PG/IVS/MTM-401/14

M.Sc. 4th Semester Examination, 2014

APPLIED MATHEMATICS WITH OCEANOLOGY AND COMPUTER PROGRAMMING

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

PAPER – MTM - 401

Full Marks : 50

Time : 2 hours

The figures in the right-hand margin indicate marks

GROUP – A

(*Topology*)

[*Marks* : 25]

Answer **Q.No.1** and any **two** from the rest

1. Answer any *two* questions : 2 × 2

(*a*) Define basis for a topology on a set X.

(*b*) Give example of a T_3 and T_4 topological spaces.

(*c*) Define connected topological space with an example.

(*d*) State the second axiom of countability.

2. (*a*) Show that every finite Point set in a Hausdorff space X is closed.

(*b*) Let $f: X \to Y$ be a function between two topological spaces X and Y. Show that the following statements are equivalent :

(*i*) $f: X \to Y$ is continuous.

(*ii*) $f^{-1}(F)$ is closed in X for each closed set F in Y. 4 + 4

3. (*a*) Consider the function $f: \mathbb{R} \to \mathbb{R}^w$ given by the equation $f(t) = (t, t, t, ...)$. Show that f is continuous if $\mathbb{R}^w$ is given in the product topology but f is not continuous if $\mathbb{R}^w$ is given in the box topology.

(*b*) Let $\phi: X \to Y$ be a continuous function and X be a connected space. Then show that $\phi(X)$ is connected. 4 + 4

4. (*a*) If (X, τ) is a Hausdorff space and (A, τ_A) is compact, then prove that A is closed in (X, τ).

   (*b*) Prove that every Euclidean n-space is a metric space. 4 + 4

5. (*a*) Is the collection $\tau_\infty = \{ U \mid X - U$ is infinite or empty or all of $X\}$ a topology on X?

   (*b*) (*i*) Give an example of a space which is 1st countable but not 2nd countable.

   (*ii*) State the following theorems :

   Urysohn lemma, Tychnoff theorem.

   3 + (1 + 4)

[*Internal Assessment* : 05 Marks]

GROUP– B

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

[*Marks* : 25]

Answer **all** questions

6. Answer any *two* questions : 2 × 2

   (*a*) Explain O(big-oh) notation along with its use.

(*b*) State the advantages and disadvantages of circularly linked linear lists over singly liked linear lists.

(*c*) Briefly state how *Quick Sort* works.

(*d*) Explain divide and conquer method.

7. Answer any *four* questions : 4 × 4

(*a*) Write short notes on any *two* of the following : 2 + 2

(*i*) Greedy method

(*ii*) Representation of a graph in a computer

(*iii*) Binary search.

(*b*) Write an algorithm to evaluate postfix expression. 4

(*c*) Distinguish between BFS and DFS. 4

(*d*) Consider the set of integers given below for sorting in some order and use *Heap sort* to sort them. Clearly show the steps necessary,

and count number of comparisons and number of moves required in this case of sorting.

{ 35, 21, 8, 37, 28, 17, 3, 31, 11, 42, 5, 25 } 4

(*e*) Write an algorithm to find the average of *n* numbers using linked list. 4

(*f*) Write Dijkstra algorithm to find the shortest distance from a vertex to all other vertices in an undirected graph. 4

[*Internal Assessment* : 05 Marks]