The Islamia University of Bahawalpur

Department: Mathematics

522

MSc. Mathematics
Paper: *201 (Topology & Functional analysis)*

First Annual / 2017
Maximum Marks: 100
Time Allowed: 3 ½ 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 B of subset of a topological space (X, τ) is a base for topology iff

   (i) $X = UB$, that is, every point of X is in some $B \varepsilon \boldsymbol{B}$

   (ii) For $B_1, B_2 \epsilon \boldsymbol{B}$ and $x \epsilon B_1 \cap B_2$, there is a $B \varepsilon \boldsymbol{B}$ 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.

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