Mth 322: Applied Partial Differential Equations

Text: An Introduction to the Mathematical Theory of Waves, by Roger Knobel, Student Mathematical Library, Volume 3, AMS, 1999, ISSN 1520-9121

Examples of Partial Differential Equations and Terminology

Introduction (*motivation, partial vs. ordinary differential equations, terminology*)
Traveling and Standing Waves

Wave fronts and pulses
Wave trains and dispersion

The wave equation (derivation and general solution, vibrating string)
D'Alembert Solution of the wave equation
Semi-infinite string (fixed and free end)
Characteristics of the wave equation (domain of dependence, constructing a solution)
Standing waves (modes of vibrations, finite string, non-homogeneous elastic string)

Conservation Laws (*one equation, one spatial dimension*)

Derivation of a general conservation law, constitutive equations
Examples: diffusion, traffic flow, advection equation
The method of characteristics (linear and nonlinear conservation laws, non-homogeneous advection equation)
Breaking times of solutions
Piecewise smooth solutions and shock waves, the Rankine-Hugoniot condition
Shock waves and the viscosity method
Shock waves and rarefaction waves, examples
Non-uniqueness of piecewise smooth solutions

Heat Equation (*time permitting*)

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