UBC MATH 257/316 *Partial Differential Equations* Spring 2013 Outline

Main Reference:

- W.W. Boyce & R.C. DiPrima, *Elementary Differential Equations and Boundary Value Problems* (9th. ed.), Wiley, 2009.

This text is *optional*, and students may choose to rely solely on the lecture notes.

Some Other References:

- N.H. Asmar, *Partial Differential Equations with Fourier Series and Boundary Value Problems*

- R. Haberman, *Applied Partial Differential Equations with Fourier Series and Boundary Value Problems*

- R. Froese, *Partial Differential Equations, UBC Math257/316 Lecture Notes* at http://www.math.ubc.ca/ rfroese/notes/Lecs316.pdf

Rough Schedule of Topics (with approximate class time, and corresponding Boyce & DiPrima sections)

1. **Intro to Partial Differential Equations, and Some Review** (4 hours)

    (a) The heat (10.5), wave (10.7), and Laplace (10.8) equations

    (b) Review of ODE methods (especially 2.1-2.2, 3.1-3.4)

    (c) Review of sequences, series, power series, & Taylor series (5.1)

2. **Series Solutions of Ordinary Differential Equations** (6 hours)

    (a) Series solutions at ordinary points (5.1-5.3)

    (b) Regular singular points (5.4-5.7)

3. **Fourier Series and Separation of Variables** (16 hours)

    (a) The heat equation and Fourier series (10.1-10.6)

    (b) The wave equation (10.7)

    (c) The Laplace equation (10.8)

4. **Numerical methods for PDE** (3 hours)

    (a) Finite difference approximations

    (b) Spreadsheet computation of solutions

5. **Boundary Value Problems and Sturm-Liouville Theory** (7 hours)

    (a) Eigenfunctions and eigenvalues (11.1)

    (b) Sturm-Liouville boundary value problems (11.2)

    (c) Nonhomogeneous boundary value problems (11.3)

Dec. 2012