



Revised Curriculum-2023

PGDCA

Department of Computer Science

Jamia Millia Islamia, New Delhi.

Approved in the BoS dated 09.05.2023

DEPARTMENT OF COMPUTER SCIENCE

Faculty of Natural Sciences, Jamia Milla Islamia, New Delhi

PGDCA Programme Structure

SEM	CODE	COURSE TITLE	L-T-P	CR	Marks	SUMMARY
I	DS11	Computer Fundamentals	3-1-0	4	100	Periods: 28 Credits: 24 Total Marks: 600
	DS12	Programming with C	3-1-0	4	100	
	DS13	Applied Operating Systems	3-1-0	4	100	
	DS14	Website Design & Maintenance	3-1-0	4	100	
	DS15	Foundations of e-Business	3-1-0	4	100	
	DS16	Lab-I (C)	0-0-4	2	50	
	DS17	Lab-II (Linux & WDM)	0-0-4	2	50	
II	DS21	Programming with Python	3-1-0	4	100	Periods: 28 Credits: 21 Total Marks: 500
	DS22	Network & Internet Technologies	3-1-0	4	100	
	DS23	Database Management Systems	3-1-0	4	100	
	DS24	Lab-III (Python)	0-0-4	2	50	
	DS25	Lab-IV (Oracle)	0-0-4	2	50	
	DS26	Minor Project	0-2-6	5	100	
PGCA Programme Summary: Courses[Th (8)+Labs(4)+MP(1)] =13					Total Marks: 1100	Total-Credits: 45

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DS11: Computer Fundamentals

LEARNING OUTCOMES

Understanding the basics of Computers.

Understanding the history, generations, and classifications of Computers.

Learn the components of the Computers and their working.

Understanding the memory and processing of the Computers

Learning how to perform the binary arithmetic operations and logical gates

Getting acquainted with programming languages, operating systems, networks and www, and graphics terms.

- 1. Computer Basics and Data Representation:** Simple model of computer, computer generations, characteristics of computers, classification of computers, problem-solving using computers; flow chart, program, working of a computer, stored program concept, hardware and software. Representation of characters in computers, representation of integers, representation fractions, numbers systems; decimal, binary, octal, hexadecimal and their conversions.
- 2. Input/Output Units:** Traditional computer input/output units; keyboard, display unit, computer mouse, other technologies: touchpad, touch screen, magnetic ink character recognition(MICR), optical mark reader recognition(OMR), flatbed scanner; computer output devices: flat panel display technology, E-ink display, printers, inkjet printers, dot matrix printers, line printers, plotters, choosing a printer.
- 3. Computer Memory & Processor:** Memory cell, memory organization, read-only memory, flash memory, Serial access memory, Magnetic hard disk, solid state disk, compact disk read-only memory(CDROM): digital versatile disk read-only memory, CDROM-R, magnetic tape drive, memory hierarchy; structure of instructions, description of a processor, machine language program.
- 4. Binary Arithmetic and Logic Circuits:** Binary addition, binary subtraction, signed numbers 2's complement representation of numbers, binary multiplications, floating point representation of numbers; switching circuits, AND, OR, NOT, Boolean functions, precedence of operators, truth tables.
- 5. Programming Languages & Operating Systems:** Why programming languages? Assembly language, higher level programming languages, compiling high-level languages. Why do we need operating systems? personal computer operating system; need for computer communication networks, Local area networks, internet and world wide web; graphical user interface, vector graphics, raster graphics.

REFERENCES

V. Rajaraman: Fundamentals of Computers, 6th Edition, PHI Learning.

Dromy: How to Solve by Computer, Pearson

P. K. Sinha: Computer Fundamentals, 8th edition, BPB Publication,

DS12: Programming with C

LEARNING OUTCOMES

Understanding of programming concepts such as variables, data types, operators, control structures, functions, and arrays.

Development of efficient programming skills optimized for efficiency and debugging.

Knowledge of programming best practices.

Development of versatile programming capabilities.

- 1. Problem-Solving Approach:** Introduction to Programs and Algorithms; Problem-Solving Aspect (Algorithm Devising); Basic Features of an Algorithm; Algorithm Design Using Pseudo codes; Algorithm Implementation; Program Verification; Flowchart – Symbols and Conventions.
- 2. Basic Concepts of C:** Character Set; Keywords; Identifier, Constants, and Variables; Constant Types – Numeric and Character Constants; Data Types –Character, Integer and Floating Point; Signed, Unsigned, Short, and Long Integers; Data Declaration and Definition, Operator & Expression – Arithmetic, Relational, Logical, Increment, Decrement, Assignment, Conditional, and Bitwise Operators; Precedence & Associability of Operators; Managing Console I/O, Formatted I/O, Control Structures: Decision Making (Branching) Structures – If Statement, If-Else Statement, Nested If-Else Statement, Else-If Ladder, Switch Statement, Goto Statement; Looping Structures – While Statement, Do-While Statement, For Statement, Continue and Break Statements.
- 3. Functions:** Library Functions; User-Defined Functions; Function Declaration (Prototype) and Function Definition; Function Arguments – Dummy, Actual and Formal Arguments; Local and Global Variables; Function Calls – Call by Value and Call by Reference; Returning Multiple Values from a Function, Recursion and Recursive Functions, Storage Class & Scope of Variables – Automatic Storage, Extern Storage, Static Storage, and Register Storage.
- 4. Arrays, Strings & Pointers:** Single Dimensional Arrays; Accessing Array Elements; Initializing an Array;

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Multidimensional Arrays; Initializing Multidimensional Arrays; Memory Representation; Accessing Multidimensional Array Elements; Array of Characters; String Manipulation Functions; Introduction to Pointers; Pointer Variable Declarations and Initializations; Null Pointer; Constant Pointers; Void Pointer; Pointer Operators; Pointer Arithmetic; Application of Pointers; Dynamic Memory Allocations – malloc, calloc, realloc and free functions; Pointers and Strings.

5. Structure, Union, Enumeration and Files: Structure Declaration and Initialization; Accessing Structure Members, Structure Assignments; Array of Structures and Arrays within Structures, Nested Structures; Structure as Function Arguments; Structure Pointer; Unions; Difference between Structure and Union; Bit-Fields; Introduction to File; Text and Binary Files; Defining, Opening and Closing Files; I/O Operations on Files, Command Line Arguments.

REFERENCES

Balagruswamy: Programming in ANSI C, TMH
Dromey: How to Solve by Computer, Pearson
Deitel & Deitel: C – How to Program, Pearson

DS13: Applied Operating Systems

LEARNING OUTCOMES

Understands the different services provided by Operating System at a different level.
Understands the use of different process scheduling algorithm and synchronization techniques to avoid deadlock.
Learn different memory management techniques like paging, segmentation and demand paging etc.
Understand Linux Environment, Structure, Commands, and File Systems
Learning Security, File Permissions, and Shells in Linux

1. Operating Systems Primitives: Definition, Structure and Operations; Process Management; Memory Management; Storage Management; Protection and Security; Distributed Systems; Special-Purpose Systems; Computing Environments; Open Source OS. OS Structures: OS Services; User OS Interface; System Calls; System Programs; OS Design and Implementation; OS Structure; Virtual Machines, System Boot.

2. Process Management: Process Scheduling; Process Scheduling Criteria, Scheduling Algorithms, Process Synchronization; Critical-Section Problem; Peterson's Solution; Synchronization Hardware; Semaphores; Classic Problems of Synchronization; Monitors. Deadlocks – System Model; Deadlock Characterization; Methods for Handling Deadlocks; Deadlock Prevention, Avoidance, Detection and Recovery.

3. Memory Management: Basic Concepts; Swapping; Contiguous Memory Allocation; Paging; Structure of Page Table; Segmentation; Virtual Memory; Demand Paging; Page Replacement; Page Replacement Algorithms; Thrashing.

4. Basic Concepts of Unix/Linux: The Linux Environment, Linux Structure, Commands, The vi Editor, Modes, Commands; File Systems – File Names, File Types, Regular Files, Directories, File System Implementation, Operations on Directories and Files.

5. Security and File Permission in Unix/Linux: Users and Groups; Security Levels; Changing Permissions; User Masks; Changing Ownership and Group, Introduction to Shells; Linux Session; Standard Streams; Redirection; Pipes; Command Execution; Command-Line Editing; Quotes; Command Substitution; Job Control; Aliases; Variables; Predefined Variables; Options; Shell/ Environment Customization.

REFERENCES

Silberschatz, Galvin and Gagne: **Operating System Concept**, 9th Edition, John Willey
Richard Petersen: **Linux: The Complete Reference**, 6th Edition, TMH
Sumitabha Das: **UNIX – Concepts and Applications**, 4th Edition, TMH

DS14: Website Design & Maintenance

LEARNING OUTCOMES

Understand the basic concepts of the Internet, WWW, and Web Development Process
Construct a website that conforms to the web standards of today.
Understand fundamental concepts of Website design

1. Fundamental Concepts: Overview; Technical Infrastructure; Information Sharing; Types of Web Sites; Website Architecture – 2-Tiered and n-Tiered Architecture, Website Design Issues – Administrative, Creative, Technical, and Marketing; Introduction to Web Site Editors. Web Site Design Process – Analysis, Design, Development, Implementation, Evaluation and Maintenance, and Promotion; Factors Influencing Web Site Design; Elements of Web Site Design, Web Page Design and Layout.

2. Web Page Design: Introduction; Components of a Web Page – Typography (Fonts and Styles), Color (Color

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Models, Color Profiles, etc.), Graphics (Raster and Vector Graphics), Audio, Video, Plug-ins; Slicing Images; making Images Load Faster; Reducing the Colors in an Image; Reducing the Size of Images – Resizing, Cropping, and Creating Thumbnails; Developing Web Site Using Dreamweaver, Testing a Web Site.

3. Hyper Text Markup Language: HTML Document Structure – HTML, HEAD, and BODY; HTML Tags and their Functions; Creating Web Pages Using HTML. Dynamic HTML (DHTML): Introduction, DHTML Features; Components of DHTML – Cascading Style Sheets (CSS); Animations; Types of Animations – GIF Animations, DHTML Animations, Web Video Animations, 3-Dimensional and Virtual Reality Animations; Object Referencing, Dynamic Styles, Dynamic Positioning.

4. Java Script: Introduction to Scripting; Obtaining User Input with Prompt Dialogs, Memory Concepts, Arithmetic; Control Statements & Loop structures, Break and Continue Statements, Labeled Break and Continue Statements. Functions – Programmer Defined Functions, Function Definition, Scope Rules, Java Script Global Functions, Recursion. Arrays – Declaring, Allocating and using Arrays; Sorting Arrays; Searching Arrays; Multidimensional Arrays Introduction to Objects; Types of Objects – Math, String, Date, Boolean, and Window Objects. Introduction to Server-Side JavaScript; PHP – Introduction, Form Handling using PHP.

5. Web Servers: Introduction to Internet Information Services (IIS), HTTP Request Types, System Architecture, Client-Side Scripting versus Server-Side Scripting, Accessing Web Servers; Apache Web Server; Requesting Documents (XHTML, PHP, Python). Miscellaneous topics and supplements.

REFERENCES

Wang & Katila: An Introduction to Web Design+Programming. Indian Edition, Cengage Learning.

Joel Sklar: Web Design Principles. 5th Edition, Cengage Learning.

Steven Holzner - HTML Black Book, DreamTech Press

Michael K. Glass, et. al.- Beginning PHP, Apache, MySQL Web Development, Wrox

DS15: Foundations of e-Business

LEARNING OUTCOMES

Explaining Systems; and IT-related terminology, trends, challenges, obstacles and prospects.

Illustration and performing work-centered analysis on business systems.

Analyzing and developing business process models.

Identifying typical information systems, and roles in current e-business perspective.

Evaluation of the performance of IT and e-Business and vice-versa.

1. Toward E-business Systems: Systems, Business Systems, Building and Maintaining Systems, IT-Based Innovations in Every Business Function, Product Design Systems, CAD Software, Procurement Systems, Supply Chain Management, Electronic Data Interchange, Manufacturing, Sales and Marketing Systems, Delivery Systems, Customer Service Systems, Finance Systems, Dramatic Progress in Processing Data, Recent Trends in IT; Applying IT to the Real World.

2. Business Systems: Frameworks and Models, Viewing Businesses as Systems, Businesses as Systems Consisting of Business Processes, The Value Chain, Business Processes and Functional Areas of Business, Information Systems and Work Systems, Increasing Overlap Between Information Systems and Work Systems, Framework for Thinking About Any System in Business, WCA Framework, Five Perspectives for Viewing a Work System, Architecture: System Components and How They Operate Together, Performance: How Well the System Operates, Analyzing an IT-Enabled System From a Business Professional's Viewpoint, Work-Centered Analysis Method, Limitations and Pitfalls

3. Business Processes and Models: Business Processes, Process Characteristics: Degree of Structure, Range of Involvement, Level of Integration, Rhythm, Complexity, Degree of Reliance on Machines etc, Communication and Decision Making; Evaluating Business Process Performance: Activity Rate and Output, Consistency, Productivity, Cycle Time, Downtime and Security, Basic Communication and Decision-Making Concepts.

4. Typical Information Systems: Information System Categories related to Specific Functional Areas of Business, IS Categories applicable Functional Areas; Office Automation Systems; Communication Systems: Teleconferencing, E-Mail, Fax, SMS, Groupware, Internet, Intranets, Extranets, Knowledge Management, and Group Support Systems, Transaction Processing Systems, MIS and Executive Information Systems, Decision Support Systems, Case Based Reasoning, and Intelligent Systems, Enterprise Systems, Limitation and Uses of Typical Information Systems.

5. Customer, Product and IT: Customer's View of Product and services, The Customers' Experience, Evaluating Products and Services: Cost, quality, responsiveness, Reliability and Conformance to standards, Performance Variables of IT: Functional Capabilities and Limitations, Ease of use, Compatibility and Maintainability, Approaches of Organizational Computing-Centralized, Personal, Distributed, Networked and Client-Server, Current Limits of Software; Types of Software, Programming viewed as Business Process, Major Developments in Programming – Special purpose, Spreadsheets and CASE, Artificial Intelligence and Intelligent Systems.

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REFERENCES

Alter: Information Systems – The Foundations of E-Business, Pearson
Combe: Introduction to E-business Management and Strategy, Elsevier
Colin Combe Haag and Cummings: Information Systems Essentials, TMHI

DS16: Lab-I (C)

Implementation of at least ONE specific assignment concerning each of the following:

1. Simple programs based on operators and input/ output.
2. Programs based on conditional control statements.
3. Programs based on looping and transfer statements.
4. Programs based on functions.
5. Programs based on recursive functions.
6. Programs based on array.
7. Sorting and searching programs.
8. Programs based on structures.
9. File handling programs.
10. File handling with structure programs.

DS17: Lab-II (Linux & Website Design)

Implementation of at least ONE specific assignment concerning each of the following:

1. Some basic commands that are frequently used.
2. Dealing with file operations such as creating files, displaying their contents, deleting files, creating links to files, renaming files, and moving files.
3. Maintaining directories, creating a directory, changing the current directory, and removing a directory
4. Advanced commands used in the Linux operating system such as setting access permissions for the existing files and directories, setting default permissions for the newly created files and directories, creating groups, changing ownerships of the files, and sharing files among groups.
5. Sorting content and performing input/output (I/O) redirections, Shell programming.
6. Understanding DNS and exploring the Whois directory for DNS records.
7. Designing simple webpages with Header, Footers, Article, Lists, etc.
8. Working with Hyperlinks, Images, and Tables.
9. Design HTML forms with various form elements and CSS.
10. Writing Simple JavaScript Programs for basic computations, and dynamic content/styling.

DS21: Programming with Python

LEARNING OUTCOMES

Understand the basic construct of Python programming language
Apply various constructs and control structures in problem-solving
Understand the object-oriented program design and development in Python
Write clear and effective Python code
Access database using Python programming

1. Introduction: Getting Started: Setting up Programming Environment, Python on Different Operating Systems, Running Python Programs from a Terminal. Variables & Simple Data Types: Variables, Strings, Numbers, Comments, The Zen of Python. Working with Lists: What is a List, Changing, Adding, Removing Elements, Organizing a List, Avoiding Index Errors, Looping through an Entire List, Avoiding Indentation Errors, Making Numerical Lists, Slicing a List, Working with Tuples and Dictionaries.

2. Basic Constructs:User Inputs: input() and int() Functions, Accepting Input in Python. Conditional Tests: if Statements, Using if Statement with Lists. While Loop: Introducing while Loops, using a flat, break, continue, Using a while Loop with Lists and Dictionaries.

3. Functions, Classes, & Modules:Functions: Defining a Function, Passing Arguments, Return Values, Passing a List, Passing an Arbitrary Number, Storing Your Functions in Modules. Classes: Creating and Using a Class, Working with Classes and Instances, Inheritance, _init_() Method for a Child Class, Overriding Methods, Instances as Attributes, Importing Classes, Modules, Storing Multiple Classes in a Module, Importing Classes

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from a Module, Importing a Module into a Module.

4. Files & Exceptions: Reading from a File, Reading an Entire File, File Paths, Reading Line-by-line, Making a List of Lines from a File, Working with a File's Contents, Large Files, Writing to a File, Writing to an Empty File, Writing Multiple Lines, Appending to a File. Exceptions: Handling the ZeroDivisionError Exception, Using try-except Blocks, The else Block, Handling the FileNotFoundError Exception, Analyzing Text, Working with Multiple Files,

5. Advanced Python Features: Data Visualization: Generating Data, Installing matplotlib, Plotting a Simple Line Graph, Rolling Dice with Pygal, Making a Histogram. CSV File Format: Parsing CSV File Headers, Extracting and Reading Data, Plotting Data in a Temperature Chart, the datetime Module, Plotting Dates.

REFERENCES

Eric Matthes: Python Crash Course: A Hands-On, Project-Based Introduction to Programming. No Starch Press

Mark Lutz: Learning Python. O'Reilly

Zed A. Shaw: Learn Python the Hard Way. Addison-Wesley

DS22: Network & Internet Technologies

LEARNING OUTCOMES

Recognize different components and essential protocols of computer networks.

Plan a computer network and estimation of network costs.

Understanding the Network Security.

Manage a computer network.

1. Networks standards & Model: Introduction to Computer Networks; Communication Media and Nodes; Workstations; Hosts and Servers; Packets, Frames, and Cells; Networking Capabilities; Peer-to-Peer Networking and Workgroups; Networking with Servers; Client-Server Networking; Local Area Network (LAN), Metropolitan Area Network (MAN), Wide Area Network (WAN), Enterprise Network; Networking Standards and their Types; ISO-OSI Model; TCP/IP Model.

2. Topologies, Communication Media and Network Transport Systems: Network Topologies, Communication Media, Communication Media Costs and Considerations; Ethernet and the IEEE 802.3 Standards, Token Ring and the IEEE 802.5 Standards.

3. High Speed Network Transport and Devices for Network Connectivity: WAN and Enterprise Network Communications; Fast Ethernet; FDDI; X.25, ISDN, Frame Relay; Multistation Access Units (MAU); Multiplexers, Repeaters, Bridges, Routers, Hubs, Gateways ; ATM Switches, VLANs.

4. Network Planning and Fault-Tolerance Techniques: Assessing Network Needs; Developing a Plan; Selecting the Right Network Media and Topology; Estimating Network Costs; Managing Network Performance through Centralized Planning; Planning Network Security; Component Failures; Fault Tolerance; Disk-Storage Fault Tolerance; Server Fault Tolerance; Developing a Disaster Recovery Plan.

5. Remote Network Access and Network Monitoring: A Brief History of Remote Access; Modems; Remote Access Protocols; Security; An Overview of Network Monitoring; Establishing Network Traffic Characteristics; SNMP; Network Monitoring Devices; An Overview of Enterprise Network Management Tools; Event Management; Domain Services Management; Server and Workstation Management; Firewalls. Troubleshooting Network Problems: Developing a Problem Solving Strategy; Know Your Network; Know the Business Processes of Your Organization, Solving Problem Step-by-Step.

REFERENCES

Palmer: Hands-on Networking Essentials with Projects, VPH

Tanenbaum: Computer Networks, PE

Stallings: Data and Computer Communications, PHI

DS23: Database Management Systems

LEARNING OUTCOMES

Understanding of database concepts and database management systems.

High-level understanding of major DBMS components and their functions.

Able to apply conceptual modeling tools like ER diagrams and database design schemas.

Able to write SQL commands to create tables and indexes, insert/update/delete data, and query data.

1. Basic Concepts: Data, Database and DBMS; Database vs. Traditional File System Approach; Three Schema Architecture of DBMS and Data Independence; Categories of Database Management Systems: Hierarchical, Network and Relational Database Systems.

2. Database Models: Introduction, Categories of Database Models: High-level or Conceptual Data Models, Representational or Implementation Data Models, Low-level or Physical Data Models, Object Data Models.

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Entity relationship (ER) Model: Basic Concepts and their representations – Entity, Entity Type and Entity Set, Attributes and Keys, Relationships, Relationship Types, and Structural Constraints, Weak Entity, Naming Conventions & Design Issues in ER Model. ER and EER Diagrams.

3. Relational Database Model: Structure of Relational Model; Domains, Attributes, Tuples, and Relations; Characteristics of Relations; Relational Constraints – Domain Constraints, Key Constraints, Entity Integrity, and Referential Integrity Constraints; Relational Database Schema; Relational Algebra Operations – Select, Project, Rename, Union, Intersection, Set Difference, Join, and Division Operations; Aggregate Functions and Groupings.

4. Structured Query Language (SQL): Schema, Table and Domain Creation; Schema and Table Deletion; Table Modification; Insert, Delete, and Update Statements; SELECT- FROM-WHERE Structure; Renaming Attributes; Nested Queries and Set Comparisons; EXISTS and UNIQUE Functions; Aggregate Functions; Creating and Updating Views. Introduction to PL/SQL.

5. Functional Dependencies and Normalization: Informal Design Guidelines for Relation Schemas; Functional Dependencies; Inference Rules for Functional Dependencies; Normalization using Functional Dependencies – First Normal Form (1NF), Second Normal Form (2NF), Third Normal Form (3NF), and Boyce-Codd Normal Form (BCNF); Multi-Valued Dependencies and Fourth Normal Form (4NF); Join Dependencies and Fifth Normal Form (5NF); Relation Decomposition and Insufficiency of Normal Forms; Dependency Preserving and Lossless Join Decompositions; Null Values and Dangling Tuples. Transaction Management and Concurrency Control: Transaction Concept; Transaction State; Concurrent Executions; Serializability and Recoverability; Testing for Serializability. Concurrency Control – Lock-Based Protocols and TimestampBased Protocols.

REFERENCES

Navathe: Fundamentals of Database Systems, Pearson.

PE Silberschatz, Korth and Sudarshan: Database System Concepts, TMH

Loney and Koch: ORACLE 9i – The Complete Reference, TMH.

DS24: Lab-III (Python)

Implementation of at least ONE specific assignment concerning each of the following:

1. To use and understand the basic data types of Python programming language
2. To apply various constructs and control structures of Python in problem-solving
3. To use the functions and methods related to Numbers and Strings in a Python program
4. To use the functions and methods related to Lists, Tuples, and Dictionary in a Python program.
5. To write user-defined modules
6. To use inbuilt modules in Python program
7. To implement the Object-oriented concepts in a Python program
8. To write a Python program for file handling using single and multiple files.
9. To access database using python programming
10. To plot Graphs through a Python program.

DS25: Lab-IV (Oracle)

Implementation of at least ONE specific assignment concerning each of the following:

1. SQL statements to create, update, and delete databases and tables
2. SQL statements to insert, update, and delete records from tables
3. SQL statements to create, update, and delete views
4. Simple SQL queries to retrieve information from a database; Nested SQL queries.
5. Managing changes affecting the data using COMMIT, ROLLBACK and SAVEPOINT.
6. Providing security to databases using GRANT and REVOKE commands.
7. SQL queries using order by, group by and having clauses.
8. SQL sub queries, joins, views, nested queries, inner and outer joins.
9. SQL queries using aggregate functions like count, average, sum, etc.
10. PL/SQL blocks using basic data types, branching and looping constructs.

DS26: Minor Project

Students must do minor project as per the Department/University guidelines.