

## Revised Syllabus

# PG Diploma in Computer Applications (PGDCA)



**Centre of Computer Education**  
**Institute of Professional Studies**  
**University of Allahabad**  
**Allahabad**

## POST GRADUATE DIPLOMA IN COMPUTER APPLICATIONS

### SEMESTER I

#### PAPER I: Computer Architecture and Organization

- 1. Computer Basics:** Types of computers, components of a digital computer- CPU, Memory- Primary and Secondary, I/O devices, Types of primary and secondary memories, Cache memory, Introduction to MS-Office-MS-word, MS-Excel and MS-PowerPoint.
- 2. Number Systems:** Binary, Decimal, Octal, Hexadecimal; Inter-conversions; Weighted & unweighted codes; Error Correction & detection; Error correcting codes; ASCII & EBCDIC codes.
- 3. Boolean Arithmetic & Theorem:** Mathematical logic; Truth Tables; Logic variables & logic functions; Logic expressions; Equivalent classes of logic functions; Boolean Algebra; Theorems of Boolean Algebra; Switching Algebra & functions; Disjunctive & conjunctive canonical forms; Transformations between these forms; Simplification of Boolean functions.
- 4. Logic gates & families:** AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR; TTL, ECL, CMOS logic families.
- 5. Analysis of combinational logic circuits:** Adder, Subtractor, Multiplier, Multiplexer, Demultiplexer, Decoder, Encoder, Parity Generator/ Checker, Etc.
- 6. Analysis of Sequential logic circuits:** Flip-Flops, Registers, Counters, Shift Registers, etc.
- 7. Minimization Techniques:** Karnaugh Map.
- 8. Basic Model of Stored Program Computer:** CPU Organization, Memory Organization, memory interleaving Cache Memory addressing techniques, I/O methods – direct and indirect, memory management techniques, Concept of virtual Memory.
- 9. Microprocessors:** Essential & Non-essential components; Comparative study of 8-bit microprocessors addressing modes, instruction set and its use.

#### REFERENCES:

1. Digital Logic & Computer Design: Mano, M.M.
2. Computer System Architecture-Mano, M.M.
3. P.K. Sinha and P. Sinha, "Foundations of Computing", BPB Publication
4. ITL Educational Society, "Introduction to IT", Pearson Education, 2009.
5. Miller M, "Absolute Beginners Guide to Computer Basics", Pearson Education, 2009
6. Mansfield Ron, "Working in Microsoft Office", 2008, Tata McGraw-Hill
7. Balagurusamy E, "Fundamentals of Computers", 2009, Tata McGraw-Hill

#### Paper II: Programming Paradigms

- 1. Introduction:** Characteristics of programming Languages, Factors influencing the evolution of programming language, Development in programming methodologies, desirable features and design issues.
- 2. Programming Language processors:** Structures and operations of translators, software simulated computer, syntax, semantics, structure, virtual computers, binding and binding time
- 3. Elementary and structured data type:** Data object variables, constants, data type, elementary data types, declaration, assignments and initialization, enumeration, characters, strings.
- 4. Structured data type and objects:** Specification of data structured types, vectors and arrays, records, variable size data structure, pointers and programmer constructed data structure, Set files.
- 5. Imperative Languages:** Block structure, Scope rules, Parameter Passing, Construct like co-routines, Tasks etc.
- 6. Object Oriented languages:** The class notion- Information hiding and data abstraction using classes, derived classes and inheritance- Polymorphism – Parameterized types.
- 7. Functional languages:** Functional programming concepts – Referential transparency – Types – Type systems – Names, bindings, environment and scope – Recursive functions – Polymorphic functions – Type variables – High order functions – Curried functions – Lists and programming with lists – Definition of new user defined types in ML – Abstract data types – Evaluation methods.
- 8. GUI Programming;** GUI vs CUI; Event Driven Programming; Visual Programming; VB Environment: Steps in creating & using controls; Notion of Scripting; Scripting via Perl

**References:**

1. Terrance W Pratt, "Programming Languages: Design and Implementation", PHI.
2. Sethi, "Programming Language", Addison Wesley.
3. E Horowitz, "Fundamental of Programming Languages", Galgotia.
4. Pratt, Zolkowitz, "Programming Languages Design Implementation", Pearson Edition.
5. Tucker Noonan, "Programming languages: Principles and Paradigms", TMH
6. D. A. Watt, "Programming Languages and Paradigms", PHI
7. J. Lloyd, "Foundation of Logic Programming", Springer verlag
8. M. Hennessey, "The Semantics of Programming Languages", John Wiley & Sons
9. Julia Case Bradley & A.C.Millspaugh "Programming in VB 6.0"
10. Mark Warhol "The art of programming in Visual Basic", John Wiley & Sons
11. C. Reade, "Elements of Functional Programming", AW
12. L.C. Paulson, "ML for Working programmer", Cambridge university press
13. B. Stroustrup, "The C++ Programming language", AW

**PAPER III: Programming in 'C'**

1. **Programming in C:** History, Introduction to C Programming Languages, Structure of C programs, compilation and execution of C programs, Debugging Techniques, Data Types and Sizes, Declaration of variables, Modifiers, Identifiers and keywords, Symbolic constants, Storage classes (automatic, external, register and static), Enumerations, command line parameters, Macros, The C Preprocessor.
2. **Operators:** Unary operators, Arithmetic & logical operators, Bit wise operators, Assignment operators and expressions, Conditional expressions, Precedence and order of evaluation.
3. **Control statements:** if-else, switch, break, continue, the comma operator, goto statement.
4. **Loops:** for, while, do-while.
5. **Functions:** built-in and user-defined, function declaration, definition and function call, parameter passing: call by value, call by reference, recursive functions, multifile programs.
6. **Arrays:** linear arrays, multidimensional arrays, Passing arrays to functions, Arrays and strings.
7. **Structure and Union:** definition and differences, self-referential structure.
8. **Pointers:** value at (\*) and address of (&) operator, pointer to pointer, Dynamic Memory Allocation, calloc and malloc functions, array of pointers, function of pointers, structures and pointers.
9. **File Handling in C:** opening and closing a data file, creating a data file, read and write functions, unformatted data files.

**References:**

1. V. Rajaraman, "Fundamentals of Computers", PHI
2. Peter Norton's, "Introduction to Computers", TMH
3. Hahn, "The Internet complete reference", TMH
4. Peter Norton's, "DOS Guide", Prentice Hall of India
5. Gottfried, "Programming in C", Schaum's Series, Tata McGraw Hill
6. Kernighan, Ritchie, "The C Programming Language", PHI
7. Yashwant Kanitkar, "Working with C", BPB
8. Yashwant Kanitkar, "Pointer in C", BPB
9. Yashwant Kanitkar, "Let us C", BPB
10. Bajpai, Kushwaha, Yadav, "Computers & C Programming", New Age
11. E. Balagurusamy, "Programming in ANSI C", TMH

**PAPER IV: Systems Software**

1. **Introduction:** Definition and types of operating systems, Batch Systems, multi programming, time-sharing parallel, distributed and real-time systems, Operating system structure, Operating system components and services, System calls, system programs, Virtual machines
2. **Process Management:** Process concept, Process scheduling, Cooperating processes, Threads, Inter-process communication, CPU scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real-time scheduling and Algorithm evaluation; Process Synchronization & Deadlock
3. **Storage management:** Memory Management-Logical and Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation with paging in MULTICS and Intel 386, Virtual Memory, Demand paging and its performance, Page replacement algorithms, Allocation of frames, Thrashing, Page Size and other considerations, Demand segmentation, File systems, secondary Storage Structure, File concept, access methods, directory implementation, Efficiency and performance, recovery, Disk structure, Disk scheduling methods, Disk management, Recovery, Disk structure, disk scheduling methods, Disk management, Swap-Space management, Disk

reliability.

4. **Security & Case Study:** Protection and Security-Goals of protection, Domain of protection; Encryption; Windows NT-Design principles, System components, Environmental subsystems, File system, Networking and program interface, Linux system-design principles, Kernel Modules, Process Management, Scheduling, Memory management, File Systems, Input and Output, Inter-process communication, Network structure, security
5. **Linkers and Loaders:** Introduction to Assembler, Loaders and Linkers, Interpreters & Compilers; Introduction to Assembly Language Programming

#### References

1. Abraham Siberschatz and Peter Baer Galvin, "Operating System Concepts", Fifth Edition, Addison-Wesley
2. Milan Milankovic, "Operating Systems, Concepts and Design", McGraw-Hill.
3. Harvey M Deital, "Operating Systems", Addison Wesley
4. Richard Peterson, "Linux: The Complete Reference", Osborne McGraw-Hill.
5. Hopcroft, Sethi and Ullman, Compiler Principles, AddisonWesley
6. H. Abelson and G. Sussmann, Structure and Interpretation of Computer Programs (SICP), MIT Press

### **PAPER V: Database Management System**

1. **Introduction:** An overview of database management system, Database System Vs File System, Database system concepts and architecture, data models schema and instances, data independence and data base language and interfaces, Data definitions language, DML, Overall Database Structure.
2. **Data Modeling using the Entity Relationship Model:** ER model concepts, notation for ER diagram, mapping constraints, keys, Concepts of Super Key, candidate key, primary key, Generalization, aggregation, reduction of an ER diagrams to tables, extended ER model, relationships of higher degree.
3. **Relational data Model and Language:** Relational data model concepts, integrity constraints: entity integrity, referential integrity, Keys constraints, Domain constraints, relational algebra, relational calculus, tuple and domain calculus.
4. **Introduction to SQL:** Characteristics of SQL, Advantages of SQL, SQL data types and literals, Types of SQL commands, SQL operators and their procedure, Tables, views and indexes, Queries and sub queries, Aggregate functions, Insert, update and delete operations, Joins, Unions, Intersection, Minus, Cursors in SQL. PL/SQL, Triggers and clusters.
5. **Data Base Design & Normalization:** Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependencies, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design.
6. **Transaction Processing Concepts:** Transaction system, Testing of serializability, Serializability of schedules, conflict & view serializable schedule, recoverability, Recovery from transaction failures, log based recovery, checkpoints, deadlock handling.
7. **Concurrency Control Techniques:** Concurrency control, locking Techniques for concurrency control, Time stamping protocols for concurrency control, validation based protocol, multiple granularity, Multi-version schemes, Recovery with concurrent transaction. Transaction Processing in Distributed system, data fragmentation. Replication and allocation techniques for distributed system, overview of concurrency control and recovery in distrusted database.

#### References

1. Date C J, "An Introduction To Database System", Addison Wesley
2. Korth, Silbertz, Sudarshan, "Database Concepts", McGraw Hill
3. Elmasri, Navathe, "Fundamentals Of Database Systems", Addison Wesley
4. Paul Beynon Davies, "Database Systems", Palgrave Macmillan
5. Bipin C. Desai, "An introduction to Database Systems", Galgotia Publication
6. Majumdar & Bhattacharya, "Database Management System", TMH
7. Ramakrishnan, Gehrke, "Database Management System", McGraw Hill
8. Bharti P.K, "An introduction to Database Systems", JPNP

## SEMESTER II

### PAPER I: Data Structures and Algorithms

1. **Introduction:** Algorithms, Analysis of Algorithms, Design of Algorithms, and Complexity of Algorithms, Asymptotic Notations, Growth of function,
2. **Arrays:** Array Definition, Representation and Analysis, Single and Multidimensional Arrays, address calculation, application of arrays, Character String in C, Character string operation, Array as Parameters, Ordered List, Sparse Matrices, and Vectors.
3. **Stacks:** Array Representation and Implementation of stack, Operations on Stacks: Push & Pop, Array Representation of Stack, Linked Representation of Stack, Operations Associated with Stacks, Application of stack: Conversion of Infix to Prefix and Postfix Expressions, Evaluation of postfix expression using stack.
4. **Recursion:** Recursive definition and processes, example of recursion, Tower of Hanoi Problem, simulating recursion. Backtracking, recursive algorithms, principles of recursion, tail recursion, removal of recursion.
5. **Queues:** Array and linked representation and implementation of queues, Operations on Queue: Create, Add, Delete, Full and Empty. Circular queue, Deque, and Priority Queue.
6. **Linked list:** Representation and Implementation of Singly Linked Lists, Two-way Header List, Traversing and Searching of Linked List, Overflow and Underflow, Insertion and deletion to/from Linked Lists, Insertion and deletion Algorithms, Doubly linked list, Linked List in Array, Polynomial representation and addition, Generalized linked list, Garbage Collection and Compaction.
7. **Trees:** Basic terminology, Binary Trees, Binary tree representation, algebraic Expressions, Complete Binary Tree. Extended Binary Trees, Array and Linked Representation of Binary trees, Traversing Binary trees, Threaded Binary trees, Traversing Threaded Binary trees, Huffman algorithm
8. **Searching and Hashing:** Sequential search, binary search, comparison and analysis, Hash Table, Hash Functions, Collision Resolution Strategies, Hash Table Implementation.
9. **Sorting:** *Insertion Sort, Bubble Sorting, Quick Sort, Two Way Merge Sort, Heap Sort, Sorting on Different Keys, Practical consideration for Internal Sorting.*
10. **Binary Search Trees:** Binary Search Tree (BST), Insertion and Deletion in BST
11. **File Structures:** Physical Storage Media File Organization, Organization of records into Blocks, Sequential Files, Indexing and Hashing, Primary indices, Secondary indices, B+ Tree index Files, B Tree index Files, Indexing and Hashing Comparisons

#### References

1. Horowitz and Sahani, "Fundamentals of data Structures", Galgotia
2. R. Kruse et al, "Data Structures and Program Design in C" Pearson Education
3. A M Tenenbaum et al, "Data Structures using C & C++", PHI
4. Lipschutz, "Data Structure", TMH
5. K Loudon, "Mastering Algorithms With C", Shroff Publisher & Distributors
6. Bruno R Preiss, "Data Structures and Algorithms with Object Oriented Design Pattern in C++", Jhon Wiley & Sons, Inc.
7. Adam Drozdek, "Data Structures and Algorithms in C++", Thomson Asia
8. Pal G. Sorenson, "An Introduction to Data Structures with Application", TMH.
9. Horowitz Sahani, "Fundamentals of Computer Algorithms", Golgotia
10. Brassard Bratley, "Fundamental of Algorithms", PHI
11. M T Goodrich et al, "Algorithms Design", John Wiley
12. A V Aho et al, "The Design and analysis of Algorithms", Pearson Education

### Paper II: System Analysis and Design

1. **System Concepts and Information Systems Environment:** The System Concept: Definition, Characteristics of Systems, Elements of a System, Open and Closed System, Formal and Informal Information Systems, Computer based Information Systems, Management Information System, Decision Support System, General Business Knowledge, and Interpersonal Communicational System.
2. **The System Development Life Cycle:** Recognition of needs, Impetus for System Change, Feasibility Study, Analysis, Design, Implementation, Post implementation & Maintenance.

3. **The Role of the Systems Analyst:** Historical Perspective, The War Effort, What Does it take to do System Analysis, Academic & Personal Qualifications, The Multifaceted role of the Analyst, The Analyst/User Interface, Behavioral issues.
4. **Systems Planning & Initial Investigation:** Strategies for Determining Information Requirement, Problem Definition & Project initiation, Background Analysis, Fact Analysis, Review of Written Documents, Onsite Observations, Interviews & Questionnaires, Fact Analysis, Performance Analysis, Efficiency Analysis, Service Analysis.
5. **Information Gathering:** What Kind of Information do we need? Information about the firms, Information gathering tools, The art of Interviewing, Arranging the Interview, Guides to a Successful Interview, Types of Interviews and Questionnaires, The Structured and Unstructured Alternatives.
6. **The Tools of Structured Analysis:** The Dataflow Diagram (DFD), Data Dictionary, Decision Trees and Structured English.
7. **Feasibility Study:** System performance, Economic Feasibility, Technical Feasibility, Behavioral Feasibility, Steps in Feasibility Analysis.
8. **Input/Output and Forms Design:** Input Design, CRT Screen Design, Output Design, Requirements of form Design.
9. **H/W / S/W Selection and Maintenance:** The Computer Industry, S/W Industry, a Procedure for H/W / S/W Selection, Major Phases in Selection, Criteria for S/W Selection, The Used Computer, The Computer Contract.

#### References

1. Elias M.Awad, "Systems Analysis & Design", Galgotia Publication.
2. Hoffer, "Modern Systems Analysis & Design", Addison Wesley.
3. Kendall, "Introduction to System Analysis & Design", McGraw Hill.

### PAPER III: Data Communication & Networks

1. **Data Communication Basics:** History of Data Communication; Open System Standard; The electrical interface-transmission media, attenuation and distortion sources, signal types and signal propagation delay, public carrier service, physical layer interface standard; Computer networks: Circuit, Message, Packet & Cell switching, Connection oriented and connectionless services
2. **Data Transmission basics:** Synchronous/asynchronous transmission; error detection method; data compression; transmission control circuits; communication control devices; protocol basics; data link control protocol
3. **Computer Networks:** LAN-wired/wireless, protocols, Ethernet switching; fast Ethernet; FDDI; Bridges
4. **Wide Area Network:** Characteristic of public data networks; packet switched; circuit switched; ISDN; private networks
5. **Internetworking:** inter network architecture issues, IP standards, ISO routing protocols
6. **Broad band multi service networks:** networking requirement, FDDI II, Cell based networks, ATM LANs
7. **Transport Protocols:** Application support protocols, Application specific protocols
8. **System aspects:** Layer interactions, implementation issues, related standards; Voice over IP

#### References:

1. Data and Computer Communication- W.Stallings,
2. Computer Networks- A.S.Tanenbaum
3. Computer Network and Distributed Data Processing- J. Martin
4. Local Networks - W.Stallings
5. Computer Communication Network Design and Analysis- M.Schwartz
6. Data Communications and Networking- B. A. Forouzan
7. Internetworking with TCP/IP -Vol I,II & III – Comer, D.E. & Stevens D.L.

### PAPER IV: Object Oriented Programming in 'C++'

1. **Object Modeling:** Object & classes, Links and Associations, Generalization and Inheritance, Aggregation, Abstract classes, A sample object model, Multiple Inheritance, Meta data, candidate keys, constraints.

- 2. Dynamic Modeling:** Events and States, Operations and Methods, Nested state Diagrams, Concurrency, Relation of Object and Dynamic Models, advanced dynamic model concepts, a sample dynamic model.
- 3. Functional Modeling:** Functional Models, Data flow Diagrams, Specifying Operations, Constraints, a sample functional model.
- 4. Programming in C++:** Classes and objects in C++, Functions, Constructors, Destructors, Inheritance, Functions overloading, Operator Overloading, I/O Operations.  
Real life applications, Extended Classes, Pointer, Virtual functions, Polymorphisms, Working with files, Class templates, Function templates.
- 5.** Translating object oriented design into an implementation, OMT Methodologies, examples and case studies to demonstrate methodology, comparison of Methodology, SA/SD, and JSD.

#### References

1. Rambaugh James et al, "Object Oriented Design and Modeling", PHI-1997
2. Bjarne Stroustrup, "C++ Programming Language", Addison Wesley
3. Balagurusamy E, "Object Oriented Programming with C++", TMH, 2001
4. Booch Grady, "Object Oriented Analysis and Design with application 3/e", Pearson
5. Lipman, Stanley B, Jonsce Lajole, " C++ Primer Reading", AWL, 1999
6. Dillon and Lee, "Object Oriented Conceptual Modeling", New Delhi PHI-1993
7. Stephen R. Shah, "Introduction to Object Oriented Analysis and Design", TMH
8. Berzin Joseph, "Data Abstraction: the object oriented approach using C++", McGraw Hill
9. Mercer, "Computing Fundamental with C++", Palgrave Macmillan

### PAPER V: Internet & Java Programming

- 1. Internet:** Internet, Connecting to Internet: Telephone, Cable, Satellite connection, Choosing an ISP, Introduction to Internet services, E-Mail concepts, Sending and Receiving secure E-Mail, Voice and Video Conferencing.
- 2. Core Java:** Introduction, Operator, Data type, Variable, Arrays, Control Statements, Methods & Classes, Inheritance, Package and Interface, Exception Handling, Multithread programming, I/O.
- 3.** Java applets, AWT controls (Button, Labels, Combo box, list and other Listeners, menu bar) layout manager, string handling (only main functions), Event handling.
- 4. JDBC:** The connectivity Model, JDBC/ODBC Bridge, java.sql package, connectivity to remote database, navigating through multiple rows retrieved from a database.
- 5. HTML:** use of commenting, headers, text styling, images, formatting text with , special characters, horizontal rules, line breaks, table, frames, forms, image maps, file formats including image formats; CSS.
- 6. JavaScript:** Introduction, Documents, Documents, forms, Statements, functions, objects in JavaScript,  
Events and Event Handling, Arrays, FORMS, Buttons, Checkboxes, Text fields and Text areas.

#### References:

1. Margaret Levine Young, "The Complete Reference Internet", TMH
2. Naughton, Schildt, "The Complete Reference JAVA2", TMH
3. Balagurusamy E, "Programming in JAVA", TMH
4. Dustin R. Callway, "Inside Servlets", Addison Wesley
5. Mark Wutica, "Java Enterprise Edition", QUE
6. Steven Holzner, "Java2 Black book", dreamtech