

MATH 215 Term 2, 2012-2013
Elementary Differential Equations I

Section 201: 10:00a.m.-11:00a.m. MWF, Room: LSK 201

Instructor: Dr. Jun Kitagawa, email: kitagawa@math.ubc.ca

Textbook: *Elementary Differential Equations and Boundary Value Problems*, 9th Edition, by W. Boyce and R. DiPrima.

Prerequisite: Calculus (MATH 101 or equivalent) and Linear Algebra (MATH 152 or equivalent).

Co-requisites (crucial): Multivariable Calculus (MATH 200 or 253).

Grading:

- Homework 10%, Midterm exams 20% $\times 2$, Final exam 50%
- There will be two midterm exams. The 1st midterm will be on February 4, 2013 (Monday) and the 2nd midterm will be on March 15, 2013 (Friday). Note that the deadline to withdraw from the course with a "W" is February 8, 2013 (Friday).

Policies:

- Homework sets will be assigned weekly and will be collected in class. Assignments and solutions will be posted on the course webpage (will be given from the instructors). A selection of the problems will be graded. No late homework accepted.
- There will be no make-up exams. Missing a midterm for a valid medical reason (the instructor must be notified as soon as possible and presented with a doctor's note immediately upon the student's return to UBC), the weighting for the final exam will be adjusted.

Topics:

- Introduction (Chapter 1): what is a differential equation (DE), order of a DE, linear and nonlinear DE, solution, general solution, particular solution, direction field.
- First order DE (Chapter 2): Solving basic 1st order DE: separable, linear and exact; modeling with DE, autonomous DE, existence and uniqueness of solutions (sections 2.1-2.6, 2.8).
- Second order ED (chapter 3): 2nd order linear homogeneous equations, fundamental set of solutions, Wronskian, constant coefficient linear homogeneous equations and characteristic equation, linear non-homogeneous equations (structure of solutions, method of undetermined coefficients, method of variation of parameters), applications (mechanical vibrations). (sections 3.1-3.7).
- Laplace transform (Chapter 6): definition, examples, solution of initial value problem, discontinuous functions, systems of 1st order equations. (sections 6.1-6.5)
- Systems of first order linear equations (Chapter 7 + section 9.1): homogeneous case, repeated eigenvalues, non-homogeneous case: undetermined coefficients, variation of parameters, classification of linear systems (sections 7.5-7.7 (no matrix exponentials), 7.8-7.9, 9.1)
- Nonlinear systems (chapter 9): Conservative systems, fixed points, linear approximations to non-linear systems, local phase portraits, simple pendulum, competing species (sections 9.2-9.4).