MATH 348 - Advanced Engineering Mathematics November 30, 2008

Final Exam - Review **Final Exam**: December 6, 2008

The final exam will be held on December 6th from 8:00am-10:00am in BB204A and is to be taken with no notecards or calculators. There will be ten questions five 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.