

MSc. Mathematics

Paper: 201 (Topology & Functional analysis)

First Annual / 2017

Maximum Marks: 100

Time Allowed: 3 1/2 Hrs

NOTE: Attempt any Five questions including compulsory Q. No. 1 & selecting at least One question from each Section. All questions carry equal marks.

Q.1: Each part of question carries 04 marks.

- i. Every totally bounded metric space is bounded.
- ii. Any infinite space with cofinite topology is connected.
- iii. A space X is a T_1 -space then prove that Each one point subset of X is closed.
- iv. State and prove polarization identity.
- v. Define following (a) Orthogonal projection (b) Hilbert space

Section-I

2. (a) A family $\mathcal{B}$ of subset of a topological space (X, τ) is a base for topology iff
 - (i) $X = \bigcup B$, that is, every point of X is in some $B \in \mathcal{B}$
 - (ii) For $B_1, B_2 \in \mathcal{B}$ and $x \in B_1 \cap B_2$, there is a $B \in \mathcal{B}$ such that $x \in B \subseteq B_1 \cap B_2$.
- (b) Prove that every second countable space is first countable. Is the converse of this statement generally hold? Verify with example.
3. (a) Prove that every completely regular T_1 -space is T_2 -space.
- (b) Prove that a closed continuous image of a normal space is normal.
4. (a) Every sequentially compact space is countably compact.
- (b) The continuous image of a connected space is connected.

Section-II

5. (a) Prove that the normed space l_∞ is a Banach space.
- (b) Let N be a normed linear space in which every absolutely convergent series converges iff N is a Banach space.
6. (a) Let N be a normed space and N^* be its dual space then prove that $\dim(N) = \dim(N^*)$.
- (b) State and prove F. Riesz lemma.

Section-III

7. (a) Let A be a complete subspace of an inner product space V . Then there is a non-zero vector z in V such that $z \perp A$.
- (b) Prove that every inner product space is normed space. Is the converse of this statement generally hold? Verify with example.

Mathematics Past Papers 201

Kathleen Armour



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German. This majestic piece was written by the composer as a gift to his wife for their own wedding ceremony.