fan in, fan out, Noise Margin, Threshold Voltage, Transfer Characteristics, Design of a NOT Gate (inverter) using transistors. Design of a debouncing switch. Logic probe, Clock (crystal timer). Verification of NAND and NOR gates as universal gates, De Morgan's Theorem.

*Analog Circuits*

- 1) Use of Diodes to implement bridge rectifier. Observe the waveform on CRO. Measure peak values. Use three terminal regulator (IC 78XX) for voltage regulation. Drawing of load regulation characteristics.
- 2) Using Transistor to construct NOT or Invert Operation and draw the transfer characteristics and measure the threshold voltage.
- 3) OP-AMP: Close loop gains inverting and non-inverting OP-AMP. Use of OP-AMP as adder, subtractor, differentiator, integrator. For each case offset null arrangement has to be done.

*Digital Circuits:***Combinational Circuits:**

- 1) Implement Half Adder/Half Subtractor / Full Adder / Full Subtractor using Logic Gates. Realize a logic function using basic/universal gates in SOP and POS form. Study the functionalities of 7483 and design a BCD adder using 7483 or equivalent.
- 2) Design a 4 bit 2's complement adder – subtractor unit using 7483 or equivalent and XOR gates.
- 3) Design a circuit to convert BCD numbers to corresponding gray codes.
- 4) Design a 4:1 MUX using NAND gates. Study of 74153 and 74151. Design Full Adder / Subtractor using MUX.
- 5) Design a 2:4 decoder using NAND gates. Study of 74155 and 74138. Design Full Adder / Subtractor using decoders.
- 6) Design a parity generator/checker using basic gates.
- 7) Design magnitude comparator using basic/universal gates. Study of 7485.
- 8) Design a seven segment display unit.

*Sequential Circuits:*

- 1) Realize S-R, D, J-K and T flip-flop using basic gates. (Study the undefined state in S-R flip-flop).
- 2) Study the functional characteristic of IC 74194 with emphasis on timing diagram.
- 3) Design Asynchronous and Synchronous counters. (Mod-8, Mod-10 up counter)
- 4) Study the functional characteristics of RAM IC chip. Study of open collector and tri-state output. Horizontal expansion of RAM chips by cascading. (Use 74189, 7489, or any available chip).

**Duration of Examination : 4 hours****Marks Allotment:**

|            |   |          |
|------------|---|----------|
| Sessional  | - | 05 marks |
| Experiment | - | 35 marks |
| Viva-voce  | - | 10 marks |

**Text Books:**

1. Digital Electronics Practice using IC by R. P. Jain and M. M. S. Anand, TMH
2. Up to TTL 7400, BPB Publication.



## Part-II

### PAPER – III(THEORETICAL) : 100 Marks

#### Group – A : Discrete Mathematical Structures

(75 Periods)

*Graphs:* Introduction, Finite and Infinite Graphs, Directed and Undirected Graphs, Degree, Isolated vertex, Pendant vertex, Null graphs. (4)

Walks, Paths and Circuits, Connected and Disconnected graphs, Euler's graphs, Hamiltonian paths and circuits, Trees, Introduction and basic properties, Distance and contents, Matrix representation of graphs, Incidence, Adjacency and Circuit matrices, Graph Search – BFS, DFS, Spanning Trees, Shortest Path Problems. (20)

*Mathematical Logic:* Proposition, Predicates and Quantifiers. Sets, Functions, Growth of Functions, Relation, Equivalence Relation: Big O Notation, Big Omega and Big-Theta Notations. (7)

*Algorithms:* Complexity of Algorithms, Space and Time, Polynomial and Exponential Algorithms. (6)

*Counting theory:* Counting, Pigeon Hole Principle, Inclusion and Exclusion Principle, Permutations and Combinations, Recurrence relations and Generating functions. (18)

*Introduction to Probability:* Sample space, events, probability, simple problems, Conditional Probability, Binomial Distribution (significance only), Random variable, expectation, Variance and Standard Deviations. (20)

#### Group – B: Numerical Methods and Algorithms

(45 Periods)

[For the methods covered in this group, the algorithm design using pseudo code needs to be done]

*Errors:* Introduction, types of errors. (2)

*Interpolation:* Newton Forward and Backward interpolation, Lagrange interpolation. (4)

*System of Linear Equations:* Properties: linear dependency, Rank, Singularity of Coefficient matrix, Ill-condition matrix, Solution methods: Gaussian Elimination, Gauss-Jordan Elimination, Gauss-Seidel method, convergence and errors. (10)

*Solution of Nonlinear Equation:* Bisection algorithm, Regula-falsi method, Secant and Newton-Raphson method, convergence and its graphical significances. (10)

*Solution of Differential Equations:* Euler Method, Modified Euler Method, Taylor Method, Runge-Kutta second and fourth order method for solving differential equations. (10)

*Integration:* Trapezoidal and Simpson's  $1/3^{\text{rd}}$  Rules and its Composite forms. (4)

*Curve Fitting:* Linear, Quadratic fittings. (5)

#### Group – C: Formal Languages and Automata Theory

(30 Periods)

Introduction to Formal Languages and Grammar, Chomsky Classification of Grammars, Regular Expressions, Finite Automata - deterministic and non-deterministic and their equivalence, state minimization, introduction to Turing Machines.

#### *Distribution of Questions/marks:*

Q1. (Compulsory 10 short questions of 2 marks each). Five more questions to be answered from the remaining taking at least two from Group A, and at least one from each of the other groups. There has to be at least eight questions other than question 1, with four from Group A, and two from each of Group B and C.

(All questions are of 16 marks; questions may have subdivisions.).



**Text Books:**

1. Graph Theory by N. Deo, PHI
2. Introduction to Graph Theory by D. B. West, Pearson Education
3. Discrete Mathematics and its Applications by Rosen, TMH
4. Discrete Mathematics by C.L.Liu, TMH
5. Numerical Methods for Scientific and Engineering Computation by M.K.Jain, S.R.K.Iyengar, R.K.Jain, New Age International Publishers
6. Computer Oriented Numerical Methods by V. Rajaraman, PHI
7. Introductory Methods of Numerical Analysis by S.S.Sastri, PHI
8. Switching and Finite Automata Theory by Z. Kohavi, TMH
9. Theory of Computer Science(Automata, Languages & Computation) by K. L. P. Misra & N. Chandrasekharan, PHI.

**PAPER-IV: 100 Marks**

**Group-A (Theoretical): 50 Marks**

**Section – I: Data Structures-II**

**(30 Periods)**

*Trees:* Introduction, Quantitative Properties, Binary Tree, Tree traversals, Internal and external path lengths: Properties, Minimum and maximum path length of a binary tree, Importance.

*Binary Search Trees:* Introduction, Searching, Insertion, Deletion. (14)

*Searching:* Linear and binary search, performance and complexity. (4)

*Hashing:* Concepts, Advantages and Disadvantages, Different types of hash functions, Collision and Collision Resolution Techniques – Open Addressing with probing, Linear Chaining, Coalesced Chaining, Application. (4)

*Sorting:* Terminology, Performance Evaluation, Different Sorting Techniques (Bubble, Insertion, Selection, Quick sort, Merge Sort, Heap, Partition Exchange, Radix with iterative and recursive description), Complexity, advantages and disadvantages. (8)

**Section-II: Programming through C Language**

**(40 periods)**

**(Example programs may be used to explain each of the topics)**

*Introduction:* History, Basic Structure, Algorithms, Structured programming constructs. (2)

*C Programming elements:* Character sets, Keywords, Constants, Variables, Data Types, Operators- Arithmetic, Relational, Logical and Assignment; Increment and Decrement and Conditional, Operator Precedence and Associations; Expressions, type casting, Comments, Functions, Storage Classes, Bit manipulation, Input and output. (6)

*C Preprocessor:* File inclusion, Macro substitution. (2)

*Statements:* Assignment, Control statements- if, if\_else, switch, break, continue, goto, Loops-while, do\_while, for. (6)

*Functions:* argument passing, return statement, return values and their types, recursion (4)

*Arrays:* String handling with arrays, String handling functions. (4)

*Pointers:* Definition and initialization, Pointer arithmetic, Pointers and arrays, String functions and manipulation, Dynamic storage allocation. (7)



User defined Data types: Enumerated data types, Structures. Structure arrays, Pointers to Functions and Structures, Unions. (4)

File Access: Opening, Closing, I/O operations. (5)

**Distribution of Questions/marks:**

Q1. (Compulsory 4 short questions of 2 mark each). Three more questions are to be answered from the remaining at least one from Section I and at least one from Section II. There has to be six questions other than question 1, three from section I and three from Section II. (All questions other than question 1 are of 14 marks; questions may have subdivisions).

**Text Books :**

1. References of Data Structure are given previously.
2. The C Programming Language by B. W. Kernighan, D. M. Ritchie, PHI
3. Programming through C by Richard Johnsonbaugh and Martin Kalin, Pearson Education
4. C Programming Essentials by K. N. Dey, S. Bandopadhyay, Pearson Education
5. A Book on C by Kelley and Pohl, Pearson Education
6. Understanding C by Y. Kanetkar, BPB
7. Programming in Ansi C by E. Balagurusamy, TMH.

**Group – B (Software Practical): 50 Marks**

**Programming through 'C' Language**

(Lab Periods 150)

Problems should cover basic features of the Language; Applications including numerical problems, Data Structure, Graph representation and manipulation.

**Duration of Examination : 4 hours**

**Distribution of Marks:**

C Program - one question to be answered

**Marks Allotment :**

|                      |   |                                    |
|----------------------|---|------------------------------------|
| Experiment           | - | 35 marks                           |
| (Algorithm/Flowchart | - | 5 marks                            |
| Source Code          | - | 25 marks                           |
|                      |   | Input/Output & Discussion 5 marks) |
| Sessional            | - | 05 marks                           |
| Viva-voce            | - | 10 marks                           |

**Part – III**

**PAPER – V (THEORETICAL): 100 Marks**

**Group – A: Microprocessor**

(50 Periods)

Evolution of Microprocessor: Architecture of 8 bit and 16 bit microprocessor Machine Language Instructions, Addressing Modes, Instruction Formats, Instruction Sets, Instruction Cycle, Clock Cycles, Timing Diagrams, Programming a Microprocessor, Interrupts, Interfacing concepts- Memory Interfacing, I/O Interfacing and Ports – PPI 8255 Keyboard Interfacing, Display Interfacing, Interrupt and subroutine handling, Methods of Interrupts, Priority and Management  
Case Studies : 8085 and 8086 microprocessor.



**Group- B : Computer Organization – II:**

**(50 Periods)**

*ALU* – Combinational ALU, 2's Complement Addition, Subtraction Unit, Booth's Algorithm for multiplication and division.

*Memory Hierarchy*: CPU Register, Cache Memory, Primary Memory (DRAM, SRAM, SAM, PAL, PLA), Secondary Memory and Virtual Memory, Associative memory.

*CISC and RISC processors*: Introduction, relative merits and demerits.

*Control Unit*: Control Structure and Behaviour, Hardwired Control and Micro programmed control: Basic Concept, Parallelism in Microinstruction.

*I/O*: Polling, Interrupts and subroutines, Memory mapped I/O and I/O mapped I/O, DMA, I/O Bus and Protocol, SCSI, PCI, USB, Bus Arbitration.

*Computer Peripherals*: VDU, Keyboard, Mouse, Printer, Scanner etc.

**Group- C: Computer Networks**

**(50 Periods)**

Data Communication Concepts: Analog & Digital Signals, Periodic & Non-periodic signals, Time and Frequency Domain; Bandwidth and Data rate; Signal rate, Serial & Parallel transmission, Various modes of transmission: Simplex/ Half Duplex, Duplex, Features of guided and non- guided transmission media, Impairments.

Purpose of Modulation & Encoding: AM, FM, PM ; Multiplexing: Purpose & Definition of FM & TDM. Goals of Computer Network, LAN, MAN and WAN. OSI & TCP/IP Architecture.

Intranet and Internet; Servers and Clients; Ports; Domain Name Server (DNS); Accounts, Internet Service Providers; Connections: Dial Up, ISDN, ADSL; Cable, Modem; E-Mail: Account, Sending, Receiving, Mailing List, IRC, Voice and Video Conferencing, WWW, Browsers.

***Distribution of Questions/marks:***

Q1. (Compulsory 10 short questions of 2 mark each). Five questions to be answered from the remaining which consists of at least 8 questions. (All questions are of 16 marks; questions may have subdivisions. At least one question to be answered from each group).

**Text Books:**

1. Computer Architecture and Organizations by J. P. Hayes, TMH.
2. Computer System Architecture by M. Morris Mano.
3. Computer Organization and Architecture by William Stallings, Pearson Education.
4. Introduction to Microprocessor by Gaonkar, Penrum Publishers.
5. Microprocessor and Peripherals by Choudhury et al, Scitech Publishers.
6. Introduction to Microprocessors by A. P. Mathur, TMH.
7. Fundamentals of Microprocessors & Microcomputers by B. Ram, Dhanpat Rai Publications.
8. Data Communications and Networking by Behrouz A. Forouzan, TMH.
9. Data and Computer Communication by William Stallings, Pearson Education.
10. Computer Networks by Tanenbaum, Pearson Education.



**PAPER – VI (THEORETICAL): 100 Marks**

**Group – A: Object Oriented Programming**

**(30 Periods)**

*Concepts:* Difference with procedure oriented programming; Data Abstraction and Information Hiding : Objects, Classes and Methods, Encapsulation, Inheritance, Polymorphism, Object Oriented Programming through C++: Input/Output, Function and Operator Overloading; Constructors and Destructors, Copy Constructors and Assignment Operator, Overloading, Single and Multiple Inheritance, Polymorphism and Virtual Functions, Namespace, Exception Handling, Templates.

**Group – B: Software Engineering**

**(30 Periods)**

Software Life Cycle, Different Models: Waterfall, Spiral; Software Requirement Analysis & Specification, Structured Analysis, DFD, Data Dictionary, Structured Design, Structure Charts, Software Testing : White Box and Black Box Testing, Software Quality Assurance.

**Group – C: Computer Graphics**

**(30 Periods)**

Introduction : Co-ordinate System, Information Handling Software, Graphics Software, Area of Application, Translation, Rotation, Scaling, Matrix Representation, Homogeneous Co-ordinate System, Composite Transformation, Inverse Transformation, Computer Art, Animation, Morphing, Projection & Clipping, 2D & 3D Transformations, Lines, Curves and their presentations.

**Group – D: Data Base Management System**

**(60 Periods)**

Basic concept, File Management Systems, Advantages of DBMS, ANSI/SPARC Architecture, Physical, Conceptual and External Models, ER Diagram; Data Models : Relational, Hierarchical, Network; File Organization : Sequential, Indexed Sequential, Random, Inverted; Query Languages, Relational Algebra, Relational Calculus, Functional Dependencies, Normal Forms : 1NF, 2NF, 3NF and BCNF; Structured Query Languages (SQL), elementary concepts of Security, Integrity.

***Distribution of Questions / marks:***

Q1. (Compulsory short questions – 20 marks). Five questions to be answered from the remaining which consists of at least 8 questions. (All questions are of 16 marks; questions may have subdivisions. At least one question to be answered from each group).

**Text Books :**

1. Object Oriented Programming with C++ by Balagurusamy, TMH
2. Object Oriented Programming with C++ by Robert Lafore, PHI
3. An Integrated Approach to Software Engineering by Pankaj Jalote, Narosa Publishing House
4. Fundamentals of Software Engineering, Rajib Mall, PHI
5. Software Engineering by Pressman
6. Introduction to System Analysis and Design by Igor Hawryszkiewicz, PHI
7. Fundamental of Computer Graphics and Multimedia by D. P. Mukherjee, PHI
8. Computer Graphics by Hearn and Baker, PHI
9. Database System Design by Elmasri, Navathe, Somayajulu, Gupta, Pearson Education
10. Database Systems: Concept, Design and Application by S. K. Singh, Pearson Education, 1st Edition
11. An Introduction to Database Systems by C.J. Date, A.Kannan, S.Swamyathan, Pearson Education
12. Relational Database Design by Jan L. Harrington, An Imprint of Elsevier



**PAPER – VII (Practical): 100 Marks**

**Group – A (Hardware: Microprocessor Programming & I/O Interfacing ): 50 Marks**

*Experiment with 8085A based micro computing kits*

- 1) Data movement between register – register, register-memory, memory-memory.
- 2) Arithmetic operations on single byte, word and multi-byte integer, signed and hexadecimal operands.
- 3) Ordered arrangement of a set of operands.
- 4) Bubble Sorting, Sequential and Binary Search.
- 5) Block Replacement and transfer.
- 6) Parity Generator.
- 7) Delay Routines.

*Interfacing:*

- 1) Display of Alphanumeric Characters on 7 segment displays.
- 2) Matrix Keyboard Interfacing and Identification of the keys.

**Duration of Examination : 4 hours**

*Marks Allotment :*

|            |   |          |
|------------|---|----------|
| Sessional  | - | 05 marks |
| Viva-voce  | - | 10 marks |
| Experiment | - | 35 marks |

**Group – B (Software: RDBMS): 50 Marks**

RDBMS: ORACLE, SQL Server

*Front Ends:* Developer 2000, Visual Basic.

*Problems:* Application Database with GUI.

**Duration of Examination : 4 hours**

*Marks Allotment:*

|            |   |          |
|------------|---|----------|
| Sessional  | - | 05 marks |
| Viva-voce  | - | 10 marks |
| Experiment | - | 35 marks |

**PAPER – VIII ( Software Practical): 100 Marks**

*Section I:* Object Oriented Programming      *Language:* C++, Visual C++ Programming

*Problems:* Problem set should cover the basic features of the language and implementation of different algorithms covered in theoretical papers.

*Section II:* UNIX: Files and Directories, Copy, Delete, Rename Directory, Creation, Navigation, Editor, Pipes and Filters, Pattern searching.

Unix Shell Programming.

*Platform:* SCO UNIX, LINUX

*Problems:* Problem set should cover the basic features of Unix / Linux and shell programming.

**Duration of Examination : 6 hours**

*Marks Allotment:*

|            |   |          |
|------------|---|----------|
| Sessional  | - | 10 marks |
| Viva-voce  | - | 20 marks |
| Experiment | - | 70 marks |

Section I - 40

Section II - 30



**Text Books :**

1. SQL / PL / SQL The Programming language of Oracle by Ivan Bayross, BPB.
2. Unix Shell Programming by Y. Kanetkar, BPB.
3. Your UNIX: The Ultimate Guide by Sumitava Das.

**Computer Science General****SUMMARY OF PERIOD DISTRIBUTION : Total Marks : 400**

| Paper<br>(F.M)                        | Group<br>(F.M) | Type   | Minimum Number of Periods |              |
|---------------------------------------|----------------|--------|---------------------------|--------------|
|                                       |                |        | Theoretical(T)            | Practical(P) |
| *COURSE WORK FOR PART-I EXAMINATION   |                |        |                           |              |
| I(100)                                | *              | T      | 120                       |              |
| *COURSE WORK FOR PART-II EXAMINATION  |                |        |                           |              |
| II(100)                               | *              | T      | 120                       |              |
| III(100)                              |                | P      |                           | 120          |
| *COURSE WORK FOR PART-III EXAMINATION |                |        |                           |              |
| IV(100)                               | A(50)<br>B(50) | T<br>P | 60                        | 72           |

\* Shown within the syllabus; T-Theoretical, P-Practical

F.M: Full Marks

Note: Figures with in( ) below indicate number of periods allotted for that topic.

**Part – I****PAPER I (THEORETICAL) : 100 Marks****Group A: General Concepts****(20 Periods)**

*Information:* Definition, Categories, Data: Storage, Retrieval and Processing.

*Compute: Hardware* – CPU, Primary & Secondary Storage, Cache Memory, I/O Devices.

*Software:* Classification System and application; Stored Program Concept and Von-Neumann Architecture;

*Evolution:* types – supercomputers, mainframes, minis and workstations, PC's, Parallel Machines.

*Generations of programming languages:* low level language, assembly level language, High Level language, 4GL

*Application Software:* User specific application development; standard packages.

*System Software:* Classifications – Operating Systems(OS); Translators – Compilers and Interpreters, Preprocessors, Assemblers, Macro Assemblers, Loaders, Linkers, Line and Screen Editors, other utilities.

*Virus:* Concept, detection and protection.

*Multimedia:* Basic concept, associated hardware and software.

*Object Oriented Paradigm:* Basic characteristics, definition, brief comparison with other types of programming paradigms.

**Group B: Digital logic Design****(35 Periods)**

Number System, Bits and Byte, Base conversion, (r-1)'s and r's complement, Fixed point, Floating point representation, ASCII, EBCDIC, Boolean Algebra;

Combinational Logic: AND, OR, NAND, NOR, XOR gates; adder, multiplexer, demultiplexer /decoder, encoder. (only conceptual study with block diagram and truth/state table)

Sequential Logic: flip-flops, registers, counters (synchronous & asynchronous) (only conceptual study with block diagram and truth/state table)

**Group C: Computer Architecture and Organization****(35 Periods)**

*Central Processing Unit (CPU)*

*ALU:* Basic Structure of ALU, Addressing Mode, Instruction formats, Handling of interrupts and subroutines.



*Control Unit:* Instruction and Execution Cycle; Control of sequence, jump and branch instruction; shift instruction.

*I/O:* Controller, interrupt, DMA, Memory mapped I/O. Standard buses. (brief description of basic characteristics, principle of operation related parameters, and comparative study where applicable)

*Memory:* Memory devices (brief description of basic characteristics, principle of operation related parameters, and comparative study where applicable), static and dynamic RAM, ROM, cache; secondary memory (floppy disc, hard disc, tape, CD ROM, DVD).

#### **Group D: Operating System**

**(30 Periods)**

*Operating System:* Definition, types of Operating System, functions of Operating System, SPOOLing, Buffering.

*Process:* Process concept, Process States, Process control block.

*Process scheduling:* Scheduling queues, Scheduler, Scheduling criteria, Long term scheduling, Short term scheduling (CPU scheduling - preemptive, non-preemptive), Medium term scheduling.

*Context Switch.*

*Memory Management:* Purpose, logical vs physical address space, overlays, swapping, contiguous memory location, memory protection, memory allocation, fragmentation, paging, associative register, segmentation, segmentation with paging, Virtual memory: Concept, demand paging and page fault (definitions only).

#### *Distribution of Questions :*

Q1. (Compulsory – 20 marks, any ten questions to be answered out of fifteen, each carrying 02 marks).

No. of questions (Group) : 03(A), 04(B), 04(C), 04(D)

Q2 to Q9. Five questions to be answered taken at least one from each group. Each group contains two questions with 16 marks each.

All questions may have smaller subdivisions.

#### **Text Books:**

1. Introduction to Computer Science by P.K.Sinha, P Sinha, BPB Publication.
2. Computer Fundamentals by Anita Goyel, Pearson Education.
3. Computer Architecture and Organizations 2<sup>nd</sup> Edition, J. P. Hayes, TMH
4. Computer System Architecture by M. Morris Mano, PHI
5. Digital logic and computer design by M. Morris Mano, PHI
6. Digital Principle and Applications by Malvino & Leach, TMH
7. Operating Systems by H.M.Deitel, 2<sup>nd</sup> Edition, Pearson Education
8. Operating System Concepts, A.Silberschatz, Peter B. Galvin, G. Gagne, 6th Ed., John Wiley & Sons, Inc.

## **Part - II**

### **PAPER-II (THEORETICAL): 100 Marks**

#### **Group A : Algorithms & Data Structure**

**(45 Periods)**

*Algorithms and Problem Solving:* Algorithm definition and characteristics; algorithm representation technique – flowchart, in words (stepwise), pseudo code, structured constructs – simple structure, selection, repetition, indentation and comments, Recursive and non-recursive algorithms, Complexity, Asymptotic notation (definition, basic properties and use)

*Data Structures:* Data types and structures – definition. Concepts of sequential and linked allocation.

*Linear Structures (concept and implementation):* Array, Stack, Queue.

*Non-linear structures:* Graph, Binary Tree, Binary Search Tree (definition, illustration and basic properties).

*Sorting and Searching:* Selection sort, insertion sort, bubble sort, linear search, binary search.

#### **Group B: Software Engineering: Models and Introduction to Analysis & Design**

**(25 Periods)**

Introduction, *Software life cycle models:* Waterfall model, Iterative waterfall model, Spiral model, Software Requirement Specifications (SRS), Data Flow Diagram (DFD).



**Group C: Database Management System****(50 Periods)**

*Overview:* File management system and DBMS, DBMS architecture, Data Dictionary, DDL, DML, DBA (Definition and Role of DBA).

*Data Models:* Network, Hierarchical, Relational models and their comparison

*Relational Model:* Definition and properties, Keys of different types

*Relational Data Design:* ER diagram to relational schema, Normalization (upto 3NF)

*Query Language:* SQL – basic concepts.

*Distribution of Questions :*

Q1. (Compulsory – 20 marks, any ten questions to be answered out of fifteen, each carrying 02 marks).

No. of questions (Group) : 06(A), 03(B), 06(C)

Q2 to Q9. Five questions to be answered taken two from group A (out of 3 questions), one question from group B (out of 2 questions), and two questions from group C (out of 3 questions).

Each question carries 16 marks.

All questions may have smaller subdivisions.

**Text Books:**

1. Data Structure by Liptsuitz, S. Outline Series
2. Data Structure by Ellis Horowitz, Sartaz Sahani, Galgotia
3. Data Structure Using C by S. K. Bandyopadhyay and K. N. Dey, Pearson Education
4. Data Structures and Algorithm Analysis in C by Mark Allen Weiss, Pearson Education
5. Introduction to data structure by Trembly & Sorenson, TMH
6. Software Engineering by Pressman
7. Fundamental of Software Engineering by Rajib Mall, PHI.
8. Database System Design by Elmasri, Navathe, Somayajulu, Gupta, Pearson Education
9. Database Systems: Concept, Design and Application by S. K. Singh, Pearson Education
10. Database System Concept by Korth, Silberschatz, Mc GrawHill
11. An Introduction to Database Systems by C.J. Date, A.Kannan, S.Swamynathan, Pearson Education
12. Relational Database Design by Jan L. Harrington, an imprint of Elsevier

**Paper-III (Practical) : 100 Marks****Group A: Word processing, Document Preparation & Presentation and Spreadsheet (24 Periods)****Group B: Programming in C****(48 Periods)**

*Basic Structure:* Character set, keywords, identifiers, constants, variables and type declaration, preprocessor.

*Operators:* Arithmetic, relational, logical, Assignment, Increment and Decrement, ternary, comma, casting; operator precedence and associativity; type conversion, character I/O, Escape sequence and formatted I/O.

*Control Structure:* if, if-else, switch case, break, continue.

*Loop Structure:* for, while, do-while.

*Arrays:* One-dimensional and two-dimensional, Different types of uses. String handling: concatenation, copy, comparison, string functions.

*User defined functions:* prototype, needs; argument passing; return value and types, recursion.

*Structures:* Initialization; arrays of a structure, arrays within structures, nested structure, size of structures.

*Pointers:* Declaration and initialization; operators; pointer arithmetic, accessing variables, pointer & arrays, strings, dynamic storage allocation.

**Group C: Database Design and Applications****(48 Periods)**

The student should be familiar with at least one standard commercial RDBMS software under desktop or multiuser environment. Topic of works should include :

*SQL:* creation and modification of databases, insert, delete, update operations, creating view, queries, nested queries, aggregate function.

*Validation:* Correctness, Integrity.



*Distribution of Questions :*

|   |          |
|---|----------|
| Group A: One question to be answered out of three | 10 marks |
| Group B: One question to be answered out of five  | 30 Marks |
| Group C: One question to be answered out of four  | 30 marks |
| Viva: 20 marks                                    |          |
| Sessional: 10 marks                               |          |

*Duration of Examination – 6 hours*

Note : Problems to be assigned to a student by drawing lots in a manner similar to that followed in other practical examinations. The sessional work must be submitted in a word processed version with computer printout of problems, algorithms, listings, output, discussions, graphs, charts, figures, Handwritten output will not be accepted under any circumstances.

Questions will not be package/product specific.

**Text Books:**

1. Special Edition using Microsoft Office 2003 by Ed Bott & Woody Leonhard, Amazon Publication.
2. Office 2007 all-in-one Desk Reference for Dummies by P. Weverka, Amazon Publication.
3. C programming essentials by K. N. Dey and S. K. Bandyapadhyay, Pearson Education.
4. Programming in C by E Balagurusamy, TMH
5. Let us C by Y. Kanetkar, BPB Publication
6. Teach Yourself SQL & PL/SQL using Oracle 8i & 9i by Ivan Bayross, BPB Publication.

### **Part III**

#### **Paper IV : 100 Marks (Theoretical 50, Practical 50)**

#### **Group A (Theoretical) Full Marks : 50**

#### **Communication and Computer Networks**

**(60 Periods)**

*Communication Concepts:* Analog and Digital communication – basic concept and comparison. Signal types frequency spectrum, strength, bandwidth, data rate, channel capacity. S/N ratio, modulation and demodulation FSK, ASK.

*Transmission media (brief idea, characteristics, comparison) :* Guided (twisted pair, co-axial, optical fiber) and unguided (microwave, satellite-geo synchronous and low-orbit, VSAT).

*Audio and Video communication systems :* Analog and digital telephone, AM & FM radio, cable TV network, ISDN, paging, cordless and cellular phones, ATM.

*Computer Networks :* Distributed processing and resource sharing concepts. Classes – LAN, MAN, WAN

*Architecture – OSI , TCP/IP and http protocol – brief study.* Basic idea of protocols, routing, congestion control.

*LAN :* Ethernet and Token Ring topology (principle of operation, characteristics, comparison). High speed LANs Internetworking Modems, bridges and routers, connectivity concepts. Network security.

*The Internet :* basic idea, DNS and URL, IP address, browsers

*E-mail :* Architecture and services.

*Distribution of questions :*

Q1. (Compulsory – 10 marks, any five questions to be answered out of eight, each carrying 02 marks)

Q2 to Q9. Any five questions to be answered out of eight, each carrying 08 marks.

Questions may have smaller subdivisions.

**Text Books :**

1. Data Communications and Networking by Behrouz A. Forouzan, 2<sup>nd</sup> or 4<sup>th</sup> Edition, TMH
2. Data and Computer communication by William Stallings, 6<sup>th</sup> Edition, Pearson Education
3. Computer Networks by Tanenbaum, Pearson Education



**Group B (Practical) Full Marks – 50**

**Group B1 & B2 together constitute Group B.**

**Group B1: Unix / Linux and Shell Programming**

**( 36 periods)**

*Files & Directories* : Copy, delete, rename, compare files, create, navigate, remove directories, access vi editor, status of users, background jobs; Pipes & filters; cut, paste and sort , pattern searching in a string, Other internal and external commands.

*Shell Programming* : Concept and simple programming problems.

**Group B2 : Programming in Visual Basic**

**( 36 periods)**

Students should learn about programming on the following topics using one of the two languages, primarily through practical sessions, along with theoretical classes in between.

Basic Features; building objects with classes, operations with objects, class libraries. Multitasking and multithreading applications; software design involving forms, objects, events, functions, procedure and methods (32 bit programming). ODBC driver; Front and development for database. MFC based multimedia applications.

*Distribution of questions:*

|   |          |
|---|----------|
| Group B1: One question to be answered out of four | 20 marks |
| Group B2: One question to be answered out of four | 10 marks |

Sessional Work – 10 marks, Viva-voce – 10 marks

*Duration of Examination – 4 hours*

Note : Problems to be assigned to a student by drawing lots in a manner similar to that followed in other practical examinations. The sessional work must be submitted in a word processed version with computer printout of problems, algorithms, listings, output, discussions, graphs, charts, figures, Handwritten output will not be accepted under any circumstances.

Question will not be package/product specific.

**Text Books :**

1. Your Unix The Ultimate guide by Sumitabha Das, McGraw Hill
2. Unix Shell Programming by Y Kanetkar
3. Microsoft Visual Basic 2008 Step by Step, Michael Halvorson, Microsoft Press
4. Simply Visual Basic 2008, Paul Deitel, H.M Deitel, and G. J. Ayer, Prentice Hall
5. Mastering Microsoft Visual Basic 2008, Evangelos Petroustos, Sybex Publisher
6. Visual Basic 6 by Prasenjit Sinha, S Chand Publication.