THE OHIO STATE UNIVERSITY

Mathematics 4557
Partial Differential Equations
Autumn, Spring
3 credits

Catalog Description:
First and second-order PDE's; existence and uniqueness, initial and boundary value problems, Fourier series; Green's functions; wave, heat and Laplace equations; nonlinear PDE's; applications.

Prerequisite:
C- or better in 2255, 2415, 4556, or 5520H; or credit for 255, 415.xx, or 521H.

Exclusions:
Not open to students with credit for Math 4512 or 512.

Text:
Partial Differential Equations, an Introduction, 2nd edition, Walter A.Strauss, published by Wiley, ISBN: 0471548685.

Topics List:
1. Definition of a PDE, linearity; solution of first-order linear (transport) equation; modeling with PDEs.
2. Well-posed problems, initial- and boundary conditions; secondorder equations; classification into types; the wave equation.
3. Causality and energy; diffusion equation; diffusion on the whole line.
4. Solution of the wave and diffusion equations on a half-line; diffusion and waves with sources.
5. Separation of variables for the wave equation, Dirichlet, Neumann and Robin conditions.
6. Fourier series; sine and cosine series; orthogonality and general Fourier series; completeness and convergence.
7. Midterm. Gibbs phenomenon.
8. Laplace's equation; maximum principle; rectangular coordinates.
9. Poisson's formula; Laplace's equation in circular coordinates.
10. Green's identities; maximum principle; Dirichlet principle; Green's second identity.
11. Green's functions; symmetry; half-space and sphere.
12. Wave equation in two and three dimensions; energy; causality; Huyghens' principle.
13. Rays and characteristics; relativistic geometry; sources; the diffusion equation.
14. The Schrödinger equation; the hydrogen atom.