### Computer Science Honours Course

#### Course Structure

<table>
<thead>
<tr>
<th>Paper</th>
<th>Type/Marks</th>
<th>Group</th>
<th>Title</th>
<th>Periods</th>
</tr>
</thead>
</table>
| **Part-I**
| I | Theoretical 100 | A | Computer Fundamentals | 35 |
| | | B | Introduction to Basic Electronics | 35 |
| | | C | Digital System Design | 35 |
| | | D | Computer Organization-I | 45 |
| II | Theoretical 50 | A | Section-I : System Software-I | 10 |
| | | | Data Structure-I | 25 |
| | | B | Section-II : Programming through C Language | 40 |
| | | | Hardware | |
| **Part-II**
| III | Theoretical 100 | A | Graph Theory | 30 |
| | | B | Discrete Mathematical Structures | 45 |
| | | C | Numerical and Optimization Techniques | 45 |
| | | D | Formal Languages and Automata Theory | 30 |
| IV | Theoretical 50 | A | Section-I : Data Structure-II | 30 |
| | | B | Section-II : System Software-II | 45 |
| | | | Software : Operating System, PC Software, C Language | |
| **Part-III**
| V | Theoretical 100 | A | Microprocessor | 45 |
| | | B | Computer Organization-II | 45 |
| | | C | Data Communication & Computer Network | 40 |
| | | | Internet Technology | 20 |
| VI | Theoretical 100 | A | Object-Oriented Programming | 30 |
| | | B | Software Engineering | 30 |
| | | C | Computer Graphics | 30 |
| | | D | Database Management System | 60 |
| VII | Practical 100 | A | Hardware : Microprocessor Programming & I/O Interfacing | |
| | | B | Project | |
| VIII | Practical 100 | A | Object-Oriented Programming | |
| | | B | RDBMS | |
| | | C | Shell Programming | |
PART – I  PAPER – I (THEORETICAL) : 100 Marks

**Group A: Computer Fundamentals**  
(35 Periods)

*Introduction to Computer and Problem Solving: Information and Data.*
Hardware: CPU, Primary and Secondary storage, I/O devices, Bus structure
Software: Systems and Application.
Introduction to Programming Languages: Machine Language, Assembly Language, High Level Language.
Problem Solving: Flow Charts, Decision Tables and Pseudocodes.

*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; Single Error-Detecting and Correcting Codes, Hamming Codes.

*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, Truthtable and minimization of switching function upto four variables, Algebraic and K-map method of Logic circuit synthesis: Two level and Multi level.

**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.

*Elementary Physics of semi-conductors:*
Intrinsic and Extrinsic semiconductors, P & N type, Diode & its applications: P-N Junction diodes, Biasing of a junction diode, Depletion region & its effect, Zener diodes & its applications, Diode as a rectifier, Types of diodes, LED, LCD. 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 & -parameters of Transistor, Biasing of a transistor : Q point, load line, Self-bias, fixed bias & collector to base bias.

*Amplifiers:*
Concepts, Class A & B.
Inverters using Transistors–transfer characteristics and threshold voltages. Switching characteristics of diodes and transistors-SCR & UJT.
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.
Principle of Multivibrators, Applications of Multi-vibrators – Monostable and Astable Multivibrators
Principle of differential amplifiers, CMRR of differential amplifiers, Properties of Ideal OP-AMP, Concept of virtual ground, Offset parameters and its uses as an inverting, non-inverting amplifiers, adder/subtractor/multiplier/divider, differentiator, integrator and scale changer, Schmitt trigger.

**Group C : Digital System Design**  
(35 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 & bit), 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: function realization, Demultiplexer and function realization, Encoder, Priority Encoder, Parity bit Generator/checker, Gray Code Generator, Code Converters, Keyboard encoder, Seven segment display unit, Comparators.

*Sequential Circuits:*
**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. SSI, MSI, LSI, and VLSI classifications.

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

*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. CISC & RISC processors.


*Memory*: Types of Memory, RAM, ROM, EPROM, DRAM, SRAM, SAM, PLA, Associative memory. Different storage technology. I/O system organization and interfacing, Bus: SCSI, PCI, USB; Tri State Devices, Bus Arbitration.

**Distribution of questions/Marks:**

Q1. (Compulsory short questions – 20 marks). Five questions to be answered from the rest 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. Introduction to Computer Science, by P.K.Sinha (PHI)
3. Digital Logic and Computer Design by M.Morris Mano, PHI
4. Digital Principle and Applications by Malvino & Leach, TMH
6. Digital Fundamentals by Floyd, Pearson Education
8. Computer System Architecture by M. Morris Mano
10. Electronics Devices and Circuit Theory by Boylestad, Nashelsky, PHI

**PAPER – II : 100 MARKS**

**Group – A(THEORETICAL) : 50 Marks**

**Section – I : System Software-I**


*Data Structure-I*

Definition: Concepts of Data Types, Elementary structures, Data types and their interpretation

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

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


*Recursion*: Divide and Conquer, Elimination of Recursion.

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

*Introduction*: Basic Structure, Character sets, Keywords, Identifiers, Constants, Variables, Data Types, Program Structure.
Operators: Arithmetic, Relational, Logical and Assignment; Increment, Decrement and Conditional, Operator Precedence and Associations; Expressions. Expression evaluation and type conversion. Formatted input and output.


Pointers: Declaration and initialization, Accessing variables through pointer arithmetic, Pointers and arrays, String, Pointer to Functions and Structures.


Low-Level Programming.

Distribution of Questions/Marks:
Q1. (Compulsory Short questions – 8 marks). Three questions to be answered from the rest which consists of at least 5 questions (All questions are of 14 marks: questions may have subdivisions. At least one question to be answered from each section).

Text Books:
1. System Programming by John J. Donovan, TMH
4. Data Structure by Liptsutz, 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
8. C Programming by Karnighan,&Ritchie, PHI
9. Programming through C by Richard Johnsonbaugh and Martin Kalin, Pearson Education
10. A Book on C by Kelley and Pohl, Pearson Education

Group-B(Practical) Hardware Laboratory: 50 Marks

Marks Allotment:
- Sessional - 05 marks
- Experiment - 35 marks
- Viva-voce - 10 marks

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 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 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:
Combination 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 of two level AND – OR, NAND –NAND, NOR-NOR circuits to realize any truth table. Realize XOR in two level and multilevel.
3) Design a 4 bit 2’s complement adder – subtractor unit using 7483 or equivalent and XOR gates.
4) Design a circuit to convert BCD numbers to corresponding gray codes.
5) Design a 4:1 MUX using NAND gates. Study of 74153 and 74151. Design Full Adder/Subtractor using MUX.
7) Design a parity generator/checker using basic gates.
8) Design magnitude comparator using basic/universal gates. Study of 7485.
9) 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) Design a shift register (shift left and shift right) using flip-flops. (Study the functional characteristic of IC 74194 with emphasis on timing diagram).
3) Design Asynchronous and Synchronous counters. Study of IC 74193.
4) Study the functional characteristics of RAM IC chip. Study of open collector and tri-state output. Horizontal and vertical expansion of RAM chips by cascading. Use 74189, 7489, 2114 or any available chip.

Part-II Paper – III (Theoretical) : 100 MARKS

Group – A : Graph Theory
Graphs : Definition, Finite and Infinite Graphs, Directed and Undirected Graphs, Degree, Isolated vertex, Pendant vertex, Null graphs.
Walks : Paths and Circuits, Connected and Disconnected graphs, Euler’s graphs, Hamiltonian paths and circuits, Trees, Definition and basic properties, Distance and contents, Matrix representation of graphs, Incidence, Adjacency and Circuit matrices, Graph Search – BFS, DFS, Spanning Trees, Shortest Path Problems.

Group – B : Discrete Mathematical Structures
Logic : Proposition, Predicates and Quantifiers. Sets, Functions, Growth of Functions, Relation, Equivalence Relation : Big O Notation, Big Omega and Big-Theta Notations.
Introduction to Probability: Definition of sample space, events, probability, simple problems, Conditional Probability, Probability distribution – Binomial Distribution (significance only), Random variable, expected value, Standard Deviations and Variance;

Group – C : Numerical and Optimization Techniques
Errors : Concepts, types of errors
Nonlinear Equation: Iterative Methods and different types convergence, divergences and its test conditions, Bisection algorithm, Regular-falsi method, Secant and Newton-Raphson method, Problems and its graphical significances.
Interpolation : Newton Forward and Backward interpolation, Lagrange interpolation
Curve Fitting: Linear, Quadratic, fittings.
Integration: Mathematical Foundation for Trapezoidal and Simpson’s 1/3rd Rules and its Composite forms.
Linear Programming: Linear Programming, Simplex Method, Duality, Transportation, Assignment problems.

Group – D : Formal Languages and Automata Theory

Department of Computer Science
West Bengal State University, Barasat
Introduction to Formal Languages and Grammar, Finite Automata, Regular Expressions, Deterministic and Non-Deterministic finite automata and their equivalence. State minimization, Chomsky Classification of Grammars, Concepts of Turing Machines and Universal Turing Machines.

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. Graph Theory by Narsingh Deo, PHI
2. Introduction to Graph Theory by D B West, 2nd edition, Pearson Education
4. Discrete Mathematics by C.L.Liu, TMH
7. Operations Research by Kanti Swarup, P.K. Gupta, Sultan Chand & Sons
9. Switching and Finite Automata Theory by Kohavi, TMH

Paper-IV : 100 Marks

Group-A(Theoretical) : 50 Marks

Section – I : Data Structures-II
(30 Periods)
Trees : Definition, 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 : Definition, Searching, Insertion, Deletion.
Searching: Linear and binary search, Performance and complexity.
Hashing : Concepts, Advantages and Disadvantages, Different types of hash functions, Collision and Collision Resolution Techniques – Open Addressing with probing, Linear Chaining, Coalesced Chaining, Application.

Section-II: Systems Software –II
(45 Periods)
Processor Management : Scheduling and its types, Priority Queue.
I/O Management : Device and Device Controllers, Interrupt Handlers and Device drivers.
Memory Management : Real & Virtual memory, Swapping, Paging, Segmentation, Page Replacement Techniques.
Dead Lock : Definition, Prevention, Avoidance, Detection, Recovery.
Case Study : Standard OS.

Distribution of Questions/Marks:
Q1. (Compulsory Short questions – 8 marks). Three questions to be answered from the rest which consists of at least 5 questions (All questions are of 14 marks: questions may have subdivisions. At least one question to be answered from each section).

Text Books :

Department of Computer Science
West Bengal State University, Barasat
3. References of Data Structure is given previously

Group – B(Practical) Software Laboratory : 50 marks

Section – I (Lab Periods – 5)
Familiarity with single user and multi user operating systems.
Internal and External Commands. File name and extension, Batch File creation, Command Line Arguments, System Configuration.
Menus, Folders, Program Manager, File Creation, View and sort files, Document Preparation and Presentation.
Files and Directories, Copy, Delete, Rename Directory, Creation, Navigation, Editor, Pipes and Filters, Pattern searching.

Section-II
Programming through ‘C’ Language (Lab Periods – 35)
Problems should cover basic features of the Language; Applications including numerical problems, Data Structure, Graph representation and manipulation.

Distribution of Marks:
Section I - one question to be answered
Section II - do-
Marks Allotment : Section I - 5 marks
Section II - 30 marks
Sessional - 05 marks
Viva-voce - 10 marks

Part – III -Paper – V (Theoretical) : 100 Marks

Group – A : Microprocessor and Computer Organization – II


Computer Organization – II:
Fixed and Floating Point Arithmetic : Addition, Subtraction, Multiplication and Division.
ALU – Combinational ALU, 2’s Complement Addition, Subtraction Unit
Memory Hierarchy: CPU Register, Cache Memory, Primary Memory, Secondary Memory and Virtual Memory.
Control Unit : Control Structure and Behaviour, Hardwired Control and Micro programmed Control : Basic Concept, Parallelism in Microinstruction.
Computer Peripherals – VDU, Keyboard, Mouse, Printer, Scanner etc.

Group B : Data Communication and Computer Network (40 Periods)

Group – C : Internet Technologies (20 Periods)

Department of Computer Science
West Bengal State University, Barasat
Intranet and Internet; Servers and Clients; Ports; Domain Name Server (DNS); Accounts, Internet Service Providers; Connections : Dial Up, ISDN, ADSDN; Cable, Modem; E-Mail: Account, Sending, Receiving, Mailing List, IRC, Voice and Video Conferencing, WWW, Browsers.

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 :
2. Computer System Architecture by M. Morris Mano
4. Introduction to Microprocessor by Gonakar, PHI
5. Introduction to Microprocessor by Ajit Pal, PHI
8. 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)

Group – C : Computer Graphics
(30 Periods)

Group – D : Data Base Management System
(60 Periods)
Case Studies : Any Commercial RDBMS Package.

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

Department of Computer Science
West Bengal State University, Barasat
Paper – VII (Practical) : 100 MARKS

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

Experiment with 8085A based micro computing kits (50 Marks)
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.

Group – B : Project Work (50 Marks)

Marks Allotment :

<table>
<thead>
<tr>
<th>Component</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Report</td>
<td>08</td>
</tr>
<tr>
<td>Presentation</td>
<td>07</td>
</tr>
<tr>
<td>Project Work</td>
<td>25</td>
</tr>
<tr>
<td>Viva-voce</td>
<td>10</td>
</tr>
</tbody>
</table>

Guidelines : Each student of B.Sc Part II (Computer Science Honours) will carry out one project work under the supervision of a faculty member of the college. The project will be assigned at the beginning of Part II academic session. The student will submit a project report representing the actual work in a suitable format. The student should defend the project before the examiners. The project work will be evaluated on the basis of presentation and viva-voce examination. The examination will be as per University guidelines.

Project Report should contain the following:
1) Title of the Project
2) Objectives of the Project
3) Analysis Report in a suitable format
4) Detailed Design steps
5) Circuit Layout/Program Listing
6) Testing and Analysis
7) Conclusion and future scope for development
8) Bibliography


Project Evaluation:

Department of Computer Science
West Bengal State University, Barasat
Projects (Paper-VII, Group-B, Full Marks-50) for B.Sc(Hons) Part-II Examination are to be evaluated internally by the college itself in the presence of the project guide.

### Paper – VIII (Practical) : 100 Marks

<table>
<thead>
<tr>
<th>Marks Allotment</th>
<th>Sessional</th>
<th>10 marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viva-voce</td>
<td>20 marks</td>
<td></td>
</tr>
<tr>
<td>Experiment</td>
<td>70 marks</td>
<td></td>
</tr>
</tbody>
</table>

**Group-A : Object Oriented Programming**  
**Language :** C++  
**Problems :** Problem set should cover the basic features of the language and implementation of different algorithms covered in theoretical papers.

**Group-B : RDBMS**  
**RDBMS :** standard database  
**Front Ends :** standard font end.  
**Problems :** Application Database with GUI.

**Group C : Shell Programming**  
**Platform :** UNIX/LINUX  
**Problems :** Problem set should cover the basic features of shell programming.
Computer Science General

SUMMARY OF PERIOD DISTRIBUTION : Total Marks : 400

<table>
<thead>
<tr>
<th>Paper (F.M)</th>
<th>Group (F.M)</th>
<th>Type</th>
<th>Minimum Number of Periods</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Theoretical(T) Practical(P)</td>
</tr>
<tr>
<td>*COURSE WORK FOR PART-I EXAMINATION</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I(100)</td>
<td>*</td>
<td>T</td>
<td>120</td>
</tr>
<tr>
<td>*COURSE WORK FOR PART-II EXAMINATION</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II(100)</td>
<td>*</td>
<td>P</td>
<td>35</td>
</tr>
<tr>
<td>III(100)</td>
<td>A(50)</td>
<td>T</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>B(50)</td>
<td>P</td>
<td>10</td>
</tr>
<tr>
<td>*COURSE WORK FOR PART-III EXAMINATION</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV(100)</td>
<td>A(50)</td>
<td>T</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>B(50)</td>
<td>P</td>
<td>10</td>
</tr>
</tbody>
</table>

* Shown within the syllabus; T-Theoretical, P-Practical F.M-Full Marks
Note: Figures within( ) below indicate number of periods allotted for that topic.

Part – I Paper I (Theoretical) : 100 Marks

Distribution of Questions : Q1. (Compulsory – 20 marks, any ten questions to be answered out of fifteen, each carrying 02 marks). No. of questions (Group) : 02(A), 05(B), 06(C), 02(D) Q2 to Q9. Five questions to be answered out of eight as given below : Group A & B combined : any two – from three questions of 16 marks each with emphasis on Gr. B Group C : Any two – from three questions of 16 marks each. Group D : Any one – from two questions of 16 marks each All questions may have smaller subdivisions.

Group A : General Concepts (15 Periods)
Information : Definition, Categories, Data : Storage, Retrieval and Processing.
Software : Classification System and application; Stored Program Concept and Von-Neumann Architecture; Evolution : types – supercomputers, mainframes, minis and workstations, PC’s, Parallel Machines.
Computer Languages : Types – low level, Assembly, High Level
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 Languages : Basic characteristics, brief comparison with other types of languages.

Group B : Algorithms & Data Structure : Brief Introduction (35 Periods)
Algorithms and Problem Solving : Flowchart; algorithm definition and characteristics; structured form sequence; selection and iteration; recursive and non-recursive algorithms. Writing algorithms – use of pseudo language, structured constructs, indentation and comments. Efficiency – O notation (definition, basic properties and use)

Data Structures : Data types and structures – definition. Concept of sequential and linked allocation. Simple Structures (concept and implementation) : Array, Stack, Queue, Binary Tree.

Brief Study on Algorithms; linear search, binary search, bubble sort, quick sort, merge sort, heap sort.

Group C : Computer Architecture and Organization (50 Periods)
Basic Building Blocks** : Combinational Logic – Boolean Algebra; AND, OR, NAND, NOR, XOR gates; adder, multiplexer, demultiplexer/decoder, encoder-sequential logic; flip-flops, registers, counters (synchronous & asynchronous) (**only conceptual study with block diagram and truth/state table)
**Computer Arithmetic and ALU**: Positional number system and conversion – base 2, 8, 10, 16 Bits and Bytes: use in arithmetic, storage capacity, data transmission, alphanumeric codes (ASCII, EBCDIC).

**Integer Representation**: Unsigned, signed magnitude, 1’s complement, 2’s complement, biased, floating point representation – single and double precision IEEE format. Algorithms for integer and floating point addition, multiplication/division; range, precision and accuracy. Basic structure of an ALU.

**CPU**: Addressing modes, instruction formats. Handling of interrupts and subroutines, Instruction pipelining, CISC and RISC processor.

**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. Concept of interfacing. Devices; VDU, mouse, keyboard, joystick, scanner printers-DMP, LASER, ink jet, line/matrix.

**Memory**: Memory devices – static and dynamic RAM, ROM, cache; secondary memory (floppy disc, hard disc, tape, CD ROM, DVD); large memory using chips.

(*brief description of basic characteristics, principle of operation related parameters, nomenclature and comparative study where applicable)

**Elements of Computer Networks**: Centralized and Distributed Processing LAN and WAN. Media Telephone lines, coaxial cables, optical fiber, satellite; VSAT; Basic components – LAN card, Modem; TCP/IP protocol. Concept of E-mail and Internet.

**Group D : Brief Studies on OS**

OS types (single user, multi user, multitasking): Brief idea on resource management concepts.

GUI and Window: Basic idea. Case Study (latest version of OS).(#) : characteristics, advantages and limitations, shell, memory management, file and directory system (I/O).

**Text Books**:
1. Introduction to Computer Science by P.K.Sinha
3. Computer System Architecture by M. Morris Mano
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

**Part - II Paper II (Practical) : 100 Marks**

**Distribution of questions**: Group A : One question to be answered 10 marks. Group B : One question to be answered 10 marks. Group C : One question to be answered 40 marks. Sessional Work – 20 marks; Viva-voce – 20 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.

**Group A : Operating System**

(Theoretical – 8 periods. Minimum Laboratory work – 20 periods in total)
Booting, warm and cold reboot, internal and external commands; file name and extensions; wild card notation. Commands; directory, file management, disc management, general. Disc Organization: sectors, boot records, partitioning, FAT. Redirection, pipes. EDIT; Copy Con-batch file creation commands, command line arguments, loop structures, nested, config.sys, utilities.
Starting menus, simultaneous use, reduction/enlargement, folders, starting an application, running one or more application, help, exit.

**Program manager**: Move, Copy, Delete items/folders, changing attributes.

**File Manager**: Expansion of compressed files, management of multiple folders, creation/renameing; view and sort files, browse, identify and save settings, disc operations.

Department of Computer Science
West Bengal State University, Barasat
Group B: Wordprocessing, Document Preparation & Presentation and Spreadsheet
(Theoretical – 02 periods, Minimum Laboratory Work – 20 periods)

**WORDPROCESSING**: Opening, creating, saving, quitting documents. Using menus and toolbars.

**Text**: Copy, delete, move, spell check; Character & page formatting; size, font, header, footer, bordering, coloring, margins and justification, graph, text

**Picture**: Creation, Editing and import, Printing. Use of other available features.

**DOCUMENT PREPARATION & PRESENTATION**: Slide Preparation, Adding Special Effects, Adding Picture, Animation, Time Control, Slide Show.

**SPREADSHEET**: Data Entry, Moving data, range selection, use of toolbars and menus: editing; calculation and use of formula, display, print. Graphs and Charts: formatting facilities for presentation (e.g. changing fonts, colours, sizes, adding titles, legends, gridlines).

**Macros**: Creation, running shortcut.

Group C: Programming in C (Theoretical 25 periods, Minimum Laboratory work – 80 periods)

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

**Operators**: Arithmetic, Relational, Logical, Assignment, Increment and Decrement, Conditional, comma; operator precedence and associativity; arithmetic expression-evaluation and type conversion. Character I/O, Escape sequence and formatted I/O.

**Branching and Looping**: if, if-else, while, do-while, for.

**Arrays**: One-dimensional and 2-dimensional. Different types of uses. String handling with arrays – read and write, concatenation, comparison, string functions.

**User defined functions**: Need; Call by Reference and Call by value; return values and types; nesting of functions; recursion.

**Structures**: Initialization; arrays of a structure, arrays within structures, structure within structure, size of structures, Dynamic Storage Allocation.

**Pointers**: Declaration and initialization; operators; pointer arithmetics; accessing variables, pointer & arrays, strings, functions, Linked lists, concepts and use in C with different examples.

**File handling**: Opening & Closing, I/O.

**Other Features** – bit level operations, macro definitions, union, command line arguments.

---

Paper III: Full Marks – 100 (Theoretical-50, Practical-50)

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

**Groups A1 & A2 together constitute Group A**

**Distribution of questions**:

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

No. of questions (Group) : 02(A1), 06(A2)

Q2 to Q9. Five questions to be answered out of eight as given below :

**Group A1 (any one – from two questions of 08 marks each)**

**Group A2 (any four – from six questions of 08 marks each)**

Questions may have smaller subdivisions.

---

**Group A1 : System Analysis and Design**

(20 Periods)

**Introduction**: System definition, characteristics; real-time and distributed systems.

**System Life Cycle**: Waterfall model, description of different phases.

**Planning**: Data gathering techniques; feasibility study. Cost-benefit analysis
**Design and Modelling**: Logical and physical design; flowcharts and structured charts; DFD and ERD. Form design, User interface design

**Modularity**: Module specification concepts; coupling and cohesion

**Maintenance**: Evaluation, testing and validation. Maintenance issues

**Case Study**: Accounting and Finance System, Personnel system

**Group A2 : Database Management**

**(40 Periods)**

**Overview**: Files and database. Data independence. 3-level DBMS architecture, Data Dictionary, Database Languages

**Traditional Models**: Network, Hierarchical and Relational. Comparison

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

**Relational Algebra**: Operations – select, project, cross product, join, set.

**Relational Calculus**: Concept of tuple and Domain Calculus.

**Query Language**: SQL – basic concepts, Transaction Processing

**Design**: ER diagram to relational scheme; Normalization (upto 3NF)

**File Organizations**: Hashed, Sequential, heap, indexed sequential B-Tree.

**Related topics**: Concurrency and recovery; security and integrity.

**Current trends in databases**: Distributed, Client-Server, Object oriented

**Text Books**:

2. Introduction to System Analysis and Design by Igor Hawryszkiewycz, PHI
3. Database System Design by Elmasri, Navathe, Somayajulu, Gupta, Pearson Education
5. An Introduction to Database Systems by C.J. Date, A.Kannan, S.Swamynathan, Pearson Education

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

Groups B1 & B2 together constitute Group B

**Distribution of questions**:

Group B1 : One question to be answered out of four  
Group B2 : One question to be answered out of four  
Sessional Work – 10 marks; Viva-voce – 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. Question will not be package/product specific.

**Group B1 : Database Design and Applications**

*(Minimum Laboratory Periods – 70)*

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

**Database Design**: Data types, creating databases, adding records, edit, browse, delete, save.

**Application Design**: Menu and screen design; data validation; report design and generation; use of GUI facilities.

**SQL**: Constructs; insert, delete, update, view, temporary tables; nested queries, API types of call, native API, ODBC.

**Trouble shooting**: Validation, correctness, integrity, Performance tuning and documentation.

**Group B2 : Assembly and Troubleshooting of PCs**

*(Theoretical 10 periods, Minimum Laboratory Work – 40 periods)*

Department of Computer Science
West Bengal State University, Barasat
Theoretical:
PC Organization
Overview of Intel 16-bit, 32-bit/latest processor
(Block Diagram, bus width, clock speed, real and virtual memory, performance parameters)

Laboratory Work:

Students should get appropriate ideas reg the following : assembling a PC, upgradation of a PC, installation of different softwares, running diagnostic software for performance tuning and related topics.

Experiments (the following topics should at least be covered):

1. Assemble a PC with a given configuration
2. Upgrade processor, RAM, SMPS, Operating System
3. Install mouse, keyboard, printer
4. Servicing problems : HDD – not booting from it, formatting, partitioning, virus removal, changing
5. FDD : Head alignment, seek error, sector not found
6. Power Supply problem
7. VDU problems
8. Networking problems including installation of LAN card
9. Install TV; tuner card, MPEG card, multimedia components
10. ROM location error
11. RAM : general protection error.

Part – III Paper IV Full Marks: 100(Theoretical 50, Practical 50)

Group A (Theoretical) Full Marks : 50

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.

Group A : 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.


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

E-mail : Architecture and services

Text Books :
3. Computer Networks by Tanenbaum, Pearson Education

Group B (Practical) Full Marks – 50 Group B1 & B2 together constitute Group B.

Department of Computer Science
West Bengal State University, Barasat
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 – 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.

Question will not be package/product specific.

Group B1: Shell Programming (Minimum Laboratory Work 50 periods)

Files & Directories: Copy, delete, rename, compare files, create, navigate, remove directories, access vi editor, status of users, background jobs; Pipes & filters; cutting, pastings and sorting of files, pattern searching in a string.

Shell Programming: Concept and simple programming problems. Unix/Linux system administration-creation and maintenance of accounts, super user, disk management, backups, X-windows.


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. Multimedia applications.
ADDITIONAL INFORMATION

EQUIPMENT, COMPONENT & SOFTWARE

i. Computing System (minimum configuration)

PC with Pentium MMX colour monitor, keyboard, mouse, multimedia cards, speaker; Peripheral : at least DMP. Add-ons (expected) : LAN facility, with proper OS.

Minimum number of units : 1 per batch of 2 students.

# : As any particular package has not been specified in the syllabus, any other standard package may be used. At any point of time the latest version available is recommended.

ii. Other equipment and components

1. (a) Logic probes, Digital or Analog multimeter, soldering iron, Desoldering pump, wire cutter, screw driver set. (b) CRO (20 MHz or higher) storage type recommended.
4. System management and device installation software: Disk manager, installation CDROM, diagnostics – PC tools etc.