Orals Examination Syllabus
Major Area: Algebraic Topology

Justin M. Curry

1. Fundamental Group and Covering Spaces (Hatcher)
   (a) The Seifert-Van Kampen theorem
   (b) Lifting properties and Deck Transformations
2. Homology and Cohomology (Hatcher, Bredon, Bott & Tu)
   (a) Singular and Cellular homology
   (b) Eilenberg-Steenrod axioms
   (c) Mayer-Vietoris sequence
   (d) The Universal Coefficient Theorems for Homology and Cohomology
   (e) Cross product and the Künneth formula
   (f) Cup and cap products
   (g) Poincaré and Alexander duality
   (h) De Rham cohomology and differential forms
3. Homotopy Theory (Hatcher, Bott & Tu)
   (a) Higher homotopy groups and long exact sequences in homotopy, Fibrations
   (b) Whitehead's Theorem
   (c) Excision for homotopy groups, Freudenthal Suspension Theorem
   (d) Hurewicz's Theorem
   (e) Brown Representability
4. Serre Spectral Sequence and Applications (Hatcher SSAT)
5. Bundle Theory and Characteristic classes (Milnor & Stasheff through §16, Bott & Tu)
   (a) Euler, Steifel-Whitney, Chern and Pontrijagin classes
   (b) Classifying spaces
   (c) Thom isomorphism and the Gysin sequence
6. Morse Theory (Nicolaescu's Invitation to Morse Theory, Chapters 1,2)
   (a) Morse Functions
      i. The Local Structure of Morse Functions
      ii. Existence of Morse Functions
   (b) The Topology of Morse Functions
      i. Surgery, Handle Attachment, and Cobordisms
      ii. The Topology of Sublevel Sets
      iii. Morse Inequalities
      iv. Morse-Smale Dynamics
      v. Morse-Bott Functions
      vi. Min-Max Theory