

**SYLLABUS FOR THE TOPOLOGY PRELIMINARY
EXAMINATION**

- (1) **Basic Concepts:** Topologies and comparisons of topologies, bases, the subspace topology, continuous functions.
- (2) **Compactness:** compactness, local compactness, paracompactness and partitions of unity, the one-point compactification.
- (3) **Connectedness:** connectedness, path connectedness.
- (4) **Countability and Separation Axioms:** Hausdorff property, regularity, normality, Urysohn's lemma, the Tietze extension theorem, first/second countable, separable.
- (5) **Product Spaces**
- (6) **Quotient Spaces**
- (7) **Metric Spaces:** completeness, Baire category theorem.
- (8) **Function Spaces:** compact-open topology, uniform topology.
- (9) **The Fundamental Group:** retractions, homotopy, homotopy equivalence, deformation retractions, contractible spaces, π_1 , the Seifert - van Kampen theorem.
- (10) **Covering Space Theory:** the lifting theorem, the group of Deck transformations, classification of covering spaces.
- (11) **Manifolds:** smooth manifolds, tangent spaces, regular values, the smooth approximation theorem, surfaces.