Mathematics 547/548/549: Geometric Structures

MWF 1:30–2:20

PREREQUISITES: *Topology and Geometry of Manifolds* (Math 544/5/6).

TEXT (AUTUMN QUARTER): *Riemannian manifolds*, Lecture notes by John M. Lee, available and Professional Copy 'n' Print, 4200 University Way NE (634-2689).

(WINTER AND SPRING QUARTERS): no required text.

Math 547 (Autumn Quarter)

JOHN M. LEE

RIEMANNIAN MANIFOLDS

- Definitions and examples of Riemannian metrics
- Connections
- Geodesics and distance
- Curvature
- Riemannian submanifolds and the Gauss-Bonnet theorem
- Jacobi fields, and applications to curvature and topology

Math 548 (Winter Quarter)

JOHN M. LEE

BUNDLES, CONNECTIONS, AND COHOMOLOGY

- Sheaves, cohomology and the proof of the deRham theorem
- Vector bundles, fiber bundles, and principal bundles
- Introduction to characteristic classes
- Čech construction of the first Chern and Stiefel-Whitney classes
- Connections in vector bundles and principal bundles
- Chern-Weil construction of characteristic classes

Math 549 (Spring Quarter)

DANIEL POLLACK

MINIMAL SURFACES

- Sobolev spaces and the calculus of variations
- Special solutions of the minimal surface equation
- The classical Plateau problem
- Global properties and Bernstein's theorem
- Embedded surfaces of finite total curvature
- Applications to the geometry and topology of Riemannian manifolds