Math 250 ABC

Algebraic Topology

Lecture, 3 hours. It roughly contains three parts: first part: fundamental group and covering space; second part: homology and cohomology; third part: differential topology.

Prerequisite: Math 218ABC or consent with the instructor
Text Books:

1. *Algebraic Topology*, A. Hatcher, Cambridge University Press;
2. *Foundations of differential manifolds and Lie groups*, GTM 94, F. Warner, Springer-Verlag;
3. *Differential forms in algebraic topology*, GTM 82, R. Bott & L. Tu, Springer-Verlag.

Fall quarter

1. The fundamental group
    1) Basic constructions
    2) Van Kampen's Theorem
    3) Covering spaces
    4) *Additional topics*: graphs and free groups
2. Homology
    1) Simplicial and singular homology
    2) Cellular homology
    3) Computations and applications
3. The formal viewpoint
    1) Categories and functors
    2) Axioms of homology

Winter quarter

1. Cohomology groups
    1) The universal coefficient theorem
    2) Cohomology of space
    3) The cohomology ring
    4) Kunneth formula
    5) Orientation of manifolds
    6) Poincare duality
    7) Baby sheaf theory
    8) *Additional topics*: universal coefficients for homology

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Spring Quarter

1. Differential manifold revisited
    1) Differential manifold and differential forms
    2) Stokes Theorem
2. de Rham cohomology
3. Cech cohomology
    1) Sheaves
    2) Cech cohomology
    3) Isomorphism between the de Rham and Cech cohomology
4. Vector bundles
5. Characteristic Classes
6. Bott-Chern Classes
7. *Additional topics*: Donaldson's functional
