CAMOSUN COLLEGE	**School of Arts & Science** **MATHEMATICS DEPARTMENT** **MATH 252 – X01** **Applied Differential Equations** **2014 Quarter 3**

COURSE OUTLINE

The course description is online @ http://camosun.ca/learn/calendar/current/web/math.html

✷ *Please note: the College electronically stores this outline for five (5) years only.*
*It is **strongly recommended** you keep a copy of this outline with your academic records.*
You will need this outline for any future application/s for transfer credit/s to other colleges/universities.

1. Instructor Information

Instructor:	Raymond Lai
Office Hours:	• Monday to Thursday: 11:30am – 12:20pm • Drop in, and by appointment
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Website:	http://faculty.camosun.ca/raymondlai/

2. Intended Learning Outcomes

Upon completion of this course the student will be able to:

1. Classify a differential equation (DE) by type (ordinary differential equation ODE vs. partial differential equation PDE), order, and linearity.
2. Verify an implicit or explicit solution of an ODE/initial value problem (IVP).
3. Determine the existence and uniqueness of a solution of a first-order IVP.
4. Model real-life phenomenon with linear/non-linear DE (for example, vibration problems such as the spring-mass system, population dynamics [logistic equation], radioactive decay, Newton's law of cooling/warming, spread of a disease, chemical reactions, mixture problems, draining a tank – Torricelli's law, series circuits, falling bodies with/without air resistance, slipping chain).
5. Model real-life phenomenon with a system of linear or nonlinear DE's (for example, radioactive series, mixture problems, population dynamics (predator-prey model, competition model), electrical networks.
6. Sketch approximate solution curves for a first-order IVP using a direction field.

7. Sketch solution curves of an autonomous first-order DE by drawing and analyzing the one-dimensional phase portrait.
8. Solve various types of first-order DE: separable DE, linear DE (using integrating factor), exact DE and non-exact DE (by making it exact), homogeneous DE of a certain degree, Bernoulli DE.
9. Determine the existence and uniqueness of a solution of a n^{th}-order IVP.
10. Solve 2^{nd}-order linear homogeneous and nonhomogeneous DE using the method of reduction of order.
11. Solve higher-order linear homogeneous and nonhomogeneous DE with constant coefficients.
12. Solve 2^{nd}-order nonhomogeneous DE using the method of variation of parameters.
13. Solve Cauchy-Euler equations.
14. Solve systems of linear equations.
15. Sketch trajectories of a system of two linear first order DE by drawing and analyzing the two-dimensional phase portrait.
16. Classify a point for a DE as an ordinary point, regular singular point, or irregular singular point.
17. Find power series solution of a DE about an ordinary point.
18. Find series solution of a DE about a regular singular point.
19. Apply the Frobenius Theorem to find series solution of a DE about a regular singular point.
20. Use a Laplace transform and its properties to solve an IVP.

3. Required Materials

(a) Texts: (Optional Reference) Dennis G. Zill, A First Course in Differential Equations with Modeling Applications, 10th Edition, Brooks/Cole, 2009.

(b) Other: Non-graphing non-programmable scientific calculator

4. Course Content and Schedule

Introduction to Differential Equations

Section 1.1 (Reference: section 1.1) Definitions and Terminology

Section 1.2 (Reference: section 1.2) Initial-Value Problems

First-Order Differential Equations

Section 2.1 (Reference: section 2.1) Solution Curves Without a Solution:
Direction Fields and Autonomous First-Order DEs

Section 2.2 (Reference: section 2.2) Separable DEs

Section 2.3 (Reference: section 2.3) Linear Equations

Section 2.4 (Reference: section 2.4) Exact Equations

Section 2.5 (Reference: section 2.5) Solutions by Substitutions

Modeling with First-Order Differential Equations

Section 3.1 (Reference: sections 1.3, 3.1) Linear Models

Section 3.2 (Reference: sections 1.3, 3.2) Nonlinear Models

Section 3.3 (Reference: section 3.3) Modeling with Systems of First-Order DEs

Higher-Order Differential Equations

Section 4.1 (Reference: section 4.1) Preliminary Theory of Linear Equations

Section 4.2 (Reference: section 4.2) Reduction of Order

Section 4.3 (Reference: section 4.3) Homogeneous Linear Equations with Constant Coefficients

Section 4.4 (Reference: section 4.4) Undetermined Coefficients – Superposition Approach

Section 4.5 (Reference: section 4.6) Variation of Parameters

Section 4.6 (Reference: section 4.7) Cauchy-Euler Equations

Modeling with Higher-Order Differential Equations

Section 5.1 (Reference: section 5.1) Linear Models: Initial-Value Problems

Section 5.2 (Reference: section 5.3) Nonlinear Models

Series Solutions of Linear Equations

Section 6.1 (Reference: section 6.1) Review of Power Series

Section 6.2 (Reference: section 6.2) Solutions about Ordinary Points

Section 6.3 (Reference: section 6.3) Solutions about Regular Singular Points

Laplace Transforms

Section 7.1 (Reference: section 7.1) Definition of the Laplace Transform

Section 7.2 (Reference: section 7.2) Inverse Transforms and Transforms of Derivatives

Section 7.3 (Reference: section 7.3.1) Translation on the s-Axis

Section 7.4 (Reference: section 7.3.2) Translation on the t-Axis

Section 7.5 (Reference: section 7.4.1) Derivatives of a Transform

Section 7.6 (Reference: section 7.4.2) Transforms of Integrals

Section 7.7 (Reference: section 7.4.3) Transform of a Periodic Function

Section 7.8 (Reference: section 7.5) The Dirac Delta Function

Systems of Linear First-Order Differential Equations

Section 8.1 (Reference: section 8.1) Preliminary Theory – Linear Systems

Section 8.2 (Reference: section 8.2) Homogeneous Linear Systems

Section 8.3 (Reference: section 8.3.2) Nonhomogeneous Linear Systems – Variation of Parameters

Lectures, Reviews, Help Sessions	Tests	Holiday	Total
50 hours	3 hours	2 hours	55 hours

5. Basis of Student Assessment (Weighting)

To get a C or better in the course, you must get 50% or higher in the final exam *and* have an overall average of 60% or higher; your numerical grade will be computed using the following two components, which is then converted to a letter grade using the standard Camosun grade scale (see Grading System (8) below).

- 3 tests (total 50%)
  - Tentatively on 25 April (14%), 16 May (18%), 6 June (18%)
  - Some tests may have a calculator free section that does not allow use of calculator
  - Thorough understanding of the examples discussed in class and the homework exercises will be essential for success on the term tests.
  - Solutions will be emailed to you.
  - There is no makeup for missed test (except for documented medical reasons)
- Comprehensive Final Exam (50%)
  - During 21 June – 28 June
  - As stated in the college calendar, "Students are expected to write tests and final examinations at the scheduled time and place. … Exceptions, due to emergency circumstances, such as unavoidable employment commitments, health problems, or unavoidable family crisis, require approval of the appropriate instructor. Holidays or scheduled flights are not considered to be emergencies. The student may be required to provide verification of the emergency circumstances."

There is one exception: if your term work is at least 50% *and* you received 60% or higher in the final exam, then you will receive a C in the course *even if* your overall average is under 60%.

Use the table below to record your grades:

	Test 1	Test 2	Test 3	Final	Course
Grade (%)					
x Weight	x 0.14	x 0.18	x 0.18	x 0.50	
	+	+	+	=	

6. Grading System

Standard Grading System (GPA)

Percentage	Grade	Description	Grade Point Equivalency
90-100	A+		9
85-89	A		8
80-84	A-		7
77-79	B+		6
73-76	B		5
70-72	B-		4
65-69	C+		3
60-64	C		2
50-59	D	Minimum level of achievement for which credit is granted; a course with a "D" grade cannot be used as a prerequisite.	1
0-49	F	Minimum level has not been achieved.	0

Temporary Grades

Temporary grades are assigned for specific circumstances and will convert to a final grade according to the grading scheme being used in the course. See Grading Policy E-1.5 at **camosun.ca** for information on conversion to final grades, and for additional information on student record and transcript notations.

Temporary Grade	Description
I	*Incomplete*: A temporary grade assigned when the requirements of a course have not yet been completed due to hardship or extenuating circumstances, such as illness or death in the family.
IP	*In progress*: A temporary grade assigned for courses that, due to design may require a further enrollment in the same course. No more than two IP grades will be assigned for the same course. *(For these courses a final grade will be assigned to either the 3rd course attempt or at the point of course completion.)*
CW	*Compulsory Withdrawal:* A temporary grade assigned by a Dean when an instructor, after documenting the prescriptive strategies applied and consulting with peers, deems that a student is unsafe to self or others and must be removed from the lab, practicum, worksite, or field placement.

7. Recommended Materials or Services to Assist Students to Succeed Throughout the Course

LEARNING SUPPORT AND SERVICES FOR STUDENTS

There are a variety of services available for students to assist them throughout their learning.
This information is available in the College calendar, at Student Services, or the College web site at camosun.ca.

STUDENT CONDUCT POLICY

There is a Student Conduct Policy **which includes plagiarism**.
It is the student's responsibility to become familiar with the content of this policy.
The policy is available in each School Administration Office, at Student Services,
and the College web site in the Policy Section.

How to do well in the course and where to get help

1. Do not skip classes.
2. Start working on the exercises as soon as we finish a section.
3. It is important to understand the principles involved rather than to memorize a method of solution – try variations of questions.
4. Studying in groups is an efficient way to learn mathematics; however, make sure you can solve problems yourself.
5. Extra help available from assistant at the Math Lab located at Technologies Centre (TEC) Room 142 (phone: 370-4492). This drop-in centre is freely available for your use to work on math homework and to seek help from the tutor on staff (see hours posted on the door).