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 [50L]
          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.
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.
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.
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
4. Computer System Architecture by M. Morris Mano
5. Data Structure by Liptsiutz, S. Outline Series
6. Data Structure by Ellis Horowitz, Sartaz Sahani, Galgotia
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:**

**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.


Computer Architecture and Organization

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.


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)

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

Errors: Concepts, types of errors


Interpolation: Newton Forward and Backward interpolation, Lagrange interpolation

Integration: Mathematical Foundation for Trapezoidal and Simpson’s 1/3rd Rules and its Composite forms.

Ref. Books:
1. Digital Fundamentals by Floyd, Pearson Education
3. Object Oriented Programming with C++ by Balagurusamy, TMH
4. Object Oriented Programming with C++ by Robert Lafore, PHI
6. Computer System Architecture by M. Morris Mano

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.
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**

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**


**Internet Technologies**

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 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
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)

**Group – B: Data Base Management System (DBMS)**
(50 L)

Case Studies: Any Commercial RDBMS Package.

Ref. Books:
1. Database System Design by Elmasri, Navathe, Somayajulu, Gupta, Pearson Education
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
6. Introduction to System Analysis and Design by Igor Hawryszkiewycz, PHI

Paper – VII : Total:100 MARKS

**Group – A : (Theory) Microprocessor**
(50 L)

**Microprocessor:**
(50 L)

**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 & Hoopcroft 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.