MATH 348 - Advanced Engineering Mathematics Last Compiled : April 26, 2010
Final Exam - Review

The final will have no notecards or calculators. There will be five questions five of which will be from previous material. Specifically, you will be asked to conduct calculations associated with:

1. $\mathbf{Ax} = \mathbf{b}$ for $\mathbf{A} \in \mathbb{R}^{m \times n}$, $\mathbf{x} \in \mathbb{R}^m$ and $\mathbf{b} \in \mathbb{R}^n$
2. $\mathbf{Ax} = \lambda \mathbf{x}$ for $\lambda \in \mathbb{C}$, $\mathbf{x} \in \mathbb{R}^n$
3. Real Fourier Series
4. Complex Fourier Series
5. Complex Fourier Transform

The remaining questions will be associated with partial differential equations.

- The Homogeneous Heat Equation : $u_t = c^2 \nabla^2 u$.
- The Homogeneous 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:

- Vibrations on a Thin Circular Membrane
- Acoustics
- Solutions to PDE on infinite domains

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, homogeneous 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.