Math 316: Partial Differential Equations I

This course introduces partial differential equations and their use in modeling physical processes involving diffusion, heat transfer, and wave propagation. Analytical solution techniques, based on the method of separation of variables and Fourier series, are developed.

Prerequisites: One of Math 215, 255, 265

Text: Elementary Differential Equations and Boundary Value Problems (10th edition).

Evaluation: There will be (roughly) 9 or 10 assignments. We will discard the lowest two homework scores. The HW is worth 15%, there will be two in class midterms worth in total 35%, and a final exam worth 50%. No late homeworks will be accepted. They must be turned in as a hard-copy in class on the due date. There will be no make-up midterms.

Topics:

- Review of techniques to solve ODEs (1 hour).
- Series solutions of variable coefficient ODE's at ordinary points (section 5.1–5.3) and at regular singular points (section 5.4-5.7, and 5.8) (7 hours).
- Introduction to Partial Differential Equations; the heat equation (section 10.5), the wave equation (section 10.7), and Laplace's equation (section 10.8) (2 hours).
- Introduction to numerical methods for PDEs (3 hours).
- Fourier series and separation of variables for the heat equation (sections 10.1–10.6) (9 hours).
- The wave equation (section 10.7) (3 hours).
- Laplace's equation (section 10.8) (5 hours).
- Sturm-Liouville theory and boundary value problems (sections 11.1–11.3) (4 hours).