M.Sc 4th Semester Examination, 2010

APPLIED MATHEMATICS WITH OCEANOLOGY AND COMPUTER PROGRAMMING

PAPER—MA - 2201

Full Marks : 50

Time : 2 hours

The figures in the right-hand margin indicate marks

GROUP—A

(*Topology*)

[*Marks* : 25]

1. Answer any *two* questions: 1×2

(*a*) State Tychonoff theorem.

(*b*) Let $X=\{a, b, c\}$ and $Y=\{Q, \{a\}, X\}$. Find y-neighbourhoods of a.

(*c*) State Urysohn's lemma.

2. Answer any *three* questions: 4×3

(*a*) Define accumulation point of a topological space. Prove that a subset A of a topological space is closed if and only if A contains each of its accumulation point.

(*b*) Define limit points of a subset A of a topological space (X, Y). Let $X = \{a, b, c\}$ and $Y = \{Q, X, \{b\}, \{a, c\}\}$. Find the limit points of the set $\{a, b\}$.

(*c*) Let X be a topological space. Prove that X is a T_1-space if and only if every singleton subset of X is closed.

(*d*) Prove that homeomorphism is an equivalence relation in the collection of all topological spaces.

(*e*) When a subset B of a topological space (X, Y) is said to be disconnected ? Prove that every discrete topological space is disconnected.

3. Answer any *one* question: 6×1

(*a*) Let A and B be disjoint compact subsets of a Hausdorff space X. Prove that there exist disjoint open sets G and H such that $A \subset G$ and $B \subset H$.

(*b*) Define a normal space. Prove that a topological space (X, Y) is normal if and only if for every closed set $F \subset X$ and open set G containing F, there exists an open set V such that $F \subset V \subset \bar{V} \subset G$.

[*Internal Assessment*: 5 Marks]

GROUP—B

(*Data Structure and Design and Analysis of Algorithms*)

[*Marks* : 25]

Answer **Q. No. 4** and any **two** from the rest

4. Answer any *two* questions: 2×2

(*a*) Define data structure. Name two important data structures.

(*b*) What are the differences between the data structures stack and queue ?

(*c*) What are the best case, average case and worst case time complexities of binary search ?

(*d*) Define "Big-oh (O)".

5. Define heap. Write heap sort algorithm to arrange a list of real numbers in ascending order. What is the time complexity of this method ? 1 + 6 + 1

6. What do you mean by postfix expression ? Write an algorithm to evaluate a postfix expression. State the drawback of your algorithm. 1 + 6 + 1

7. Define a single linked list. Write an algorithm to create a single non-circular linked list containing n elements $x_1, x_2, \ldots, x_n$. Also, find the maximum among these elements. 2 + 4 + 2

8. Define spanning tree. What do you mean by a minimum cost spanning tree? Give examples. Describe an algorithm in computing a minimum cost spanning tree with all basic assumptions, and show how it works for a suitable example. 2 + 2 + 4

[*Internal Assessment* : 5 Marks]