TOPICS FOR MATHEMATICS 246A, WINTER 2009

Preface
Prerequisites

I. Foundational and geometric background

1. Categories and functors (Hatcher, 2.3)
2. Barycentric coordinates and polyhedra (Hatcher, 2.1)
3. Subdivisions (Hatcher, 2.1)
4. Cones and suspensions (Hatcher, Ch. 0)

II. Topological background

1. Homotopic mappings (Hatcher, 0; Munkres, 58)
2. Review of the fundamental group (Hatcher 1.1 – 1.3, 1.A; Munkres, 52, 54)
3. Abstract cell complexes (Hatcher, 0)
4. The Homotopy Extension Property (Hatcher, 0, 2.1)

III. Simplicial homology

1. Exact sequences and chain complexes (Hatcher, 2.1)
2. Homology groups (Hatcher, 2.1)
3. Homology and simplicial complexes (Hatcher, 2.1)
4. Chain homotopies (Hatcher, 2.1)
5. Comparison principles (Hatcher, 2.1 – 2.2)

IV. Singular homology

1. Definitions (Hatcher, 2.1)
2. Eilenberg-Steenrod properties (Hatcher, 2.1, 2.3)
3. Proofs (Hatcher, 2.1 – 2.3)
4. Excision (Hatcher, 2.1, 2.3)
5. Homology and the fundamental group (Hatcher, 2.A)

V. Geometric applications

1. Degree theory (Hatcher, 2.2)
2. Classical theorems of Jordan and Brouwer (Hatcher, 2.A; Munkres, 61 – 64)
3. Simplicial approximation (Hatcher, 2.C)
4. The Lefschetz Fixed Point Theorem (Hatcher, 2.C)
5. Dimension theory (Munkres, 50)

VI. Homology and differential forms

(These will be covered if time permits.)

1. Cohomology and coefficients (Hatcher, 2.2, 3.1)
2. Smooth singular chains
3. Differential forms and Stokes' Formula
4. de Rham's Theorem