Rough Syllabus: Hodge Theory and de Rham cohmology

January 7, 2025

Background References:

- Chapter 1 of Warner *Foundations of Differentiable Manifolds and Lie Groups*
- Folland *Real Analysis: Modern Techniques and Their Applications*
- Spivak *Calculus on Manifolds*

Main References:

- Lee *Introduction to Smooth Manifolds*
- Brezis *Functional Analysis, Sobolev Spaces, and Partial Differential Equations*
- Evans *Partial Differential Equations*

Some Other References That May Come Up, Which I Will Mention if Necessary:

- Morrey *Multiple Integrals in the Calculus of Variations*
- Jost *Geometric Analysis*
- My notes on weak convergence

What are the Goals of This Course?

The main goals are:

1. To get you familiarized with the basics of partial differential equations necessary to geometric analysis

2. An introduction to the calculus of variations, one of the most fundamental techniques of modern analysis

3. To explore the connection between geometry, topology, and analysis

What is the expectation?

1. Weakly readings, and meetings in-person

2. Problems every 1-4 weeks(Not Mandatory to do but useful)

3. A group project consisting of a write up of some of the course material

4. Individual project consisting of reading and explaining a topic that students are interested in, relating to the material of the project. Before finalizing a topic please talk to me over email, discord, or in-person.