UBC Math 256: **Differential Equations**, 2025W1

**Description**: this course serves as an introduction to differential equations with a focus on solution techniques, transforms and modelling. Topics include first and second order linear ordinary differential equations, systems of first order linear differential equations, Laplace transforms, Fourier series and separation of variables for linear partial differential equations.

**Topics**: a rough breakdown of the material covered (with section references to online text J. Lebl, Notes on Diffy Qs) is:

- 1st order linear and separable DE's (∼3 hrs: 1.1-1.4)
- 2nd order linear DE's (∼7 hrs: 2.1-2.2; 2.4-2.6)
- Laplace transforms (∼5 hrs: 6.1-6.5)
- Systems of linear DE's (∼6 hrs: 3.1-3.5; 3.7-3.9)
- Fourier series and simple BVP's (∼3 hrs: 4.1-4.5)
- Heat/diffusion, wave and Laplace's equations/separation of variables (∼9 hrs: 4.6-4.9)

**Text and notes**: the course does not follow a particular textbook. A useful (free) online textbook is listed on the Canvas site. Thorough lecture notes will also be posted to Canvas.

**Marking scheme**:

- WeBWorK assignments (approximately weekly) - 5 %
- 2 written long question assignments - 10 %
- 5 Python assignments - 5 %
- 2 Midterm exams (Oct. 8 and Nov 5) - 30 % (15 % each)
- Final exam - 50 %

**Homework**: homework for the course will come in three forms: (1) WeBWorK assignments; (2) written long question assignments (to be scanned or created electronically and uploaded); and (3) Python assignments.

The WeBWorK questions will generally be short and are targeted simply so that you may practice the machinery of solving problems.

The written assignments will contain questions that may develop additional insights or explore applications in the format of multi-part questions. These are specifically designed to give you exposure to the type of questions that you may face on a midterm or on the final exam. No late submissions will be accepted. You may work

on these together with classmates, but you must write up your own solutions, without any copying.

The Python assignments explore the use of Python code to study solutions of differential equations (especially those we cannot solve explicitly).

**Written assignment guidelines**: for each written assignment, you will upload a scan of your written work to Canvas. Using a tablet with writing app is fine as long as you can export as a well-formatted pdf that appears as a letter sized page. Points may be deducted for quirky difficult-to-navigate submissions. Your work must be legible and well-organized enough for the markers to be able to read it and follow your logic without hesitation. You must use a scanner or scanning mobile app to create a single small ($<$ 10MB) pdf file that has even lighting. Do not take jpg pictures and glue them together in Word. These tend to be difficult-to-read grey-scale images that are sometimes ridiculously large (100+MB). Use letter-sized paper. Do not use graph paper unless the lines are not visible once scanned. You can use a tablet or similar to write up your answers provided your submitted pdf consists of separate letter-sized pages. The TAs may deduct points for not adhering to these guidelines.

**Missing midterms, exams, late homework**: if you are unable to attend a midterm test, you must notify your instructor before (preferred) or within two days after (in the case of emergencies) the exam date. In either of these two cases (and only in these two cases), suitable accommodations will be made. Generally, your final exam mark will be used in place of the missing midterm mark. Undocumented absence from the midterm will be given a score of zero.

The written homework will be due on the specified due dates at 11:59 pm. It is possible to submit up to one hour late without penalty but neither exceptions nor extensions beyond that will be granted.

No WebWork late submission will be accepted. The solutions will be released immediately after the due date.

DO NOT make any travel plans for December until the exam schedule is announced as no accommodation will be made for students unable to attend the final exam due to conflicting plans. Note that the exam period is densely packed and your exams could be scheduled any day of the week.

**Prerequisites**: first-year calculus (MATH 100/101 or equivalent); linear algebra (MATH 152, MATH 221 or MATH 223)
**Co-requisite**: multivariable calculus (MATH 200, MATH 217, MATH 226, MATH 253 or MATH 263)