

**Course Outline for Mathematics 406 (3 credits) Term 1, Sept.-Dec., 2018**  
**Variational and Approximate Methods in Applied Mathematics**

**Prerequisites:** One of MATH 307, CPSC 302 and either MATH 400 or 80% in M256, M257, or M316  
**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 14<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<sup>Ed</sup> (2010).
2. Zauderer, Partial Differential Equations of Applied Math., Wiley-Interscience, 3<sup>Ed</sup>. (2006).
3. Stakgold and Holst, Green's functions and Boundary value problems, Wiley, 3<sup>Ed</sup>. (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.