Registration No. :

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# First Year Special Examination – 2014

## DATA STRUCTURE USING C
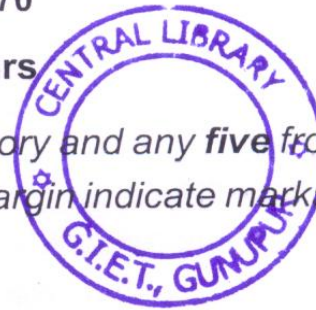
### BRANCH(S) : CSE, EC, ELECTRICAL, ETC.

#### QUESTION CODE : G 648

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*
*The figures in the right-hand margin indicate marks.*

1. Answer the following questions :                                                 2 ×10
   (a) Define algorithm ? What are the criteria that every algorithm must satisfy ?
   (b) What is two-dimensional array ? How they are stored in memory ?
   (c) Write a short note on Overflow and Underflow in linked list.
   (d) A complete binary tree contains 15 nodes. Calculate the depth of the tree ?
   (e) Write a postfix form of a following expression:
       A && B !C || D
   (f) What do you understand by sparse matrix ?
   (g) What is threaded binary tree ?
   (h) Write a short note on garbage collection.
   (i) What is minimum spanning tree ?
   (j) What is tree data structure ? What are different ways of traversing a tree ?

2. (a) Define stack with suitable example. Develop an algorithm in which each item
       on the stack is a varying number of integers to design a push and pop
       function for it.                                                            5
   (b) How two-dimensional arrays are stored in one dimensional memory ? If an
       array is defined as int a[10][20] in C. Device a formula to calculate the
       address of an any variable say a[i][j] for any valid value of i and j.       5

3. (a) Consider an initially empty B-Tree with minimum degree t = 3. Draw the
       B-Tree after the insertion of the keys 27, 33, 39, 1, 3, 10, 7, 200, 23, 21, 20,

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and then after the additional insertion of the keys 15, 18, 19, 13, 34, 200, 100, 50, 51.

5

(b) Write an algorithm to find the number of connected components in a graph.

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4. Explain the various graph representation methods. List merits and demerits of each ?

10

5. (a) What is Binary Search Tree ? Define. Draw a binary search tree when following keys are inserted in order in the initially empty binary search tree 5, 75, 19, 36, 8, 62, 49, 84, 12, 18, 25. How can a binary search tree be used for sorting of the keys ?

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(b) What is an AVL tree ? Discuss the various kinds of rotations done for rebalancing the tree after insertion. Choose suitable example for illustration.

5

6. (a) Develop an algorithm to delete a specific element in a single linked list. Doubly linked list takes more space than singly linked list for storing one extra address. In what condition could be a doubly linked list be more beneficial than singly linked list.

5

(b) Consider the array $A = \{29, 18, 10, 15, 20, 9, 5, 13, 2, 4, 15\}$

5

   (i) Does A satisfy the max-heap property? If not, ?x it by swapping two elements

   (ii) Using array A (possibly corrected), illustrate the execution of the max-heap algorithm, which calculates the max element and then rearranges the array to satisfy the max-heap property

7. (a) Illustrate the execution of the merge-sort algorithm on the array

$A = \{3, 13, 89, 34, 21, 44, 99, 56, 9\}$

For each fundamental iteration or recursion of the algorithm, write the content of the array.

5

(b) A hash table with chaining is implemented through a table of K slots. What is the expected number of steps for a search operation over a set of $N = K/2$ keys ? Briefly justify your answers.

5

8. Write short notes on (any **two**) :

5 x 2

(a) Application of link list
(b) Buddy system of Allocation
(c) Topological sorting
(d) B-tree.