Math 435 lecture plan
Spring 2024

Note: this lecture plan is tentative and will be adjusted to adapt to the pace of the course.

Week 1 (Monday, Jan 8)
Spivak, chapters 1-2

- Calculus review

Week 2 (Monday, Jan 15)
Spivak, chapters 1-2

- *(Martin Luther King Day)*
- More calculus review
- Implicit and inverse function theorems

Week 3 (Monday, Jan 22)
Spivak, chapter 3

- Multidimensional integration
- Measure 0 sets
- Jordan-measurable sets

Week 4 (Monday, Jan 29)
Spivak, chapter 3

- Fubini's theorem
- Partitions of unity
- Integration on arbitrary open sets
- Sard's theorem

Week 5 (Monday, Feb 5)
Spivak, chapter 4

- Multilinear algebra
- Differential forms
- Exterior derivative

Week 6 (Monday, Feb 12)
Spivak, chapter 4

- Closed and exact forms
- Poincaré Lemma

Week 7 (Monday, Feb 19)
Spivak, chapter 4

- *(President's Day)*
- Chains
- Stokes' theorem on chains

Week 8 (Monday, Feb 26)
Spivak, chapter 5

- **Midterm in class on Monday, Febuary 26**
- Manifolds
- Differential forms on manifolds
- Orientations

Week 9 (Monday, Mar 4)
Spivak, chapter 5

- Stokes' theorems on manifolds
- The volume element
- The classical theorems (Divergence, Green's, Stokes')

Week 10 (Monday, Mar 11)
Spring break

Week 11 (Monday, Mar 18)
Tapp, Chapter 1-2

- Curves in $\mathbb{R}^n$
- Arc length
- Curvature
- Torsion
- Curves with prescribed curvature and torsion
- Hopf's Umlaufsatz
- Isoperimetric inequality

Week 12 (Monday, Mar 25)
Tapp, Chapters 3.7-3.9 and 4.1

- The first fundamental form
- Archimedes hat box theorem
- The Gauss map

Week 13 (Monday, Apr 1)
Tapp, Chapters 4.3-4.5

- The second fundamental form
- Normal curvature and Gaussian curvature

Week 14 (Monday, Apr 8)
Tapp, Chapters 5.1-5.3

- Geodesics
- Exponential map
- Theorema Egregium

Week 15 (Monday, Apr 15)
Tapp, Chapter 6

- The Gauss-Bonnet theorem
- Compact surfaces

Week 16 (Monday, Apr 22)

- (Time permitting) Riemann surfaces

Week 17 (Monday, Apr 29)

- (Time permitting) Hyperbolic geometry