MATHEMATICS 4160
PARTIAL DIFFERENTIAL EQUATIONS I

This course is largely concerned with learning about and solving such famous equations of mathematical physics as the wave equation, the heat equation and the potential equation. These are *partial differential equations*. For instance, if an elastic string stretched along the *x*-axis is plucked, the resulting deflections of the string will be a function of both the *x*-coordinate and time *t*. The governing equation (an example of the wave equation), involving derivatives and the variables *x* and *t*, is called a partial differential equation. Since the time of Sir Isaac Newton (1642-1727), many mathematicians have worked on the vibrating string problem. Around 1800, knowledge of the fundamental modes of vibration of a string and, at the same time, work by J. Fourier on the conduction of heat along a rod led mathematicians to the important idea of representing functions by trigonometric series; thus *Fourier analysis* was born. Fourier analysis has turned out to be tremendously important in many areas of pure and applied mathematics and the physical sciences. This course also introduces Fourier analysis as a tool for solving the equations of mathematical physics. It should be emphasized that, collectively, the wave, heat and potential equations describe a huge number of physical phenomena including, for instance, the propagation of radio waves, the motion of the oceans, the flow of electrical current along a transmission line, and diffusion processes.

Text. *Elementary Partial Differential Equations with Boundary Value Problems* by L. C. Andrews (Academic Press) or a similar book.

Marks. The exact scheme may vary from semester to semester, but typically it is this:

Assignments	15%
Midterm exam	25%
Final exam	60%

Calendar description. **4160 Partial Differential Equations I** covers two point boundary value problems, Fourier series, Sturm-Liouville theory, canonical forms, classification and solution of linear second order partial differential equations in two independent variables, separation of variable, integral transform methods.
Prerequisites: Mathematics 2260 (or 3260) and 3202.

Offered. Fall