TOPICS FOR MATHEMATICS 205C, SPRING 2005

0. Prerequisites (Conlon, Preface)

I. Topological background

1. Topological manifolds (Conlon, §§1.1–1.2, 1.7, Appendix A)
2. Partitions of unity (Conlon, §§1.4–1.5)
3. The Contraction Lemma (Conlon, Appendix B)
4. Basic topological constructions revisited

II. Local theory of smooth functions

1. Differentiability (Conlon, §§2,1, 2.3–2.4)
2. Implicit and Inverse Function Theorems (Conlon, Appendix B, §§2.4–2.5)
3. Bump functions (Conlon, §2.6)
4. Vector fields and integral flows (Conlon, §§2.7–2.8, Appendix C.1–C.3)

III. Global theory of smooth manifolds and mappings

1. Basic definitions and examples (Conlon, §§3.1–3.2, 3.5)
2. Constructions on smooth manifolds (Conlon, §§1.7, 3.7)
3. Smooth approximations (Conlon, §§3.5, 3.8)
4. Amalgamation theorems (Conlon, §1.3)
5. Tangent spaces and vector bundles (Conlon, §§3.3–3.4)
6. Regular mappings and submanifolds (Conlon, §§1.5, 2.5, 3.7)

IV. Vector fields

1. Global vector fields (Conlon, §§2.2, 3.3)
2. Global flows and completeness (Conlon, §§2.7–2.8, 4.1)
3. Lie brackets (Conlon, §§2.2, 2.8, 4.3)

V. Cotangent spaces and tensor algebra

A. Dual spaces (Conlon, §6.1)
1. Vector bundles (Conlon, §§3.3–3.4)
2. Cotangent spaces and differential 1-forms (Conlon, §§6.1–6.2)
3. Line integrals (Conlon, §6.3)
4. Tensor and exterior products (Conlon, §§7.1–7.2, 7.4)
5. Constructing tensor fields (Conlon, §7.5)

VI. Differential forms

1. Exterior differential calculus (Conlon, §§8.1)
2. Orientability (Conlon, §3.4)
3. The Poincaré Lemma (Conlon, §8.3)
4. Generalized Stokes' Formula (Conlon, §8.3)