COURSE OUTLINE FOR MATH 215: DIFFERENTIAL EQUATIONS

Text: We will use the free online text in .pdf form "Diffy Qs: Differential Equations for Engineers", by Jiri Lebl. Please download the book from:

http://www.jirka.org/diffyqs/diffyqs.pdf

For a few topics you will need to rely on the course notes which will supplement and enrich the material in this online book.

Topics:

- **Introduction to Differential Equations:** What is a differential equation; differences between linear and nonlinear; general and particular solutions.
- **First order differential equations:** existence uniqueness, integrating factors, separable equations, homogeneous equations, Bernoulli equations, applications.
- **Second order linear differential equations:** linear operators, existence uniqueness, linear homogeneous equations, linear inhomogeneous equations.
- **Second order linear differential equations:** Wronskians and linear independence (fundamental set of solutions), constant coefficient linear homogeneous equations (characteristic equation; real roots, double roots, complex roots), linear nonhomogeneous equations (method of undetermined coefficients).
- **Second order linear differential equations:** Linear homogeneous equations and the method of variation of parameters; applications to electrical circuits and mechanical vibrations.
- **The Laplace Tranform:** definition and examples, solution of initial value problems.
- **The Laplace Tranform:** discontinuous functions, impulse functions, convolutions.
- **Linear Systems:** the homogeneous case. Eigenvalues and eigevectors.
- **Linear Systems:** the inhomogeneous case. The matrix exponential and variation of parameters.
- **Nonlinear Systems:** introduction to the geometry of the phase plane for qualitative understanding of the behavior of solutions to autonomous ODE systems.
- **Nonlinear Systems:** linearization, critical points, population dynamics and the nonlinear pendulum.

- **Grading:** There will be two 55 minute quizes given during the course at times to be announced. They will count for 40% of your grade. The final will count for 50% of your grade. I will assign homework every week and will provide detailed solutions. Please make sure to do the homeworks and examine the solutions. The HW will count for 10% of your grade.

- **Instructor:** Michael Ward, Email: ward@math.ubc.ca (Tel: 822-5869: Offce Math Annex 1217). Office hours to be arranged.