B.TECH/EE/5TH SEM/ELEC 3104/2016

DATA STRUCTURE & DATABASE CONCEPT
(ELEC 3104)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) Which of the following Data Structures is essential for the conversion of an infix expression to postfix?
(a) Queue (b) Operator Stack
(c) Operand Stack (d) None of these.

(ii) In array representation of Binary tree, if the index number of a child node is 7 then the index number of its parent node is
(a) 2 (b) 3 (c) 4 (d) 1.

(iii) There are 8, 15, 13 and 17 nodes in 4 different trees. Which one of them can form a full as well as complete binary tree?
(a) Tree with 8 nodes (b) Tree with 15 nodes
(c) Tree with 13 nodes (d) Tree with 17 nodes.

(iv) In C language, malloc () returns
(a) integer pointer (b) structure pointer
(c) null pointer (d) void pointer.

(v) The minimum number of edges required to connect all the nodes of a graph with p nodes is
(a) $2p$ (b) p^2 (c) $p - 1$ (d) $p + 1$.

(vi) DDL stands for
(a) Data dictionary language
(b) Dictionary defined language
(c) Data defined language
(d) Data definition language.

(vii) In a relational model, data in columns of a table are called
(a) Relation (b) Tuple
(c) Degree (d) Attributes.

(viii) View is a
(a) Virtual table (b) Temporary table
(c) SQL statement (d) Query.

(ix) The information about data in a database is called
(a) Meta Data (b) Tera Data
(c) Hyper Data (d) None of these.

(x) A transaction is said to be atomic, if and only if
(a) transaction is partially completed
(b) transaction is fully completed
(c) transaction does not take place
(d) none of these.

Group – B

2. (a) Convert the following infix expression into its corresponding postfix one: A * (B + D) / E – F * (G + H / K).Explain the steps involved.

(b) Write an algorithm or a pseudo-code to insert a number (given by the user) before an existing number in the linked list. Suppose the structure for a node is already written and the address of the first node of the list is stored in head.

(c) Define linear and non-linear data structure using examples.
6 + 4 + 2 = 12

3. (a) Write an algorithm or pseudo-code to evaluate postfix expression using stack and use it to evaluate 4 3 2 * + 9 -. Write all intermediate steps.

(b) Write a function to implement the push() operation in a stack using linked list.

(c) In case of a Linked List which method of searching is more suitable and why?
(3 + 3) + 4 + 2 = 12

Group – C

4. (a) Construct a binary tree whose nodes in inorder and preorder are given as follows:
Inorder : 5, 10, 12, 13, 15, 20, 25, 30, 33, 35, 45
Preorder: 15, 10, 5, 13, 12, 25, 20, 35, 30, 33, 45
Show all intermediate steps.

(b) Write a function to implement Binary Search on an n-element array.

(c) State the advantages of Binary Search over Linear Search.

(d) How bubble sort may be improved by reducing the time complexity? Explain.

5 + 3 + 2 + 2 = 12

5. (a) Write down an algorithm to implement Quick Sort on a set of n numbers.

(b) Make a BST for the following sequence of numbers.
45, 32, 90, 34, 68, 72, 15, 24, 30, 66, 11, 50. Show all intermediate trees.

(c) Write a recursive function to find the sum of first *n* natural numbers.

5 + 4 + 3 = 12

Group – D

6. (a) What do you mean by degree and cardinality of a relationship? What do you mean by data abstraction? Explain three levels of data abstraction.

(b) Consider the following relations for a database that keeps track of business trips of salespersons in a sales office.
SALESPERSON(SSN, Name, start-year, dept-name)
TRIP(TRIP-id, SSN, from-city, to-city, departure-date, return-date)
EXPENSE(TRIP-id, Account#, Amount)
Specify the following queries in SQL.
(i) Give the details for trips that exceeded Rs.2000 in expenses.
(ii) Print SSN of a salesman who took trips to 'Andaman'.

(c) What do you mean by attributes?

(2 + 1 + 2) + (2.5 + 2.5) + 2 = 12

7. (a) Draw an ER diagram for the following system:
An organization has number of faculty members who are experts in one or more subjects. For each subject, number of such experts are there. System will store subjects and faculty information and must support query on finding expertise on subjects. Students get enrolled to have training on one or more subjects. System will also keep the student information. One faculty is allocated to teach one or more subjects and for one subject only one faculty has been assigned. System will keep the information regarding such assignment.

(b) State the advantages of DBMS over file processing system.

8 + 4 = 12

Group – E

8. (a) Explain fully functional dependency with example. Define foreign key with example. Why is referential integrity so called?

(b) Discuss "insertion anomalies", "deletion anomalies", "updation anomalies" with respect to normal forms with suitable example and suggest a method to overcome it.

(2 + 2 + 2) + 6 = 12

9. (a) Let T1, T2 and T3 be transactions that operate on the same data items A, B and C. Let r1(A) means that T1 reads A, w1(A) means that T1 writes A and so on for T2 and T3.
Consider the following schedule :
S1 : r2(c), r2(B), w2(b), r3(B), r3(C), r1(A), w1(A), w3(B),w3(C), r2(A), r1(B), w1(B), w2(A).
Is the schedule serializable?
What is ACID property?

(b) Consider the relation assignment {worker_id,building_id, startdate, name skilltype} and FDs are:
{worker_id->name
(worker_id, building_id)->startdate}.
Is the relation in 2NF? If not, then make it in 2NF.
Explain 3NF with suitable example(s).

(3 + 4) + (3 + 2) = 12