Course Outline for Mathematics 257/316 (3 credits) Term 1, Sept.-Dec., 2014
Partial Differential Equations

Prerequisites: One of Math 215, 255, 265.
Credit: 3 Credits. Credit only given for one of Math 256, 257, 316.
Instructor: Anthony Peirce, **Office:** Mathematics Building 108
Home Page: http://www.math.ubc.ca/~peirce
Office Hours: Monday: 5-6 pm, Wed: 3-3:55 pm, Fri: 1-1:55 pm.
Assessment: The final grades will be based on homework (15%) (including EXCEL/MATLAB projects), two in class midterm exams (35%) and one final exam (50%). **Assignments are to be submitted in hard-copy from at the designated class – no late assignments can be accepted. There will be no make-up midterms.**
Test Dates: Wednesday, October 8th, Wednesday, November 12th.
Text: (recommended not prescribed) Elementary Differential Equations and Boundary Value Problems (10th Ed), W.E. Boyce and R.C. DiPrima (John Wiley & Sons) 2006

Other References:
1. Partial Differential Equations with Fourier Series and Boundary Value Problems (2nd Ed), by N.H. Asmar , (Pearson), 2004.
2. Applied Partial Differential Equations with Fourier Series and Boundary Value Problems (4nd Ed), R. Haberman, (Pearson), 2004.
3. http://www.math.ubc.ca/~rfroese/notes/Lecs316.pdf, Richard Froese, Partial Differential Equations, UBC M257/316 lecture notes free on the web.

Topics:	**Approx Time**
1. Review of techniques to solve ODEs	1 hr
2. Series Solutions of variable coefficient ODEs (Chapter 5)	
a. Series solutions at ordinary points (5.1-5.3)	3 hrs
b. Regular singular points (5.4-5.7, 5.8 briefly)	4 hrs
3. Introduction to Partial differential equations (Chapter 10)	
The heat equation (10.5), the wave equation (10.7), Laplace's equation (10.8)	2 hrs
4. Introduction to numerical methods for PDEs using spread sheets	3 hrs
a. First and second derivative approximations using finite differences - errors	
b. Explicit finite difference schemes for the heat equation	
• Stability and derivative boundary conditions	
c. Explicit finite difference schemes for the wave equation	
d. Finite difference approximation of Laplace's Equation – iterative methods	
5. Fourier Series and Separation of Variables (Chapter 10)	
a. The heat equation and Fourier Series (10.1-10.6)	9 hrs
b. The wave equation (10.7)	3 hrs
c. Laplace's equation (10.8)	5 hrs
6. Boundary Value Problems and Sturm-Liouville Theory (Chapter 11)	
a. Eigenfunctions and eigenvalues (11.1)	1 hr
b. Sturm-Liouville boundary value problems (11.2)	1 hr
c. Nonhomogeneous boundary value problems (11.3)	2 hrs
Tests	2 hrs
	36 hrs