



QP CODE: 25050454



25050454

Reg No :

Name :

MSc DEGREE (CSS) EXAMINATION DECEMBER 2025

First Semester

M Sc MATHEMATICS

Core Courses - ME010103 - BASIC TOPOLOGY

2019 Admission Onwards

8DA3B197

Time: 3 Hours

Weightage: 30

Part A (Short Answer Questions)

Answer any **eight** questions.

Weight 1 each.

1. Define convergence of a sequences in a topological space. Discuss the convergence of sequence in a discrete space.
2. Define order topology.
3. Define hereditary property Show that subspace of an indiscrete space is indiscrete.
4. Define neighborhood of a point and interior point of a set.
5. Define (i) homeomorphism (ii) imbedding
6. Define quotient topology and quotient space.
7. Let A be a clopen subset of a space X .Prove that boundary of A is empty.
8. Let $\mathcal{C}$ be a collection of connected subsets of a space X and suppose K is a connected subset of X such that $C \cap K \neq \emptyset, \forall C \in \mathcal{C}$. Prove that $(\bigcup_{C \in \mathcal{C}} C) \cup K$ is connected.
9. Define T_0 and T_1 space with example. Give an example of a T_0 space which is not T_1
10. Define T_5 space

(8×1=8 weightage)

Part B (Short Essay/Problems)

Answer any **six** questions.

Weight 2 each.

11. What are the properties of open sets in a metric space?
12. Given any family S of subsets of X show that there exist a unique topology having S as a sub base
13. Let the function $f : X \rightarrow Y$ is $\mathcal{J} - \mathcal{U}$ continuous, where $\mathcal{J}, \mathcal{U}$ be topologies on X, Y respectively. Then show that for all $V \in \mathcal{U}$, $f^{-1}(V) \in \mathcal{J}$ if and only if there exist a sub-base $\mathcal{S}$ for $\mathcal{U}$ such that $f^{-1}(V) \in \mathcal{J}$, for all $V \in \mathcal{S}$





14. Let X have the strong topology determined by a family $\{f_i : Y_i \rightarrow X / i \in I\}$ of functions where each Y_i is a topological space, I being an index set. Then show that for any space Z , a function $g : X \rightarrow Z$ is continuous if and only if for each $i \in I$, the composite $g \circ f_i : Y_i \rightarrow Z$ is continuous.
15. Prove that every continuous real valued function on a compact space is bounded .
16. Prove or disprove : Every first countable space is second countable.
17. Show that path connectedness is preserved under continuous onto functions.
18. What is the peculiarity of limit of a converging sequence in a Hausdorff space. What is the converse.? Justify your answer.

(6×2=12 weightage)

Part C (Essay Type Questions)

Answer any **two** questions.

Weight **5** each.

19. Explain three equivalent conditions for a base of a topological space
20. Let A, B be subsets of a topological space X and $c(A)$ is the closure of A . Then show that (i) $c(A)$ is a closed set in X and it is the smallest closed subset of X containing A . (ii) A is closed in X if and only if $c(A) = A$. (iii) $c(\phi) = \phi$. (iv) $c(c(A)) = c(A)$. (iv) $c(A \cup B) = C(A) \cup C(B)$.
21. (i) Let (X, τ) be a topological space and A be a subset of X . Prove that A is a compact subset of X if and only if the space $(A, \tau|_A)$ is compact.
(ii) Prove that every second countable space is separable.
22. What are the equivalent conditions of locally connected space? Explain.

(2×5=10 weightage)

