Purbanchal University

Post Graduate Diploma in Computer Application (PGDCA)

(Jestha, 2069)

PGDCA 1st Semester

Subject Code	Subject Name	Credit	Lecture	Tutorial	Lab	Total
PCA111	Introduction to Information Technology	2	2	1	2	5
PCA112	Data Communication & Networks	3	3	1	2/2	5
PCA113	Web Technology	2	2	1	2	5
PCA114	Mathematics	3	3	1	-	4
PCA115	Digital Computer Design	3	3	1	2/2	5
PCA116	Problem Solving & Programming in C	3	3	1	2	6
Total Credits		**16**	**16**	**6**	**8**	**30**

PGDCA 2nd Semester

Subject Code	Subject Code	Credit	Lecture	Tutorial	Lab	Total
PCA121	Statistics & Numerical Methods	4	4	1	2/2	6
PCA122	Object Oriented Programming in C++	3	3	1	2	6
PCA123	System Analysis & Design	3	3	1	-	4
PCA124	Data Structure & Algorithm	3	3	1	2/2	5
PCA125	Database System	3	3	1	2/2	5
PCA126	Project	2	-	-	3	3
Total Credits		**18**	**16**	**5**	**8**	**29**

Introduction to Information Technology

Semester: I **Full Marks: 100**
Credit Hr: 2 **Internal: 20+20**
Final Exam: 60

Course Objective: This course aims to give the fundamental idea about information technology to the graduates from difference discipline. It provides the interface for non-IT students to pursue higher studies in IT.

Course Contents:

1. Information Concepts 4 hrs

Introduction, History and Evolution of Computers, Types of Computer (Supercomputers, Mainframes, Minicomputers, Workstations, Microcomputers), Definition of Information Technology, Evolution of Information Processing, Scopes of Information Technology

2. Elements of Computer Processing System 9 hrs

Definition of Hardware, I/O Devices, Types of Input Devices (Keyboard, Mouse and brief overview of other input devices), Types of Output Devices (Monitors, printers and brief overview of other input devices), Microprocessors (Intel Processors, RISC Processors, Concepts of Parallel Processing), Storage Devices (Magnetic Storage Devices, Optical Storage Devices)
Definition and Types of Software, System Software (Operating systems, Compilers and Interpreters, Device Drivers), Application Software (Word Processors, Spreadsheets, Multimedia applications and brief overview of other application software), Utility software

3. Operating Systems 2 hrs

Introduction, Functions of an Operating System, Classification of Operating Systems

4. Programming Languages 2 hrs

Introduction, Types of Programming Languages, Machine Language, Assembly Language, High Level Language (Procedure Oriented, Problem Oriented), Natural Languages

5. Database Management Systems 3 hrs

Introduction (Data, Database, DBMS, RDBMS), Significance, Characteristics, Types of Database Management System (Hierarchical Model, Network Model, Relational Model, Object Oriented Model)

6. Computer Networks and Communications 4 hrs

Introduction, Uses, Types (LAN, MAN, WAN, Client-Server, Peer-to-Peer), Topologies (Bus, Star, Ring, Mesh, Tree), Network Media (Twisted-Pair, Coaxial Cable, Fiber-Optic Cable, Wireless Media), Network Software

7. Internet Technology 3 hrs

Definition (Internet, Intranet, Extranet), Uses of Internet, World Wide Web, Electronic Mail, URL, Web Browsers, Web Servers, HTML

8. Information Security 3 hrs

Concepts of Security, Privacy Issues (Junk Mails and Faxes, Spam blocking, Privacy in corporate computers), Computer Crime (Software Piracy, Antipiracy), Computer Viruses (Categories and Prevention), Theft, Ethical Issues in Computing

Reference Books:

1. Peter Nortons, Introduction to Computer, 4th Edition, Tata McGraw Hill
2. Alexis Leon & Mathews Leon, Fundamentals of Information Technology, 1st Edition, Leon TechWorld
3. P. K. Sinha, Computer Fundamentals, 1st Edition, BPB Publication
4. V. Rajaraman, Fundamentals of Computer, 3rd Edition, Asoke K
5. Ram B., Computer Fundamentals, 2nd Edition, New Age International
6. Shankar N. Adhikary, Ajay K. Shah, Business Application of Computers, Buddha Publication

Data Communication & Networks

Semester: I **Full Marks: 100**
Credit Hr: 3 **Internal: 20+20**
Final Exam: 60

Course Objective: This course must provide students with the fundamental concepts of data communications and networking and their practical applications. This course should also impart managerial aspects along with technical aspects of communications.

Course Contents:

1. Introduction 3 Hrs
Introduction, Information and communications, The nature of business information Requirements, Transmission of Information, Communications Software, Management Issues, Standards, Regulations

2. Data Transmission 3 Hrs
Signals for conveying information, Transmission Impairments and Channel capacity

3. Data Communications Fundamentals 4 Hrs
Analog and Digital data communications, Data Encoding Techniques, Asynchronous and Synchronous Transmission, Interfacing

4. Transmission Media 3 Hrs
Guided Transmission Media, Wireless Transmission

5. Reference Models 3 Hrs
The OSI Reference Model, The TCP/IP Reference Model, Comparison, TCP and IP details, Internet Addressing

6. Data Link Control 2 Hrs
Flow control, Error Detection and Correction, Data Link Control Protocol-HDLC

7. Transmission Efficiency 2 Hrs
Multiplexing and Data Compression

8. Approaches to computer networking 3 Hrs
LANs, MANs and WANs, Circuit-Switching, Packet Switching, X.25, ISDN

9. Wide Area Networks 3 Hrs
Wide Area Networking Alternatives, Frame Relay and ATM

10. Wireless Networks 3 Hrs
Wireless Networks

11. Local Area Network Technology 8 Hrs
Background, LAN Configurations, Topologies and Transmission Media, LAN Standards, Bridges, Layer 2 and 3 Switches, The IEEE Standards for LAN: IEEE 802.X

12. Distributed Applications 2 Hrs
Electronic-Mail, Electronic Data Interchange

13. Network Management 2 Hrs
Network Management Requirements

14. Network Security 4 Hrs
Security Threats, Encryption Methods, Encryption Management, Digital Signatures, Web Security, VPN

Reference Books:

1. Business Data Communications, 4/e, William Stallings, Pearson Education
2. Business Data Communications & Networking, 6/e, Fitzgerald & Dennis, John Wiley & Sons Inc.
3. Data & Computer Communications, 7/e, William Stallings, Pearson Education
4. Data Communications, Computer Networks & Open Systems, 4/e, Fred Halsall, Pearson Education
5. An Introduction to Computer Networking, Kenneth C. Mansfield, Jr. & James L. Antonakos, PHI
6. Understanding Data Communications & Networks, 2/e, William A. Shay, Thomson Learning
7. Computer Networks, 4/e, A. S. Tanenbaum, Pearson Education / PHI
8. The Essential Guide to Telecommunications, 3/e, Annabel Z. Dodd, Pearson Education
9. Computer Networks & Internet, 2/e , D. E. Comer, Pearson Education
10. Data & Network Communications, Miller, Thomson Learning

Web Technology

Semester: I **Full Marks: 100**
Credit Hr: 2 **Internal: 20+20**
Final Exam: 60

Course Objective: This course must enable student to choose best technologies for solving web client/server problems and create conforming and adaptive web pages using HTML, JavaScript and dynamic HTML.

Course Contents:

1. Introduction [2 Hrs]

Basics of Internet: Concepts of Client and Server, Web Browser and Web server
Overview of how communication happens on the Internet: Basic Introduction on what is Domain name, TCP/IP Protocol and IP Addresses.
Practicals: Internet Explorer, Telnet, FTP client and Email Client.

2. Client side technologies [8 Hrs]

HTML: Structure of HTML Document - Meta tags, Basic Tags, Links, Text, Lists, Tables, Inclusions (Graphics). [2 Hrs]
Presentation of HTML Document – Alignment, Fonts, Frames. [1 Hr]
Interactive HTML Document: Forms. [2 Hrs]
Practicals: Creating Simple and conforming web pages using HTML
Introduction to HTML5, some of the popular html5 tags: <header>, <footer>, <nav>, <section>, <article>, <canvas>, <audio>, <video> [3 Hrs]

3. JAVASCRIPT [13 Hrs]

Introduction to Scripting: Overview of Java Scripts, General Syntactic Structures (Data Types and Literals, Operators and Expressions, Control Structures) [3 Hrs]
Java Script Functions: Built-in Functions, User-defined functions, Basic scoping rules [2 Hrs]
Advanced Structures in Java Script: Arrays (Declaring and Allocating Arrays), Java Script Objects (Math, String, Date and Number) [3 Hrs]
Java Script Document Object Model: Hierarchy of objects and their methods, Event Handling. [4 Hrs]
Cookies: Creating and using cookies [1 Hr]
Practicals: Creating web pages using HTML and Java Script and cookies

4. Dynamic HTML [3 Hrs]

Cascading Style sheets: Class, Using <SPAN>, External Style Sheets
Practicals: Creating web pages using external CSS

5. JQUERY Integration [2 Hrs]

JQuery Sliders, auto complete list, date picker, accordion menu etc.
Practicals: Integrating JQuery slidre, accordion menu etc in web pages

6. Server-side technologies [2 Hrs]

Basic concepts in Web Server: Introduction to Server side scripting, Difference between client side and server side scripting, Introduction to different types of server side scripting technologies (Active Server Pages, CGI, Servlets, PHP)

Reference Books:

1. Internet & World Wide Web, How to Program, Deitel, Deitel & Nieto, AWL, 2nd Edition
2. Internet & World Wide Web, How to Program, Deitel, Deitel & Goldberg, AWL, 3rd Edition
3. Web Enabled Commercial Application Development Using HTML, DHTML, Java Script, Perl CGI , Ivan Bayross, BPB Publications, 2nd Edition
4. HTML: The Definitive Guide, Chuck Musciano & Bill Kennedy, O'Reilly & Associates
5. JavaScript: The Definitive Guide By David Flanagan, O'Reilly & Associates
6. Webmaster in a Nutshell, Stephen Spainhour, O'Reilly & Associates

Mathematics

Semester: I **Full Marks: 100**
Credit Hr: 3 **Internal: 20**
Final Exam: 80

Course Objective: The purpose of this course is to round out the student's preparation more sophisticated applications with an introduction of linear algebra, a continuous of the study of ordinary differential equations and an introduction to vector algebra and Fourier series.

Course Contents:

1. Matrices and Determinant. 14 Hrs

1.1 Matrix and Deteminant
1.2 Vector Space (Introduction), Dependent and Independent vectors
1.3 Linear Transformation
1.4 System of Linear Equations, Gauss elimination method only
1.5 Inverse of Matrix (Gauss Jordan Method)
1.6 Rank of the Matrix,
1.7 Eigen Values of Matrix, Eigen Vectors and Its applications.

2. Laplace Transformation 10 Hrs

2.1 Introduction
2.2 Laplace Transform of Some Elementary Functions
2.3 Properties of Laplace Transform
2.4 Inverse Laplace transforms
2.5 Application to differential equations

3. Line, Surface and Volume Integrals 9 Hrs

3.1 Definition of Line Integral
3.2 Evaluation of Line Integral
3.3 Evaluation of Surface and Volume Integrals
3.4 Diritchlet Integrals.

4. Integral Theorems 6 Hrs

4.1 Greens Theorem in the plane
4.2 Stoke's Theorem (Without Proof)
4.3 Gauss Divergence Theorem (Without Proof)
4.4 Consequences and Applications of Integral Theorems

5. Fourier Series 6 Hrs

5.1 Periodic Function
5.2 Trigonometric Series
5.3 Fourier Series
5.4 Determination of Fourier Coefficients: Euler Formulae (-π ,π)
5.5 Fourier Series in the Intervals (0, 2π) and (*-l, l)*
5.6 Even and Odd Functions and Their Fourier series: Fourier Cosine & Sine Series
5.7 Half Range Function
5.8 Parsevals Formula
5.9 Fourier Series in Complex Form (Introduction)

Reference Books:

1. E. Kreyszig, Advanced Engineering Mathematics, 5th Edition, Wiley, New York
2. A Text Book of Engineering Mathematics - Vol. II – P. R.Pokharel
3. A Text Book of Engineering Mathematics - Vol. III – N. B. Khatakho & S. P. Pradhanang

Digital Computer Design

Semester: I **Full Marks: 100**
Credit Hr: 3 **Internal: 20+20**
Final Exam: 60

Course Objective: This course provides students with the basic concepts of digital logic, organization and architecture of digital computers as foundation for more advanced computer related studies.

Course Contents:

1. Introduction 5 Hrs

Introduction to Analog and Digital Systems, Number Systems (Binary, Octal, Decimal and Hexadecimal Numbers), Number Base conversion, 1's and 2's Complements, Subtraction using 1's and 2's Complements, Binary Codes (BCD, Excess-3, Parity and ASCII codes).

2. Boolean Algebra 5 Hrs

Basic Definitions, Basic theorems and properties, Boolean Functions, Digital Logic Gates (Name, Graphic symbol, Algebraic function, truth table), Simplification of Boolean functions, K-Map Method (two and three variable maps), Don't care conditions.

3. Combinational Logic 5 Hrs

Introduction, Design Procedure, Adders, Binary Parallel Adder, Decoders, Multiplexers.

4. Sequential Logic 7 Hrs

Introduction, Flip-Flops (Basic, RS, D, JK, T,), Triggering of Flip-flops, Timing Diagram, Flip-Flop Excitation Tables, Analysis of Sequential Circuits (State Table, State Diagram, State Equations, Flip-Flop Input Functions), Design Procedure, Registers (4-bit register), Shift Registers, Ripple Counters, Synchronous counters (Binary and BCD counter).

5. Register Transfer Logic 4 Hrs

Introduction, Interregister Transfer, Arithmetic, Logic and Shift Micro-operations, Conditional Control Statements, Fixed-point binary data (Signed Binary Numbers, Arithmetic Addition & Subtraction), Overflow, Instruction Codes, Macrooperations, Design of a simple computer.

6. Processor and Control Logic Design 4 Hrs

Introduction to Processor Logic Design, Processor Organization (Bus Organization only), Introduction to Control Logic Design, Microprogram Control and Hard-Wired Control (Definitions, Block Diagram, Comparison and Differences).

7. Computer Design 5 Hrs

Introduction, System Configuration, Computer Instructions, Timing and Control, Execution of Instructions.

8. Microcomputer System Design 10 Hrs

Introduction, Microcomputer Organization, Microprocessor Organization (Typical Set of Control Signals and CPU), Instructions (Basic Sets of Microprocessor Instructions) and Addressing Modes, Stack, Subroutines and Interrupt, Input-Output Interface, Direct Memory Access.

Reference Books:

1. Digital Logic & Computer Design, M. Morris Mano, Prentice Hall, 1st Edition
2. Computer System Organization & Architecture, John D. Carpinelli, Pearson Education
3. Digital Design, M. Morris Mano, Prentice Hall, 2nd Edition
4. An Engineering Approach to Digital Design, William I. Fletcher, Prentice Hall, 1st Edition
5. Computer System Architecture, M. Morris Mano, Prentice Hall/Pearson Education, 3rd Edition

Problem Solving & Programming in C

Semester: I **Full Marks: 100**
Credit Hr: 3 **Internal: 20+20**
Final Exam: 60

Course Objective: To provide beginning programmers with a disciplined approach to solving problems using the C programming language and to develop a strong understanding of program design.

Course Contents:

1. Introduction [3 hrs]

Basic concept of problem solving; Solving real life problems; Problem-solving techniques; Algorithms: Characteristics of algorithm, Representation of algorithm using pseudo code, Flowchart, Top-down and Bottom-up approach, Step-wise refinement; implementation of algorithms; Need for Computer Languages; Program testing, validation and verification; Program optimization.

2. Basic Algorithms [5 hrs]

Exchange of value of two variables; Summation of set of numbers; Factorial Computation; Sine function computation; Generation of Fibonacci Sequence; Reversing of Digits of an integer; base conversion; Finding Square root; GCD; Generating Prime numbers.

3. C Programming Basics [6 hrs]

History of C; Structure of a C Program; C character set; identifiers and keywords; Data types; Variables; Constants; declarations; Expressions; statements; escape sequences; preprocessor directives; Operators: arithmetic, unary, logical, assignment, conditional, bit-wise, comma, other special; arithmetic expression; evaluation of expression; Basic Input-Output Statements: getchar, putchar, scanf, printf, gets, puts functions, library functions.

4. Control Statements [5 hrs]

if statement; if-else statement; switch statement; Loops: for, while, do-while, nested loops; Break control statements: break, continue, goto, exit().

5. Functions [6 hrs]

Introduction; defining and accessing a function; return statement; function prototype; passing values to a function; actual and formal arguments; local and global variables; call by value and call by reference; use of library function: Math functions; Storage class: automatic, register, static, external; Recursion.

6. Arrays [5 hrs]

Array notation; Array initialization; Processing an array; Passing array to a function; Multidimensional array; strings; String library functions.

7. Pointers [6 hrs]

Pointer declaration; passing pointer to a function; Operations on pointers; pointer and one dimensional array; pointer and multidimensional array; pointers and strings; array of pointers; pointers to pointers; Dynamic memory allocation.

7. Structures and Unions [5 hrs]

Declaring structures; processing a structure; array of structure; arrays within a structure; Nested structure; structure and pointers; passing structures to a function; Difference between Unions and structures; operations on a union; scope of union; Bit fields in structures; typedef; Enumerations.

8. Data Files [4 hrs]

Introduction; Opening and closing a file; create a file; process a file; searching data into a file, unformatted data files.

Reference Books:

1. How to Solve it by Computer, R. G. Dromy (Prentice Hall of India)
2. Schaum's Outline Series, Programming with C, Byron Gottfried (Tata McGraw Hill)
3. Techniques of Problem Solving, Krantz, Steven G., (University Press India Ltd., 1998)
4. C - The Complete Reference, Herbert Schildt, TMH
5. The C Programming Language, Kerningham & Ritchie
6. Understanding Pointers in C, Y. Kanetkar

Statistics & Numerical Methods

Semester: II **Full Marks: 100**
Credit Hr: 4 **Internal: 20+20**
Final Exam: 60

Course Objective: After completion of the subject, students are expected to be able to assemble data, analyze data, determine central tendency, solve non-linear equations, use interpolation, solve linear equations, integration and differentiation.

Course Contents:

1. Review of Measures of Location

Concept of Variables: Qualitative, Quantitative, Discrete and continuous variable; Frequency Distribution; Measures of Location: Mean, Median and Mode. **[2 hrs]**

2. Measures of Variation, Skewness and Kurtosis

Concept of absolute and relative measure of variation; Measures of Variation: Range, Quartile Deviation, Mean Deviation, Standard Deviation, Variance, Coefficient of Variation; Five number summary; Measures of Skewness and Kurtosis based on moments. **[5 hrs]**

3. Correlation and Regression

Simple correlation: Scatter Diagram, Karl Pearson's correlation coefficient; Spearman's Rank correlation coefficient; Interpretation of correlation coefficient; Simple Linear Regression: Estimation of parameters using the Principle of Least Square Method, Regression Coefficients and their Properties. **[4 hrs]**

4. Probability

Basic Terminology in Probability: Sample Space, Events, Random Experiment, Trial, Mutually Exclusive and Not mutually Exclusive Events, Equally Likely Events, Exhaustive Events, Independent Events and Dependent Events; Approaches of Probability: Classical Approach of Probability, Statistical Approach of Probability; Laws of Probability: Additive law of probability, Multiplicative law of probability for independent events only. **[4 hrs]**

5. Random Variable and Probability Distributions

Discrete and Continuous Random variable; Mathematical Expectation of discrete random variable; Binomial Distribution: Probability Mass function; Chief characteristics of Binomial Distribution: Mean & variance; Calculation of Binomial probabilities; Fitting of Binomial Distribution; Poisson distribution: Probability Mass function; Chief characteristics of Poisson distribution: Mean & Variance; Calculation of Poisson probabilities; Fitting of Poisson distribution; Normal distribution: probability density function; Chief-characteristics: Mean & Variance; Calculation of standard normal probabilities. **[5 hrs]**

6. Sampling Distribution

Concept of Parameters and Statistics; Sampling Distribution of Mean of a sample from normal population; Standard Error of Mean. **[2 hrs]**

7. Estimation

Brief Introduction of Estimation; Criteria of a Good Estimator: Unbiasedness, Consistency, Efficiency & Sufficiency; Types of Estimates: Point Estimates & Interval Estimates. **[3 hrs]**

8. Testing of Hypothesis

Null Hypothesis and Alternative Hypothesis; Procedure in Hypothesis Testing; Types of Errors in Hypothesis Testing: Type I & Type II Error; Hypothesis test about a population Mean for Large Samples: z test; Hypothesis test about a population Mean for Small Samples: t-test. **[5 hrs]**

9. Introduction to Numerical Methods

Needs of numerical method; Errors: types and general formulas for errors; Rolle's and Intermediate value theorems. **[3 hrs]**

10. Solution of Non-linear Equations

Introduction; The Bisection method; The method of False Position; Newton-Raphson Method; Fixed-point iteration method. **[5 hrs]**

11. Interpolation

Introduction; Finite differences; Newton's formula for interpolation; Interpolation with unevenly spaced points: Lagrange's and Newton interpolation formula. **[5 hrs]**

12. System of Linear Equations

Consistency of linear system of equations; Solution of linear system: direct method, method of iteration; Direct method: Gauss-elimination method, method of factorization; Iterative method: Gauss-Jacobins and Gauss-Seidel method; Matrix Eigen values & Eigen vectors. **[7 hrs]**

13. Numerical Integration and Differentiation

Introduction; Numerical differentiation; Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rules; Romberg integration. Numerical double integration: **[5 hrs]**

14. Numerical Solution of Ordinary Differential Equations

Euler's method; Modified Euler's method; Rungekutta methods (2^{nd} & 4^{th} order); Boundary-Value problem (Finite difference method). **[5 hrs]**

Reference Books:

1. Beri G. C., Statistics for Management, Tata McGraw Hill, New Delhi, 2003
2. Medhi J., Statistical Methods, New Age International, 1995
3. Johnson Richard A., Millers Fremund's, Probability & Statistics for Engineers, Pearson Education, 2001
4. Levin Rechard I., Rubin David S., Statistics for Management, Pearson Education, 2004
5. Chandan J. S., Singh Jagit, Khanna K. K., Business Statistics, Vikas Pub. House, 1999
6. S. S. Sastry, Introductory Methods of Numerical Analysis, Prentice Hall India

Object Oriented Programming in C++

Semester: II **Full Marks: 100**
Credit Hr: 3 **Internal: 20+20**
Final Exam: 60

Course Objective: To provide the concepts of object oriented programming and develop the skills for implementing the concepts to solve real world problems using the object oriented paradigm.

Course Contents:

1. **Introduction:** **3 hrs**
   Comparing procedure oriented and object-oriented programming paradigm; Features of object-oriented programming languages; Application and benefits of OOP

2. **Introduction to C++:** **4 hrs**
   History of C++; Data types in C++; Keywords; Input output operations: cin, cout; Comments; new and delete operators; const; typecasting; manipulators

3. **Functions:** **2 hrs**
   Introduction; Function overloading; Inline function; Default arguments

4. **Classes and Objects:** **6 hrs**
   Introduction; Structure and classes; class declaration (public, protected and private modifiers); class objects; Accessing class members; Defining member functions: Member function inside the class body, member function outside the class body; this pointer; static data members and static member functions; passing objects to functions; returning objects from functions; Friend functions and friend classes

5. **Constructors and Destructors:** **3 hrs**
   Functions of constructors and destructors; Syntax of constructors and destructors; Types of constructors; Destructors

6. **Operator Overloading:** **6 hrs**
   Introduction; Operator overloading restrictions; overloading unary and binary operators; Operator overloading using a friend functions; Data conversion: conversion between basic types, conversion between user defined and basic types, conversion between user defined data types

7. **Inheritance:** **7 hrs**
   Introduction; Types of inheritance; Advantages of inheritance; Base classes and derived classes; Constructors and destructors in derived classes

8. **Virtual Functions and Run time Polymorphism:** **6 hrs**
   Introduction; Early binding vs Late binding; Virtual functions; Pure virtual functions, and Abstract base classes

9. **Templates:** **3 hrs**
   Introduction; Advantages of template; Functions template and Class template

10. **Stream in C++:** **5 hrs**
    Streams in C++; Input/output class hierarchy; File input and output

Reference Books:

1. E. Balagurusamy, "Object Oriented Programming with C++", Tata McGraw Hill Publishing Company Limited, India
2. Robert Lafore, “Object Oriented Programming in C++”, Galgotia Publication, India
3. Deitel & Deitel, “C++ How to Program”, 3/e, Prentice Hall
4. John Hubbard, “Schema’s Outlines Programming with C++”, McGraw Hill

System Analysis & Design

Semester: II **Full Marks: 100**
Credit Hr: 3 **Internal: 20**
Final Exam: 80

Course Objective: To impart the knowledge of System and its life cycle in real world.

Course Contents:

1. Introduction — 12 hrs

1.1. System
1.2. Features of System
1.3. System Development Environment
    1.3.1. Different Roles in System Development
    1.3.2. Information and its types
    1.3.3. System Development Life Cycle

2. System Analysis — 7 hrs

2.1. Data Flow Diagram
2.2. E-R Diagram

3. System Design — 9 hrs

3.1. Introduction to Design
3.2. Design Specification
3.3. Traditional Method
3.4. Prototyping

4. Implementation — 5 hrs

4.1. Introduction to System Implementation
4.2. Testing and its types
4.3. Documentation

5. Object Oriented Analysis and Design — 12 hrs

5.1. Introduction
5.2. Features of OOAD
5.3. UML
    5.3.1. Use Case Diagram
    5.3.2. Class Diagram

Reference Book:

1. Modern System Analysis & Design, Third Edition, By: Jeffery A. Hoffer, Joey F. George, Joseph S. Valacich, Pearson Education.

Data Structure & Algorithm

Semester: II **Full Marks: 100**
Credit Hr: 3 **Internal: 20+20**
Final Exam: 60

Course Objective: This course explores techniques for understanding, analyzing and selecting appropriate data structures to solve a given problem.

Course Contents:

1. Linear Data Structures: Array, Records or structures, Operations on Stack, Stack, Applications of Stack Implementation of Stacks (based on Array and linked list), Linked List, List (based on array and linked list), Queues, Operations on Queues, Circular Queues, Priority Queues, Implementation of Queues (Based on array and linked list) Doubly lists, Circularly Lists, operations on lists **15 Hrs**

2. The Analysis of Algorithms: Introduction to Algorithms, Efficiency, Asymptotic Analysis (Big O, omega and Theta Notations) **4 Hrs**

3. Hierarchical Data Structures: Trees, Binary Trees, Operations on Binary Trees, Linked list and array implementation of binary trees, Binary tree traversal, Binary Search Trees, Implementation of Insertion, Deletion and Search in Binary search trees, Indexed Search Trees, Heaps, Implementation of Heaps, Application of heaps. **15 Hrs**

4. Graph Data Structures: Graphs, Operations on Graphs, Adjacency Matrix and List representation, Transversal Algorithms (DFS, BFS), Minimum Spanning Trees, Krushkal's and Prim's, Shortest Path Algorithm (Dijkstra's Algorithm) **5 Hrs**

5. Sorting and Searching Algorithms: Selection sort, Insertion sort, Bubble sort, Binary Tree Sort, Quick sort, Merge Sort, Sequential Search, Binary Search **6 Hrs**

Reference Book:

Data Structures, Algorithms & Applications in Java, Sartaj Sahni, Tata McGraw Hill

Database System

Semester: II **Full Marks: 100**
Credit Hr: 3 **Internal: 20+20**
Final Exam: 60

Course Contents:

1. Database systems 4 Hrs

History and motivation for database systems, Components of database systems, DBMS functions,, Database architecture and data independence, Use of a database query language

2. Data modeling 4 Hrs

Data modeling, Conceptual models (including entry-relationship and UML), Object-Oriented model, Relational data model

3. Relational Databases 5 Hrs

Mapping conceptual schema to a relational schema, Entity and referential integrity, Relational algebra and relational calculus

4. Database query language 8 Hrs

Overview of database languages, SQL (Data definition, query formulation, update, sub-language, constraints, integrity), Query optimization, QBE and 4^{th}-generation, environments, Embedding non-procedural queries in a procedural language, Introduction to Object Query Language

5. Relational Database design 8 urs

Database design, Functional dependency, Normal forms (1NF, 2NF, 3NF, BCNF), Multivalued dependency (4NF), Join dependency (PJNF, 5NF), and Representation theory

6. Transaction processing 5 Hrs

Transactions, Failure and recovery, Concurrency control

7. Physical database design 6 Hrs

Storage and file structure, Indexed files, Hashed files, Signature files, B-trees, Files with dense index, Files with variable length records, Database efficiency and tuning

8. Distributed data based 5 Hrs

Distributed data storage, Distributed query processing, Distributed transaction model Concurrency control, Homogeneous and heterogeneous solutions, Client-server

Laboratory:

1. Installing database software (Oracle/MSQL/MYSQL)
2. Mapping conceptual schema to a relational schema along with following topics using any database:
   - SQL Statements (DML, DDL, DTL and DCL)
   - SQL Clauses (WHERE, ORDER BY, GROUP BY, HAVING)
   - SQL Operators (Logical Operators, Comparision Operators, LIKE, IN, IS NULL, BETWEEN....AND)
   - SQL Integrity Constraints (Primary/Foreign/Unique Key Constraint, Check/Not NULL Constraints)
   - Other SQL concepts (Aliases, Group Functions, JOINS, VIEWS, Subquery, Index, GRANT, REVOKE)
3. Practice for performance tuning (i.e. using indexes)
4. Query in distributed database environments using concept of link servers.

Reference Book:

R. Ramakrishnan, J. Gehrke, Database Management Systems, 3rd Edition, McGraw Hill

Project

Semester: II
Credit Hr: 2

Full Marks: 100
Internal: 60
Final Exam: 40

Course Objective: To design and complete the software project in any high level language (C or C++). On the completion of the project, student will be able to develop small scale software in high level programming language.

Course Contents:

There should be a total of 45 hours covering important features of a high level programming language. A software development project will be assigned to students in a group (upto 4). A relevant topic shall be identified and instructed to each group. Students must develop the assigned software, submit written report, and give oral presentation.

General Procedure:

1. Topic Selection
2. Information Gathering
3. System Requirements and Specifications
4. Algorithms and Flowcharts
5. Coding
6. Implementation
7. Documentation

The project document shall include the following:

1. Technical description of the project
2. System aspect of the project
3. Project tasks and time-schedule
4. Project team members
5. Project supervisor
6. Implementation of the project