TOPOLOGY QUALIFYING EXAM SYLLABUS


**Part 1:** Point Set Topology  
Topologies, bases, closed sets, limit points, various concepts of connectedness and compactness, countability and separation properties, subspace, product and quotient topologies.

**Part 2:** Fundamental groups and covering spaces. Homotopy, Fundamental group, retractions, deformation retractions, homotopy type, covering spaces, the fundamental group of the circle, Seifert-Van Kampen Theorem.


**Part 1:** Fundamental groups and covering spaces.  
Seifert-Van Kampen Theorem (continued), Classification of Covering Spaces.

**Part 2:** Homology  
Simplicial and chain complexes, simplicial and singular homology, and applications: homotopy invariance, relative homology, excision, long exact sequence of a pair, Mayer-Vietoris sequences, Brouwer’s Fixed Point Theorem, Invariance of domain, Jordan-Brouwer Separation Theorem.


Topological manifolds, smooth structures, smooth maps and their differentials, the tangent bundle, Lie groups and their Lie algebras, partitions of unity, vector fields, Lie brackets, submersions, immersions, embeddings, submanifolds, embedding and approximation theorems, Lie group actions, Sard’s theorem, flows, degree theory.