Computer Science

Duration: 3 hours   Total Marks: 70

1. PROGRAMMING IN C++   30 Marks
2. DATA STRUCTURES   14 Marks
3. DATABASES AND SQL   8 Marks
4. BOOLEAN LOGIC   8 Marks
5. COMMUNICATION AND OPEN SOURCE CONCEPTS   10 Marks

UNIT 1: PROGRAMMING IN C++

REVIEW: C++ covered In Class –XI,
–Object Oriented Programming:
–Concept of Object Oriented Programming – Data hiding, Data encapsulation, Class and Object, Abstract class and Concrete class, Polymorphism (Implementation of polymorphism using Function overloading as an example in C++); Inheritance, Advantages of Object Oriented Programming over earlier programming methodologies, Implementation of Object Oriented Programming concepts in C++:

–Definition of a class, Members of a class - Data Members and Member Functions (methods), Using Private and Public visibility modes, default visibility mode (private); Member function definition: inside class definition and outside class definition using scope resolution operator (::); Declaration of objects as instances of a class; accessing members from object(s), Array of type class, Objects as function arguments - pass by value and pass by reference;

–Constructor and Destructor:
Constructor: Special Characteristics, Declaration and Definition of a constructor, Default Constructor, Overloaded Constructors, Copy Constructor, Constructor with default arguments;

–Destructor: Special Characteristics, Declaration and definition of destructor;
Inheritance (Extending Classes):

–Concept of Inheritance, Base Class, Derived Class, Defining derived classes, protected visibility mode; Single level inheritance, Multilevel inheritance and Multiple inheritance, Privately derived, Publicly derived and Protectedly derived class, accessibility of members from objects and within derived class(es);

–Data File Handling:
Need for a data file, Types of data files – Text file and Binary file;

Text File: Basic file operations on text file: Creating/Writing text into file, Reading and manipulation of text from an already existing text File (accessing sequentially);

-Binary File: Creation of file, Writing data into file, Searching for required data from file, Appending data to a file, Insertion of data in sorted file, Deletion of data from file, Modification of data in a file;
Implementation of above mentioned data file handling in C++;

-Components of C++ to be used with file handling:
Header file: fstream.h; ifstream, ofstream, fstream classes;
Opening a text file in in, out, and app modes;

-Using cascading operators for writing text to the file and reading text from the file; open(), get(), put(), getline() and close() functions; Detecting end-of-file (with or without using eof() function);
Opening a binary file using in, out, and app modes; open(), read(), write() and close() functions; Detecting end-of-file (with or without using eof() function); tellg(), tellp(), seekg(), seekp() functions

-Pointers:
Declaration and Initialization of Pointers; Dynamic memory allocation/deallocation operators: new, delete; Pointers and Arrays: Array of Pointers, Pointer to an array (1 dimensional array), Function returning a pointer, Reference variables and use of alias; Function call by reference. Pointer to structures: Deference operator: *, ->; self referencial structures;

UNIT 2: DATA STRUCTURES

-Arrays:
One and two Dimensional arrays: Sequential allocation and address calculation;
One dimensional array: Traversal, Searching (Linear, Binary Search), Insertion of an element in an array, deletion of an element from an array, Sorting (Insertion, Selection, Bubble sort), concatenation of two linear arrays, merging of two sorted arrays;

-Two-dimensional arrays: Traversal, Finding sum/difference of two NxM arrays containing numeric values, Interchanging Row and Column elements in a two dimensional array;

-Stack (Array and Linked implementation of Stack):
Operations on Stack (PUSH and POP) and its Implementation in C++, Converting expressions from INFIX to POSTFIX notation and evaluation of Postfix expression;

-Queue: (Circular Array and Linked Implementation):
Operations on Queue (Insert and Delete) and its Implementation in C++.

UNIT 3: DATABASES AND SQL

-Database Concepts:
Relational data model: Concept of domain, tuple, relation, key, primary key, alternate key, candidate key;
Relational algebra: Selection, Projection, Union and Cartesian product;

-Structured Query Language:
General Concepts: Advantages of using SQL, Data Definition Language and Data Manipulation Language;
Data types: NUMBER, CHARACTER, DATE;

-SQL commands:
CREATE TABLE, DROP TABLE, ALTER TABLE, UPDATE…SET…, INSERT, DELETE; SELECT, DISTINCT, FROM, WHERE, IN, BETWEEN, GROUP BY, HAVING, ORDER BY;
SQL functions: SUM, AVG, COUNT, MAX and MIN;
obtaining results (SELECT query) from 2 tables using equi-join, cartesian product and union
Note: Implementation of the above mentioned commands could be done on any SQL supported software on one or two tables.

UNIT 4: BOOLEAN LOGIC

-Binary-valued Quantities, Boolean Variable, Boolean Constant and Boolean Operators: AND, OR, NOT; Truth Tables; Closure Property, Commutative Law, Associative Law, Identity law, Inverse law, Principle of Duality, Idem potent Law, Distributive Law, Absorption Law, Involution law, DeMorgan's

-Law and their applications;
Obtaining Sum of Product (SOP) and Product of Sum (POS) form from the Truth Table, Reducing Boolean Expression (SOP and POS) to its minimal form, Use of Karnaugh Map for obtaining minimal form of Boolean expressions (up to 4 variables);

-Applications of Boolean Logic:
l Digital electronic circuit design using basic Logic Gates (NOT, AND, OR, NAND, NOR)
l Use of Boolean operators (AND,OR) in SQL SELECT statements

l Use of Boolean operators (AND, OR) in search engine queries.

UNIT 5: COMMUNICATION AND OPEN SOURCE CONCEPTS

-Evolution of Networking: ARPANET, Internet, Interspace;
Different ways of sending data across the network with reference to switching techniques;
Data Communication terminologies:
Concept of Channel, Baud, Bandwidth (Hz, KHz, MHz, GHz) and Data transfer rate (bps, kbps, Mbps, Gbps, Tbps);

-Transmission media:
Twisted pair cable, coaxial cable, optical fiber, infrared, radio link, microwave link and satellite link.

-Networking devices:
Modem, RJ45 connector, Ethernet Card, Hub, Switch, Gateway;

-Network Topologies and types:
Bus, Star, Tree; Concepts of PAN, LAN, WAN, MAN

-Network Protocol:
TCP/IP, File Transfer Protocol (FTP), PPP, Level-Remote Login (Telnet); Wireless/Mobile Communication protocols such as GSM, CDMA, GPRs, WLL; Electronic Mail protocol such as SMTP, POP3, iMAP, Chat, Video Conferencing;

-VoIP protocols such as Wi-Fi and Wi-Max Network Security Concepts:
Threats and prevention from Viruses, Worms, Trojan horse, Spams
Use of Cookies, Protection using Firewall;
India IT Act, Cyber Law, Cyber Crimes, IPR issues, Hacking.

-Web Services :
Hyper Text Markup Lanuage (HTML), eXtensible Markup Language (XML); Hyper Text Transfer Protocol (HTTP); Domain Names; URL; IP Address; Website, Web browser, Web Servers; Web Hosting, Web Scripting – Client side (VB script, Java Script, PHP) and Server side (ASP, JSP, PHP), Web 2.0 (for social Networking)
Open Source Terminologies: Open Source Software, Freeware, Shareware, Proprietary software, FLOSS, GNU, FSF, OSI;