

The University of Burdwan
Syllabus for B.Sc. Honours
(1+1+1 Pattern)
in
Computer Science
with effect from 2014-2015

PART-I

PAPER-I (Theory, Full Marks: 100)

Group-A: Computer Fundamentals	[25L]
Programming Language	[25L]

Group-B: Graph Theory	[15L]
Algorithms and Data Structures	[35L]

PAPER-II (Theory & Practical, Full Marks: 100)

Group-A: (Theory, Full Marks: 50)	
Operating System	[50L]

Group-B: (Practical, Full Marks: 50)	
Programming Language and Data Structures	[50L]

PART-II

PAPER-III (Theory, Full Marks: 100)

Group-A: Digital Logic	[25L]
Computer Architecture and Organization	[25L]

Group-B: Object Oriented Programming (OOP)	[35L]
Numerical Methods	[15L]

PAPER-IV (Practical, Full Marks: 100)

Group-A: (Hardware Practical, Full Marks: 50)	
Digital Circuit Design	[50L]

Group B: (Software Practical, Full Marks: 50)	
Operating System Laboratory	
Object Oriented Programming (OOP) Laboratory	[50L]

PART-III

PAPER-V (Theory, Full Marks: 100)

Group-A: Formal Language and Language Translation [50L]

Group-B: Data Communication and Computer Network [50L]

PAPER-VI (Theory, Full Marks: 100)

Group-A: Software Engineering [50L]

Group-B: Data Base Management Systems (DBMS) [50L]

PAPER-VII (Theory & Practical, Full Marks: 100)

Group-A: (Theory, Full Marks: 50)
Microprocessor [50L]

Group B: (Practical, Full Marks: 50)
Microprocessor Programming Laboratory [50L]

PAPER-VIII(Practical, Full Marks: 100)

Group-A: (Full Marks: 50)
Relational DBMS (Oracle/SQL Server) Laboratory [50L]

Group-B: (Full Marks: 50)
Front-end Programming and Web Technology Laboratory [50L]

SYLLABUS FOR 3-YEAR (HONOURS) COURSE
IN
COMPUTER SCIENCE

PART – I

PAPER – I (Theory): 100 Marks

Group A:

Computer Fundamentals (25 L)

Introduction to Computer and Problem Solving: Information and Data.

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

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.

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, Minterms, Maxterms, 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.

Programming Language ('C' Language) (25 L)

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.

Statements: Assignment, Initialization, String handling with arrays, String handling functions, Functions – Arguments passing, Return values and their types, recursion. Enumerated data types. Structures. Arrays of structures. Arrays within structures.

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

File handlings: Opening, Closing, I/O operations.

Group B:

Graph Theory (15 L)

Graphs: Definition, Finite and Infinite Graphs, Directed and Undirected Graphs, Degree, Isolated vertex, Pendant vertex, Null graphs.

Walk: 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.

Algorithms & Data Structures (35 L)

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.

Stacks and Queues: Definition. Representation. Uses and Applications, Infix, Prefix & Postfix notations, Infix to postfix: conversion and evaluation. Application of queues.

Recursion: Divide and Conquer, Elimination of Recursion.

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.

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.

Ref. Books:

1. Digital Logic and Computer Design by M.Morris Mano, PHI
2. Digital Fundamentals by Floyd, Pearson Education
3. Computer Architecture and Organizations 2nd Edition, J. P. Hayes, TMH
4. Computer System Architecture by M. Morris Mano
5. Data Structure by Liptsuitz, S. Outline Series
6. Data Structure by Ellis Horowitz, Sartaz Sahani, Galgotia
7. Data Structures and Algorithm Analysis in C by Mark Allen Weiss, 2nd Edition, Pearson Education
8. C Programming by Karnighan,&Ritchie, PHI
9. Programming through C by Richard Johnsonbaugh and Martin Kalin, Pearson Education
10. Graph Theory by Narsingh Deo, PHI
11. Introduction to Graph Theory by D B West, 2nd edition, Pearson Education

PAPER – II:100 MARKS

Group – A (Theory): 50 Marks

Operating System

(50 L)

Introduction: Different System Softwares: A brief of Operating Systems, Assemblers, Loaders, Linkers, Interpreters, Compilers, various phases of compilation.

Operating Systems: Definition, Multiprogramming, Multitasking OS, Concepts of processes, Files, Shell, System Calls; Structures: Monolithic, Layered, Virtual, Client Server and Distributed Model.

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

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.

File Systems: Files and Directories, File Servers, Security and Protection.

Dead Lock: Definition, Prevention, Avoidance, Detection, Recovery.

Case Study: DOS, UNIX, WINDOWS.

Group-B: (Practical, Full Marks: 50)

Programming should be developed using C Language and Data Structures.

Ref. Books:

1. Operating System Concepts, A. Silberschatz, Peter B. Galvin, G. Gagne, 6th Edition, John Wiley Sons, Inc.
2. Operating Systems by H.M.Deitel, 2nd Edition, Pearson Education

Part-II

Paper – III (Theory): 100 MARKS

Group – A :

Digital Logic

(25L)

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, De-multiplexer and function realization, Encoder, Priority Encoder, Parity bit Generator/checker, Gray Code Generator, Code Converters, Keyboard encoder, Seven segment display unit, Comparators.

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, Decade Counter, Mod – n Counter, Finite State machine Model – State Transition Diagram and Table, Synchronous Counters – different mod counters, Ring counter, Johnson’s Counter, Registers, Registers with parallel load, Shift Registers.

Computer Architecture and Organization

(25 L)

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 and RISC processors.

Instruction: Operation Code and Operand. Zero-, One-, Two- and Three-address instruction. Instruction types. Addressing modes. Stack organization.

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.

Group – B:

OBJECT ORIENTED PROGRAMMING(OOP)

(35 L)

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.

NUMERICAL METHODS

(15 L)

Errors: Concepts, types of errors

Finding roots of an equation by Bisection algorithm, Regular-falsi method, Secant and Newton-Raphson method, Problems and its graphical significances.

Solution of Differential Equation: Euler Method, Taylor Method, Runge-Kutta second and fourth order method for solving differential equations.

Interpolation: Newton Forward and Backward interpolation, Lagrange interpolation

Integration: Mathematical Foundation for Trapezoidal and Simpson’s $1/3^{\text{rd}}$ Rules and its Composite forms.

Ref. Books:

1. Digital Fundamentals by Floyd, Pearson Education
2. Computer Organization and Architecture by William Stallings, Pearson Education
3. Object Oriented Programming with C++ by Balagurusamy, TMH
4. Object Oriented Programming with C++ by Robert Lafore, PHI
5. Computer Architecture and Organizations 2nd Edition, J. P. Hayes, TMH
6. Computer System Architecture by M. Morris Mano
7. Computer Organization and Architecture by William Stallings, Pearson Education
8. Numerical Methods for Scientific and Engineering Computation by M.K.Jain, S.R.K.Iyengar
9. , R.K.Jain, 4th Edition, New Age International Publishers Computer Oriented Numerical Methods, 3rd Edition, V Rajaraman, PHI

Paper-IV: 100 Marks

Group-A (Practical): Hardware Practical F.M. 50 Marks

Digital Circuit Design

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 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.
- 6) Design a 2:4 decoder using NAND gates. Study of 74155 and 74138. Design Full Adder/Subtractor using decoders.
- 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.

Group – B : (Practical) Software Practical: F.M. 50

Familiarity with singleuser and multiuser operating systems.

DOS: Internal and External Commands. File name and extension, Batch File creation, Command Line Arguments, System Configuration.

WINDOWS: Menus, Folders, Program Manager, File Creation, View and sort files, Document Preparation and Presentation.

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

Object Oriented programming including numerical methods

Part – III

Paper – V (Theory): 100 Marks

Group – A:

Formal Languages and Language Translation

(50 L)

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 CFL, PDA, Turing Machines and Universal Turing Machines.

Group B: Data Communication and Computer Network (50 periods)

Data Communication and Computer Network

(35 Periods)

Data Communications; Transmission Media; Network : Protocol and standards; Analog & Digital Signals, Periodic & Non-periodic signals, Time and Frequency Domain; Multiplexing : FDM, TDM and Application, Encoding D/A and A/D Encoding; Error : Different types of Errors and their detection, Concepts of Centralized and Distributed Computing; Advantages of Networking; Layered Architecture : OSI Architecture, Basic Features, LAN, MAN and WAN; Simple PC based Network : Example, Block Diagram, Mode of Operation and Characteristic Features.

Internet Technologies

(15 Periods)

Intranet and Internet; Servers and Clients; TCP/IP model, Ports; Domain Name Server (DNS); IP addresses, Classes of IP address, IP addresses, Classes of IP address, IP addresses, Classes of IP address, IP routing, TCP segments, Accounts, Internet Service Providers; Connections: Dial Up, ISDN, ADSDN; Cable, Modem; E-Mail: Account, Sending, Receiving, Mailing List, IRC, Voice and Video Conferencing, WWW, web Browsers, web servers, Internet programming using HTML, HTML features.

Ref. Books:

1. Theory of Computer Science(Automata, Languages & Computation) by K L P Misra & NChandrasekharan, PHI
2. Data Communications and Networking by Behrouz A. Forouzan, 4th Edition, TMH
3. Data and Computer communication by William Stallings, 6th Edition, Pearson Education
4. Computer Networks by Tanenbaum, Pearson Education
5. Switching and Finite Automata Theory by Kohavi, TMH

Paper – VI (Theory): 100 Marks

Group – A: Software Engineering

(50 L)

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

Group – B: Data Base Management System (DBMS)

(50 L)

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), Introduction to Transaction processing ,Elementary Concepts of Security, Integrity. Case Studies: Any Commercial RDBMS Package.

Ref. Books:

1. Database System Design by Elmasri, Navathe, Somayajulu, Gupta, Pearson Education
2. Database Systems: Concept, Design and Application by S. K. Singh, Pearson Education, 1st Edition
3. An Introduction to Database Systems by C.J. Date, A.Kannan, S.Swamynathan, Pearson Education
4. Relational Database Design by Jan L. Harrington, an imprint of Elsevier
5. An Integrated Approach to Software Engineering by Pankaj Jalote, Narosa Publishing House
6. Introduction to System Analysis and Design by Igor Hawryszkiewicz, PHI

Paper – VII : Total:100 MARKS

Group – A : (Theory) Microprocessor

(50 L)

Microprocessor:

(50 L)

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, Interrupts, DMA, Bus Standards and types, Interfacing concepts- Memory Interfacing, I/O Interfacing and Ports – Keyboard Interfacing, Display Interfacing, Storage Device Interfacing, Programming a Microprocessor, Interrupt Handling, Methods of Interrupts, Priority and Management Case Studies : 8085 and 8086 microprocessor.

Group – B: Practical (50 Marks)

Microprocessor Programming Laboratory

(50 Marks)

Programs should be developed in 8085 assembly language.

- 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, etc.

Ref. Books:

1. Introduction to Microprocessor by Gonakar, PHI
2. Introduction to Microprocessor by Ajit Pal, PHI

Paper – VIII (Practical) : 100 Marks

Group-A: (FULL MARKS:50)

Relational DBMS(Oracle/SQL Server)Laboratory related to paper VI

Group-B: (FULL MARKS:50)

Front-end Programming and Internet Technology Laboratory related to paper V

1. of Elsevier

Addendum

Resolutions adopted in the workshop on revised syllabus of Computer Sc.(Hons.)

1. In B.Sc. Computer Science (hons) for computer fundamentals group of paper-1 , the book authored by P.K.Sinha is recommended for digital logic parts book authored by M. Mano is recommended. For algorithm & data structures part , algorithms should be written in pseudo codes. For algorithm & data structure part the book authored by Sahani and the book authored by Kanitkar are recommended. For programming language part emphasis is given on books authored by E. Balaguruswamy and Gottfried for graph theory part the book authored by N. Deo is recommended.

2. In B.Sc. Computer Science (hons) paper-II, in operating system part the book authored by Galvin is recommended. For system software part the book authored by J.J. Donovan (chapter 1 only) is recommended

3. In B.Sc. Computer Science (hons) for paper-III, for sequential circuit part the book authored by R.P Jain is recommended. For architecture & Organization part the book authored by M.M.Mano is recommended. For OOP part, the book authored by E. Balaguruswamy is recommended. For numerical method part, the book authored by Raja Raman and the book authored by S.A mollah is recommended.

4. In B.Sc. Computer Science (hons) paper-IV. For hardware practical the book authored by R P Jain, BPB Publication is recommended. For Software practical, the book authored by S. Das, for Unix is recommended.

5. In B.Sc. Computer Science (hons) paper-V. For group A , formal language and language translation part , the book authored by Woolman & Hoop croft is recommended. Data communication part, the book authored by A Forouzan , TMH is recommended. For internet technology, the book authored by D E comer Volume 1 is recommended.

6. In B.Sc. Computer Science (hons) paper-VI, for software engineering part, the book authored by Rajib Mall is recommended. For DBMS part , the book authored by Korth or the book authored by Navathe is recommended. For practical part, the book authored by Ivan Barros is recommended.

7. In B.Sc. Computer Science (hons) paper-VII, for microprocessor part, the book authored by R. Gaonkar, PHI is recommended. For practical experiments GNU Simu 85 should be used in linux environment.

8. In B.Sc. Computer Science (hons) paper-VIII, for front end programming any book of HTML may be used and for RDBMS part , the book authored by Ivan Bayross, SPD is recommended.