NE 216 – Advanced Calculus 1 for Nanotechnology Engineering

Where and When

Term: Fall 2015.
Classes: Monday, Wednesday and Friday 1:30-2:20pm in QNC 1502.
September 14th-December 4th.
Tutorial: Friday 3:30-4:20pm in QNC 1502.
Midterm: Friday Oct/30 3:30-4:50pm REV-200.
Final exam: To be announced by the Registrar’s office.
Lab: Tuesday 8:30-10:20am in B1-370.

Instructors

Prof. R. Thompson
Office: PHY 355
Phone: (519) 888-4567 ext. 32219
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Best method of contact

Office hours: Mondays and Wednesdays 12:00-12:45pm or by appointment.
Teaching Assistants: Mitchell Brickson, mbrickson@goshen.edu, Natacha Altamirano, naltamir@uwaterloo.ca, Katja Ried, kried@perimeterinstitute.ca, Golnaz Bohlouli-Zanjani, gbohlouli@gmail.com.
Lab Instructor: Douglas Harder, dwharder@uwaterloo.ca.
Lab Demonstrators: Xueren Wang, xueren.wang@uwaterloo.ca, Sid Zarabi, ssfarshc@uwaterloo.ca, Sebastian Lopez Maurino, slopezma@uwaterloo.ca.

Course


Main Objective: Solve ordinary differential equations both analytically and numerically.
<table>
<thead>
<tr>
<th>Week (estimated)</th>
<th>Topics</th>
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<tbody>
<tr>
<td>1</td>
<td>Introduction, 1st order ODE’s, separable and exact.</td>
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<td>2</td>
<td>1st-order linear ODE; Numerical solution of general 1st order ODE’s, Euler’s method. Local and global errors.</td>
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<td>3</td>
<td>Runge-Kutta methods. Superposition principle; 2nd-order linear ODE’s with constant coefficients.</td>
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<td>4</td>
<td>Particular solution of inhomogeneous DE. Initial Value Problem (IVP).</td>
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<td>5</td>
<td>Small oscillations in physical systems; free oscillations; damping.</td>
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<td>6</td>
<td>Forced oscillations; resonance.</td>
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<tr>
<td>7</td>
<td>Coupled ODEs and its numerical solution. System of linear ODEs with constant coefficients: eigenvectors and eigenvalues.</td>
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<td>8</td>
<td>Matrix method for ODE systems. Introduction to Laplace transform.</td>
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<td>9</td>
<td>Applications to ODE’s; Laplace transform of step functions. Impulse (or Dirac) function.</td>
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<td>10</td>
<td>Convolution and its uses; transfer function.</td>
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<td>11</td>
<td>Block diagram. Boundary value problems (BVP) and Sturm-Liouville theory. The shooting method for BVPs.</td>
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<tr>
<td>12</td>
<td>Periodic extensions; complex Fourier series and Parseval’s Theorem. Fourier transforms. Review.</td>
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**Prerequisites:** MATH 119, 2A Nanotechnology Engineering students.

**Antirequisites:** AMATH 350, MATH 218, 228.

**Evaluation:** Labs 20%, assignments 5%, midterm 25%, final exam 50%.

Accommodations will be considered only with confirmed Verification of Illness Forms. Travel is not a legitimate excuse for missing examinations or deadlines. Late assignments will be accepted for partial credit until the TA has finished marking.

**Assignments:** To be turned in during tutorial time. Late assignments are to be given directly to the responsible TA with up to a 10% penalty per day. When marking is complete, no late assignments will be accepted. Students may discuss assignments but
should solve them independently. Previous assignments can be picked up during the tutorial.

**Estimated Time Requirements:** Class time 3 hours/week; lab time 2 hours/week; assignments, lab work and reading 3 hours/week. Estimates are averages and time requirements will vary dramatically between weeks and between students.

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**Students with Disabilities**

The Office for Persons with Disabilities (OPD), located in Needles Hall Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the OPD at the beginning of each academic term. Also notify the instructor.

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**Academic Integrity**

**Academic Integrity:** In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility.

**Grievance:** A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy #70, Student Petitions and Grievances, Section 4. [http://www.adm.uwaterloo.ca/infosec/Policies/policy70.htm](http://www.adm.uwaterloo.ca/infosec/Policies/policy70.htm)

**Discipline:** A student is expected to know what constitutes academic integrity, to avoid committing academic offenses, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offense, or who needs help in learning how to avoid offenses (e.g., plagiarism, cheating) or about “rules” for group work/collaboration should seek guidance from the course professor, academic advisor, or the Undergraduate Associate Dean. For information on categories of offenses and types of penalties, students should refer to Policy #71, Student Discipline, [http://www.adm.uwaterloo.ca/infosec/Policies/policy71.htm](http://www.adm.uwaterloo.ca/infosec/Policies/policy71.htm)

**Appeals:** Concerning a decision made under Policy #70 (Student Petitions and Grievances) (other than petitions) or Policy #71 (Student Discipline) a student may appeal the finding, the penalty, or both. A student who believes he/she has a ground for an appeal should refer to Policy #72 (Student Appeals) [http://www.adm.uwaterloo.ca/infosec/Policies/policy72.htm](http://www.adm.uwaterloo.ca/infosec/Policies/policy72.htm)