

**Course Outline for Mathematics 406 (3 credits) Term 1, Sept.-Dec., 2015**  
**Variational and Approximate Methods in Applied Mathematics**

**Prerequisites:** MATH 400 and one of MATH 307, CPSC 302  
**Credit:** 3 Credits. Math M406 is credit excluded with M401 and M405.  
**Instructor:** Anthony Peirce, **Office:** Mathematics Building 108  
**Home Page:** <http://www.math.ubc.ca/~peirce>  
**Office Hours:** Monday: 10-11 am, Wed: 3-3:55 pm, Fri: 10-11 am  
**Assessment:** The final grades will be based on homework (45%) (including MATLAB projects), an in-class midterm exam (15%) and a final exam (40%).  
**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 Date:** Wednesday November 18<sup>th</sup>.

| Topics                                                                                                                                  | Lectures  |
|-----------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Introduction to numerical methods: Interpolation and Integration                                                                        | 6         |
| Variational and Green's function methods for ordinary differential equations including an introduction to finite element methods        | 12        |
| Initial value problems for ordinary differential equations: explicit and implicit one step methods, multi-step methods, convergence     | 6         |
| Green's functions for elliptic equations: finite difference, finite element and boundary element formulations for Laplace's equation    | 6         |
| Evolution equations: parabolic and hyperbolic equations, the method of lines, Lax's Convergence theory, von Neumann Stability analysis. | 5         |
| Test                                                                                                                                    | 1         |
| <b>Total</b>                                                                                                                            | <b>36</b> |

**Useful Texts:**

1. Burden and Faires, Numerical Analysis, 9<sup>th</sup> Edition, Brooks Cole; 9 Ed (2010).
2. Zauderer, Partial Differential Equations of Applied Math., Wiley-Interscience, 3 Ed. (2006).
3. Stakgold and Holst, Green's functions and Boundary value problems, Wiley, 3 Ed. (2011).
4. Crouch, S.L. and Starfield, A.M., Boundary Element Methods in Solid Mechanics, George Allen and Unwin, London, 1983.
5. Courant and Hilbert: Methods of Math. Physics Vol. 1 & 2.
6. Hildebrand, Methods of Applied Mathematics, Dover Books on Math., 1992.