Course Policy and Syllabus, Math 6451, Instructor: Tanveer

Class Room and Time: JR 304, MWF 3:00-3:55

This is a first course in Partial Differential Equations at the graduate level. While a large part of Math 6451 will involve techniques for solving linear partial differential equations (PDEs) using a variety of different methods, it will also involve theoretical concepts that requires proofs. This course is the second semester of a core mathematics sequence with Math 6411 (ODE) as the first semester complement. Though 6411 is listed as a pre-requisite, I will sign off on a waiver of this pre-requisite if you have an ODE background at an undergraduate level.

PDE is an important field and is connected to other areas of mathematics such as analysis and geometry, besides being widely applicable to many real world physical applications. Some of you may know that the solution to the famous Poincare Conjecture in Topology by Perelman required PDEs.

1. Linear partial differential equations, and their derivation: Laplace, diffusion, wave and transport equations. Elliptic, parabolic and hyperbolic characterizations of PDEs. Concept of well-posed, ill-posed problems.

2. Method of characteristics for 1st order PDEs (both linear and nonlinear). Solution to wave equations in 1-D and higher dimensions. Uniqueness arguments. Weak solutions.

3. Heat Equation, Maximum principle, Methods of solution. Existence, uniqueness theory and smoothness properties.

4. Separation of variable techniques, Fourier and Laplace Transforms. Transform applications to PDEs. Distribution and Green's function and applications.

5. Solution to Laplace and Poisson's equation and smoothness properties. Maximum Principle.

6. Introduction to energy and contraction mapping methods for existence and uniqueness of PDE solutions.

7. (as time allows) General Sturm-Liouville Theory. Maximin principle and characteriza-

tion of eigenvalues.

Text:

(1.) I will mostly use my notes in http://www.math.ohio-state.edu/∼tanveer/ (See link to Math 6451)

(2.) Additional Materials from Renardy & Rogers, Partial Differential Equations & P.R Wallace, Mathematical Analysis of Physical Problems and Partial differential equations: An introduction by W.A. Strauss, John Riley & Sons, 1992 (ISBN 0471548685)

Grading Policy:

About 8 homework sets, each due typically 9-12 days after it is assigned. Homework will be posted on my website. Homework will count for 50 % of grades. Take home final given out in the last week of classes and will count for another 50 %; collaboration in homework limited to discussion of approach. Turned in homework by different people should **not** look the same. **No collaboration of any kind** in the finals. If in doubt about policy, consult instructor.

Office hours:

MWF 2-3 p.m. at my office (MW 402); other times by appointment only.