GENERAL TOPOLOGY:

1. **Topological spaces and continuous functions**: Topological spaces, basis and subbasis, subspace topology, continuous functions, product topology, metric topology, quotient topology.

2. **Compactness:** Compact spaces, compact sets in R^n, Heine–Borel Theorem, Tychonoff Theorem, limit-point compactness, sequential compactness, compactness in metric spaces.

3. **Connectedness:** Connected spaces, path-connected spaces, components.

4. **Separation and Countability Properties:** T\_0, Hausdorff, regular, normal spaces; Uryshon Lemma, Tietze Extension Theorem, countability properties; Lindelöf, separable

References: Munkres J., Topology, a First Course

Willard S., General Topology

ALGEBRAIC TOPOLOGY:

Fundamental group, Van Kampen’s Theorem, covering spaces. Singular Homology: Homotopy invariance, homology long exact sequence, Mayer- Vietoris sequence, excision. Cellular homology. Homology with coefficients. Simplicial homology and the equivalence of simplicial and singular homology. Axioms of homology. Homology and fundamental group. Simplicial approximation. Cohomology groups, Universal Coefficient Theorem, cohomology of spaces. Products in cohomology, K¨unneth formula. Poincar´e Duality. Universal Coefficient Theorem for homology. Homotopy groups.

Main Reference: A. Hatcher, Algebraic Topology (2000).