Course Description

Partial differential equations arise naturally in almost any field of science or engineering. This course is the second part of a year long graduate series that will serve as an introduction to some aspects of the modern mathematical theory.

This semester we will introduce some fundamental tools from functional analysis (mostly the theory of Sobolev spaces) that we will use to study the existence and regularity theory for elliptic, parabolic and hyperbolic linear PDEs as well as some nonlinear equations from mathematical physics.

Participation in part one, while helpful, will not be a necessary prerequisite for this course and I will try to make the presentation as self contained as possible. Students from other scientific disciplines are especially encouraged to take this class and I will endeavor to connect material to applications.

Reference Texts

I will very roughly follow some parts of chapters 5-9 of

*Infinite Dimensional Dynamical Systems: An Introduction to Dissipative Parabolic PDEs and the Theory of Global Attractors* – J.C. Robinson

I will also make extensive use of

*An Introduction to Partial Differential Equations* – M. Renardy & R. Rogers

*Partial Differential Equations* – L.C. Evans

*Partial Differential Equations* – F. John

There are many other great introductory references for this vast subject.

Grading & Exams

I will assign homework on a roughly weekly basis. There will also be a take home final. You are encouraged to collaborate with other students but all your work should be your own.