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MT-507

M.A./M.Sc. Mathematics (MAMT/MSCMT)

Topology

Examination, 2026 (Feb.)

Time : 2:00 Hrs. Max. Marks : 70

Note* :–** This paper is of Seventy (70) marks divided into Two (02) Sections 'A' and 'B'. Attempt the questions contained in these Sections according to the detailed instructions given therein. ***Candidates should limit their answers to the questions on the given answer sheet. No additional (B) answer sheet will be issued.

Section–A

Long Answer Type Questions 2×19=38

***Note* :–** Section 'A' contains Five (05) Long-answer type questions of Nineteen (19) marks each. Learners are required to answer any *two* (02) questions only.

1. Prove that a second countable space is always first countable space, but converse is not true.

2. Show that every T_2-space is a T_1-space but the converse is not true.

3. Let Y be a subspace of a topological space (X, T) and A is a subset of Y. Then show that A is compact relative to X iff A is compact relative to Y.

4. Prove that a topological space is compact if and only if every class of closed sets with empty intersection has a finite subclass with empty intersection.

5. Prove that closure of a connected set is connected.

Section–B

Short Answer Type Questions 4×8=32

***Note* :–** Section 'B' contains Eight (08) Short-answer type questions of Eight (08) marks each. Learners are required to answer any *four* (04) questions only.

1. Define the following terms :

   (i) Topological space.

   (ii) Closed sets in a Topological space

   (iii) Derived set in a Topological space

   (iv) Boundary set in a Topological space

2. Let T = {Φ, X, {1}, {1, 2}, {1, 2, 5}, {1, 2, 3, 4}, {1, 3, 4}} be the topology on X = {1, 2, 3, 4, 5}. Determine limit points, closure, interior, exterior and boundary of the following sets :

   (i) A = {3, 4, 5}

   (ii) B = {2}

3. Prove that a subset A of a space X is dense in X iff for every non empty open subset G of X. $A \cap G \neq \phi$.

4. Prove that a function $f : X \to Y$ is continuous iff the inverse image of every closed subset of Y is a closed subset of X.

5. Prove that Homeomorphism is an equivalence relation in the family of a topological spaces.

6. Prove that every metric space is T_2-space.

7. Prove that every T_4-space is a T_3-space.

8. Prove that a subset of R is connected iff it is an interval.

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