Course Structure FOR
Choice Based Credit System of
Post Graduate Diploma in Computer Application Program
(wef July 2020-21)
School of Computer & Information Science, UPRTOU, Prayagraj

Semester	Course Code	Title of the Course	Max Marks	Credits
First	PGDCA-101	Computer Fundamental & Its Organization	100	4
	PGDCA-102	Discrete Mathematics	100	4
	PGDCA-103	C Programming	100	4
	PGDCA-104	Numerical Analysis	100	4
	PGDCA-105	Computer Organization	100	4
	PGDCA-106(P)	Practical Based on PGDCA -103 & 104	100	4
Max. Marks/Credit of I semester			**600**	**24**
Second	PGDCA-107	Data Structures	100	4
	PGDCA-108	Organizational Behavior	100	4
	PGDCA-109	Software Engineering	100	4
	PGDCA-110	C++ and Object Oriented Programming	100	4
	PGDCA-111	Data Communication & Computer Network	100	4
	PGDCA-112(P)	Practical Based on PGDCA -107 & PGDCA-110	100	4
Max. Marks/Credit of II semester			**600**	**24**
Total Max Marks/ Credit			**1200**	**48**

Detailed Syllabus

PGDCA- 101: Computer Fundamentals and Its Organization

Computer Basics: Algorithms. A Simple Model of a Computer, Characteristics of Computers. Problem-solving Using Computers**.**

Data Representation: Representation of Characters in computers, Representation of Integers, Representation of Fractions. Hexadecimal Representation of Numbers, Decimal to Binary Conversion, Error-detecting codes. Input & Output Devices. Description of Computer Input Units, Other Input methods. Computer Output Units Printers. Plotters)

Computer Memory: Memory Cell. Memory Organization, Read Only Memory, Serial Access Memory. Physical Devices Used to Construct Memories. Magnetic Hard Disk, floppy Disk Drives. Compact Disk Read Only Memory, Magnetic Tape Drives.

Processor: Structure of Instructions, Description of a Processor. Machine Language and Instruction set Processors used in desktops and lap tops. Specification of a desktop and Lap top computer currently available in the market (Specifications of Processor. motherboard &chipset, memory. interface & capacity of hard disk & DVD drives, 1/0 ports).

Computer Architecture: Interconnection of Units. Processor to Memory communication. LO to Processor Communication. Interrupt Structures, Multiprogramming. Processor Features, Reduced Instruction Set Computers (RISC), Virtual memory.

Software Concepts: Types of Software. Programming Languages. Software (Its Nature & Qualities). Programming Languages. Operating Systems: History and Evolution. Main functions of OS Multitasking. Multiprocessing. Time Sharing. Real Time Operating System with Examples

PGDCA-102   **Discrete Mathematics**
Block—01: Language of Mathematics and its application
Unit-01: Mathematical Logic: statements, operations, truth values, tautology and quantifiers.

Unit 02: Arguments: Rule of Detachment, Validity of a compound statement by using Truth Table , Validity using Simplification Methods, Validity using Rules of Inference, Invalidity of an Argument, Indirect Method of proof and Proof by Counter-Example.

Unit – 03: Boolean Algebra: Boolean Algbera, Principle of Duality, Isomorphic Boolean Algebras, Boolean Algebra as Lattices, Boolean Functions, Disjunctive Normal Form**,** Conjunctive Normal Form**,** Minimization of Boolean Functions (Karnaugh Map)

Unit – 04: Switching circuits and logical Circuits : Switching Circuits, Simplification of circuit, Non-Series Parallel Circuits, Relay Circuits, Logic Circuits

Block – 02: Set theory and its application
Unit-01: Set theory: sets, Subsets, Operations on Sets, Complementation, Intersection and Union, Laws Relating Operations, Distributive Laws and De Morgan's Laws.

Unit -02: Relation: Relation, binary relations in a Set, Domain and Range of a Relation, Total number of Distinct Relations, Relations as Sets of Ordered Pairs, Types of Relations, Composition of Relations, Equivalence relation in a set, Partition of a Set, Equivalence Class and Quotient set of a set.

Unit – 03: Partitions and Distributions: Equivalence Relations, Equivalence Classes, Properties of Equivalence Classes, Quotient set and Partition.

Unit – 04: Function: Functions, Direct and Inverse image, Inverse Functions, Operations on Functions, Composite of functions, Types of Functions and Connection between Equivalence relation and mapping.

Block – 03: Counting Process
Unit-01: Mathematical Induction: Principle of Mathematical Induction, Second Principle of Induction and Well ordering property.

Unit -02: Combinatorics: Basic counting principles**,** Principle of Disjunctive counting, Principle of Sequential counting and Ordered and Unordered Partitions.

Unit – 03: Permutation

Unit – 04: Combination

Block – 04: Probability theory and application
Unit-01: Binomial theorem: Binomial theorem, General term in a binomial expansion, Middle term in a binomial expansion and Binomial expansion for rational exponents.

Unit -02: Probability: Definition of Probability, Addition law for counting and Product law for counting.

Unit – 03: General Counting methods: General Counting method is the extension part of counting process. It discusses Sum and Product Rulesand The Pigeonhole Principle **.**

Unit – 04: The Inclusion- Exclusion Principle: inclusion-exclusion principle, Alternative form of the inclusion-exclusion principle and Onto Functions.

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PGDCA-103　　　C Programming

Block 1: Introduction to algorithms and program design

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Unit 1: Introduction to Algorithms

Problem solving techniques, Algorithm

Unit 2: Pseudo-codes and Flowcharts

Tools of Algorithm, Pseudo codes, Flowchart

Unit 3: **Program design principles**

Introduction to computer programming, Program design principles, Programming techniques, Program Errors

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Block 2: Introduction to the 'C' programming language

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Unit 1: Introduction

History of C Language, Structure of a 'C' program, Creating and Executing a 'C' program,

Unit 2:Data Types in 'C'

Character Set of 'C' language, Trigraph characters, Tokens, Identifiers, Keywords, Constants, Data types, Variables

Unit 3:Storage Classes

Scope and lifetime of variable, Storage classes, Automatic storage class, Register storage class, Static storage class, External storage class

Unit 4:Input and Output Functions

Reading a single character, Writing a single character, Formatted Input-Output, Formatted Input, Formatted Output

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Block 2: Operator and Control Structures

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Unit 1: Operators and Expressions

Arithmetic operators, Relational operators, Logical operators, Assignment operators, Increment and decrement operators, Conditional operators, Bitwise operators, Special operators, Operator Precedence and Associativity, lvalue and rvalue, Type casting: Promotion and Demotion of variable types

Unit 2: Decision Structures in 'C'

if statement, if else statement, nested if … else statement, switch statement, goto statment

Unit 3: Loop Structures in 'C'

for statement, while statement, do while statement, break statement, continue statement

Unit 4: Arrays

One dimensional array, Two dimensional array, Multidimensional arrays, Strings, String handling functions, Character functions

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Block 3: Advanced Features of C

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Unit 1: Pointers

Pointers and Address (&) operator, Pointer declaration and Initialization , Indirection operator, Pointer Arithmetic, Arrays and Pointers, Character strings and Pointers, Array of Pointers, Pointer to Pointer

Unit 2: Functions

Functions, user-defined functions, categories of function, returning non-integer values, function arguments, recursion, arrays as function arguments

Unit 3: Structures, Unions, enum and typedef

Structure definition, Structures within structures, Structures as function arguments, Pointers to structures, Unions, Enumerated data type, Type definition

Unit 4: File and Memory Management in 'C'

Files, File Pointer Variable, Opening a file, Reading and writing to files, File Status Functions, Random Access to files, Command Line Arguments, Memory management

Unit 5: Preprocessor Directives and Error reporting

Macro directives, Conditional directives, Control directives, Error reporting

PGDCA-104   **Numerical Analysis**

Block-I: Solutions of Non-Linear Equations in one Variable

Unite 1: Review of Calculus, Round off Error, Truncation Error, Some properties of equations, Iteration Methods for finding the roots (zero's) of an equation. Convergence Criterion, Initial Approximation to a Root, Bisection Method,

Unite 2: Fixed Point Iteration Method, Chord Methods for Finding Roots- Regula Falsi Method, Newton Raphson Method. Order of convergence.

Block-II: Solution of System of Linear Equations

Unite 3: Direct Methods- Preliminaries, Method of solution using inverse of matrix. Cramer's rule. Gauss Elimination Method, Gauss- Jordon Reduction Method, LU decomposition method. Crout's method.

Unite 4: Iterative Method- General Iteration Method, Jacobi's Iteration Method, Gauss-Seidal Iteration Method.

Block-III: Interpolation

Unite 5: Definition, Finite Differences: Forward differences, Backward differences, Central differences, Other differences operator, Relation between operators. Interpolation at Equally interval; Newton Gregory formula for forward differences and backward difference .

Unite 6: Interpolation at Unequally interval Lagrange's interpolation formula. Divided differences, Properties of divided differences, Newton's Divided difference interpolation formula.

Block-IV: Numerical Differentiation, Integration and Solutions of Differentiation Equations

Unite 7: Numerical Differentiation, Numerical Integration; Trapezoidal Rule. Simpson's One Third Rule, Simpson's Three Eight's Rule. Weddle's Rule.

Unite 8: Numerical Solution of Ordinary Differential Equations-(first order, second order and simultaneous) by Picard's Iteration Method, Euler's Method, Runge- Kutta Methods- 4th Order.

PGDCA-105   Computer Organization

Block 1: Introduction to Digital Electronics

Unit 1: Introduction to number system: binary, octal, hexadecimal, Inter-conversion to different number system.

Unit 2: Boolean algebra and Logic Gates: De Morgan's theorem, Boolean Identity. OR, AND NOT NAND, NOR and Ex OR gates and there Truth Tables, Positive and Negative logic.

Unit 3: Reduction Techniques: Standard representation of Boolean expressions, SOP and POS forms, Combinational and sequential circuits, Minterm and Maxterm expressions, Map reduction techniques, K- tap. Code Conversions: Binary to Gray, BCD to decimal etc.

Unit 4: Binary Arithmetic: Half and Full Adder, Substractor, Multiplexer, Demultiplxer, Decoder, Encoders, Comparators.

Unit 5: Sequential Circuit: Flip Flops: S/R, J/K, D and T Latches, Digital Counters, Registers.

Block 2: Basic building blocks

Unit 1: Building blocks: I/O, Memory, ALU and its components, Control Unit and its functions

Unit 2: Instruction — word, Instruction and Execution cycle, branch, skip, jump and shift instruction, Operation of control. registers; Controlling of arithmetic operation.

Unit 3: Addressing techniques — Direct, Indirect, Immediate, Relative, Indexed addressing and paging. Registers —Indexed, General purpose, Special purpose, overflow, carry, shift, scratch, Memory Buffer register; accumulators; stack pointers; floating point; status information and buffer registers.

Block 3: Memory & I/O

Unit 1: Memory: Main memory, RAM, static and dynamic, ROM, EPROM, EEPROM, EAROM, Cache and Virtual memory.

Unit 2: I/O System: Buses, Interfacing buses, Bus formats- address, data and control, Interfacing keyboard, display, auxiliary storage devices and printers.

Unit 3: Introduction to Microprocessors and microcontrollers; Introduction to 8085 microprocessor, example of few instruction to understand addressing techniques, differences between microprocessors and microcontrollers. Interlocution to different processor families.

PGDCA-107   **Data Structures**
BLOCK - 1
UNIT 1: Introduction to data structure
Algorithm, Basic criteria for algorithms, Data type, Data structure, Data representation, linear and non linear data structure.
UNIT 2: Basics of algorithm
Algorithm, Basics of complexity of algorithm
UNIT 3:Array
Definition, Representation of array, Single and multi-dimensional array, address calculation (one dimensional, two dimensional, multidimensional), sparse matrices

BLOCK - 2
UNIT 4: Stack
Definition, Operations on stacks, Array representation and implementation of stadk; infix, prefix and postfix representation of expression and evaluation multiple stacks, Application of stacks.
UNIT 5: Recursion
Recursive definition and processes, some named problems of recursion, principle of recursion: designing recursive algorithm, how recursion works, tail recursion.
UNIT 6: Queue
Definition, operation on queues, circular queue, dequeue, priority queue, Application of queue.

BLOCK 3
UNIT 7: Linked List
Representation and implementation of single linked list, Operations in the singly linked list, stack and queue as a linked list, circularly linked list, doubly linked list, circularly doubly linked list, Application of linked list: polynomial representation and addition, garbage collection
UNIT 8: Tree
Basic terminology, binary tree, binary tree representation, complete binary tree, extended binary tree, array and linked list representations, traversing binary tree, threaded binary tree, binary search tree, Operations on BST, AVL tree, Operations on AVL tree, B-tree Insertion and deletion in B tree.
UNIT 9: Graph
Basic terminology Graph representation Depth first search, breadth first search, topological sort, connected components, spanning tree, minimum cost spanning tree, Kruskal's and prim's algorithm, Shortest path algorithms: Bellman Ford Algorithm, Dijkstra's algorithm, Floyd-Warshall algorithm.
BLOCK - 4
UNIT 10: Searching and sorting
Sequential search, binary search, comparison and analysis, Selection sort, Bubble sort, Insertion sort, Heap sort, Quick Sort, Merge sort, Shell sort, radix sort.
UNIT 11: Hashing
Hash table, hash function, collision resolution strategies, hash table implementation.
UNIT 12: File Structure
Terminology, File organization, Sequential files, Direct File organization, Indexed Sequential file organization.

PGDCA-108 Organizational Behavior

BLOCK 1 Basics of Organizational Behavior

Unit 01 Nature of Organizational Behavior- Definition, Nature, Significance of Organizational Behavior, Forces Affecting Organizational Behavior

Unit 02 Evolution of the Concept of Organizational Behavior- Disciplines Contributing to Organizational Behavior, Classical Viewpoint of Human Organizational Behavior, Human Relations Approach, Behavior Science Approach

Unit 03 Model of Organizational Behavior- Management's Assumptions about People, Model of Organizational Behavior, Relevance of OB Models, Management Challenges

Unit 04 Recent trends in Organizational Behavior- Globalization, Information Technology and OB, Changing Workforce, Workplace Values and ethics

BLOCK 2 Basics of Individual Behavior

Unit 05 Types of Individual Behavior- The types of personality, Personality Traits, The Big Five Dimensions, Myers-Briggs Type Indicators

Unit 06 Perception and Behavior- The Perceptual Process, The role of environment, observer and object in perception, Errors in Perception, Perception and Behavior

Unit 07 Learning and Behavior- Learning in Organization, Classical Learning Theory, Social Learning Theory, Behavior Modification

Unit 08 Attitude and Behavior- Concepts of Attitude, Components of Attitude, Attitude Formation, Significance of Attitude in Managing Behavior

BLOCK 3 Motivations and Leadership

Unit 09 Motivation- Concept of Motivation, Need Based Theories, Expectancy Theory, Goal Setting Theory

Unit 10 Motivation: Practical Application- Application of needs based theories: Flexi benefits, Flexitime, Job Redesigning, Application of Expectancy Theory: Goal Alignment, Application of Goal Setting Theory: Management by Objectives

Unit 11 Leadership - Concept and Definition of Leadership, Styles of Leadership, Trait Theory, Behavioral Theories

Unit 12 Leadership: Contingency Perspectives - Path-Goal Theory, Hersey Blanchard Theory, Fiedler Theory, Transitional and Transformational Leadership

BLOCK 4 Group Dynamics and Culture

Unit 13 Groups in Organizations - Concept of Motivation, Group Membership, Group Structure and norms, Group Cohesiveness

Unit 14 Group Performance- Conformity, deviance, Group Processes: Groupthink, Group Shift**,** Group Decision Making

Unit 15 Transactional Analysis- Transaction as a unit of social interaction, Three ego states: Parents, adult and child, Four life Positions

Unit 16 Organizational Culture - Concept and Definition, Dimensions of Organizational Culture, Development of Organizational Culture, Managing culture, Strong vs Weak Culture

PGDCA-109 Software Engineering

UNIT-I Software Engineering Fundamentals: Definition of Software, Software characteristics, Software Applications. Software Process: Software Process Models - Waterfall model, prototyping model, spiral model, incremental model, concurrent development model. Project management Concepts: The Management Spectrum - The People, The Product The Process, The Project.

UNIT-II Software Process and Project Metrics : Measures , Metrics and Indicators , Software measurement Size -Oriented Metrics , Function - Oriented Metrics , Extended Function point metrics Software Project Planning : Project Planning Objectives , Software Project Estimation , Decomposition Techniques - Problem Based Estimation Process Based Estimation ,Empirical Estimation Models- The COCOMO Model Risk Analysis and Management: Software risks, Risk identification, Risk Projection, Risk Refinement, Risk Mitigation , Monitoring and Management.

UNIT-III Software Quality Assurance: Basic concepts- Quality, Quality Control, Quality Assurance, Cost of Quality , Software Quality Assurance (SQA) , Formal Technical Review Software Configuration Management: Baselines , Software Configuration Items, The SCM Process, Version Control, Change Control, Configuration Audit, Status Reporting. Analysis Concepts and Principles: Requirements Elicitation for Software, Analysis Principles. The Information Domain, Modeling, Partitioning, Essential and Implementation Views, Specification: Specification Principles, Representation, The Software Requirement Specification (SRS)

UNIT-IV Design Concepts and Principles: Design Principles, Design Concepts — Abstraction, Refinement, Modularity, Software Architecture, Control Hierarchy, Structural Partitioning, Data Structure. Software Procedure, Structure, Information Hiding, Effective Modular Design- Cohesion, Coupling Software Testing: Testing Objectives & principles, Unit Testing, Integration Testing (Top Down Integration , Bottom. Up Integration, Regression Testing, Smoke Testing), Validation Testing (Alpha and Beta Testing), System Testing (Recovery Testing, Security Testing, Stress Testing, Performance Testing).

UNIT-V Reengineering: Software Reengineering, Reverse Engineering, Restructuring, Forward Engineering CASE Tools: What is CASE, Building Blocks of CASE, A Taxonomy of CASE Tools, Integrated CASE Environments, The integration Architecture, The CASE Repository.

PGDCA-110   C++ and Object oriented programming

BLOCK - 1

UNIT 1: Principles of object oriented programming

Object oricnted programming paradigm, Comparison with procedural programming, Basic concepts of object oriented programming, benefits of O0P, object oriented Languages, advantage of C++.

UNIT 2: Object Orient Programming System

Class, inheritance, abstraction, encapsulation and information hiding, polymorphism, overloading.

UNIT 3: Advanced concept

Dynamism (Dynamic typing., dynamic binding, late binding, dynamic loading). Structuring programs, reusability, organizing object oriented project,

BIOCK - 2

UNIT 5: Overview of C++

Tokens, keywords, identifiers and constants basic data types, user-defined and derived Data types, type compatibility, reference, variables type Casting, operator precedence, control structures, structure, function.

UNIT 6: Classes and objects

Class specification, class objects, accessing class members, scope resolution operator, data hiding, empty classes, Pointers within a class, passing objects as arguments, returning objects from functions, friend Functions and friend classes, constant parameters and member functions, structures and Classes, static members.

UNIT 7: Object initialization and cleanup

Constructors destructor, constructor overloading. order of construction and destruction, Constructors with default arguments, nameless objects, dynamic initialization through Constructors, constructors with dynamic operations, constant objects and constructor, static Data members with constructors and destructors, nested classes.

BLOCK - 3

UNIT 8: Operator overloading and type conversion

Defining operator overloading, overloading unary operators, overloading binary operators, overloading binary operators using friends, manipulation of strings using Operators, rules for overloading operators. type conversions.

UNIT 9: Inheritance: extending classes

Deriving derived classes, single multilevel, multiple, hierarchical, hybrid inheritance, Constructors & destructors in derived classes, constructors invocation and data members Initialization, virtual base classes, abstract classes, delegation.

BLOCK- 4

UNIT 10: Pointers, virtual functions and polymorphism

Pointers to objects, this pointer. pointers to derived classes, virtual functions, Implementation of run-time polymorphism, pure virtual functions.

UNIT 11: Working with files

Classes for file stream operations. opening and closing a file, file pointers and their Manipulations, sequential input and output operations, error handling during file Operations, command line arguments.

UNIT 12: Object Oriented Modeling

Need of object oriented Modeling, Simulation of real life problems using OOP concept: Example, Representation of problem using object and class diagrams at design level.

PGDCA-111   **Data Communication and Computer Networks**

Block 1: Computer Networks Basics

Introduction: Layered network architecture, Review of ISO-OSI Model. Data Communication techniques: Pulse code Modulation, (PCM), Data modems, Multiplexing techniques –Frequency-Division, Time-Division, Time-Division Transmission Media-Wires, Cables, Radio, Links, Fiber-Optic Links.

Asynchronous Transfer Mode (ATM); Cell Format, Layovers in ATM, Class 1,2,3,4 Traffic Random Access Data Networks, Concept of Random Access, Pure ALOHA; Throughput Characteristics Slotted ALOHA, Throughputs for Finite and Infinite, Population S-ALOHAS. MARKOV Chain Model for S- ALOHAS. Throughputs for Finite and Infinite, Population S- ALOHAS. MARKOV Chain Model for S-ALOHA.

Block 2: Data Link layer

Local Area Networks (LANs): IEEE 802.4 and 802.5 Protocols. Performance of Ethernet and Token ring protocols, FDDI Protocol , Distributed Queues Dual Bus (DQDB) Protocol.

Data Link Protocols: Stop and Wait Protocols: Noise Free and Noisy Channels Performance and Efficiency, Verification of protocols using Finite State Marching. HDLC Data Link Protocol.

Block 3: Network & Transport Layer

Network Layer Protocols: Design issue: Virtual circuits and Datagram.

Integrated Services Digital Network: Interfaces, Devices, Channel Structure. Dead Locks ad their avoidance Network Layer in ATM, Internetworking: Bridges, Routers and Gateways, Internet Architecture and Addressing.

Transport Layer Protocols: Design issues: Quality of Services, Primitives Connection Management: Addressing, Connection Establishment and Releases, Use of Timers, Flow Control and Buffering, Multiplexing, Crash Recovery.

Block 4: Upper Layer Protocols

Routing Algorithms: Optimality Principle, Shortest Path Routing- Dijkstra, Bellman – Ford and Floyd- War shall Algorithm.

Elements of TCP/IP Protocol: User Datagram Protocol Connection Management, Finite State Machine.

Session Layer Protocols: Dialog Management, Synchronization, OSI Session Primitives Connection Establishment Presentation and Application Layer Protocols: Presentation Concepts NMP- Abstract Syntax Notation-1 (ASN-1), Structure of Management, Management Information Base.