MATH 348 - Advanced Engineering Mathematics April 22, 2009
Final Exam - Review **Final Exam**: May 4, 2008

The final exam will be held on May 4th from 10:15am-12:15am in rooms posted on ticc.mines.edu and is to be taken with no notecards or calculators. Please go to the room assigned to your enrolled class. There will be ten questions four of which will be from previous material. Specifically, there will be a question asking you to find the general solution to a linear system of equations and interpret this solution geometrically. Also, from the linear algebra section there will be a question where you will need to find the eigenvalues and eigenvectors of a square matrix. Lastly, from the Fourier series section there will be questions where you will need to find a real Fourier series representation (FSR), complex FSR and a Fourier transform given some function of x. The remaining questions will be associated with partial differential equations.

- The Homogenous Heat Equation : $u_t = c^2\nabla^2 u$.
- The Homogenous wave Equation : $u_{tt} = c^2\nabla^2 u$.
- Laplace's Equation : $\nabla^2 u = 0$.

Furthermore, each student should be familiar with the boundary conditions and initial conditions necessary for finding unique separable solutions. This will naturally require a firm understanding of:

- Separation of Variables
- Solutions to Boundary Value Problems
- Fourier Sine and Cosine Series

The following concepts/techniques will not appear on the exam:

- Power Series Solutions to ODE's
- Vibrations on a Thin Circular Membrane

The following is a list of concepts and methods which you should be familiar with.

12.1 Partial Differential Equations - Terminology

From this section the student should understand:

- The terms, linear, homogenous and order associated with a PDE.
- The concept superposition of solutions to a PDE.

From this section the student should be able to:

- Check to see if a given function is a solution to a PDE.
- Determine the type, order, homogeneity, and linearity of the PDE.
- Apply the rule of superposition.

12.3 Wave equation and its solution via Fourier Series.

From this section the student should understand:

- The physical problem.
- How the physical problem is modeled by the PDE and its boundary and initial conditions.
- The solution to the wave equation on a bounded domain.

From this section the student should be able to:

- Understand the physical interpretation of the mathematical model.
- Solve the wave equation defined on bounded physical domain via Fourier Series.
- Discuss the physical interpretations of the solution to the wave equation.

12.5 Heat equation and its solution via Fourier Series.

From this section the student should understand:

- The physical problem.
- How the physical problem is modeled by the PDE and its boundary and initial conditions.
- The solution to the heat equation on a bounded domain.

From this section the student should be able to:

- Understand the physical interpretation of the mathematical model.
- Solve the heat equation defined on bounded physical domain via Fourier Series.
- Discuss the physical interpretations of the solution to the heat equation.