CAMOSUN COLLEGE	**School of Arts & Science** **MATHEMATICS DEPARTMENT** **MATH 252 – X02** **Applied Differential Equations** **2017 Fall**

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, Wednesday, Thursday : 11:30 am – 12:20 pm Tuesday: 10:30am-11:20am
Location:	CBA 152
Phone:	250-370-4491
Email:	lai@camosun.bc.ca
Website:	https://sites.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

Unit 1: Introduction to Differential Equations

Section 1 Definitions and Terminology (Reference: section 1.1)
Section 2 Initial-Value Problems (Reference: section 1.2)

Unit 2: First-Order Differential Equations

Section 3 Solution Curves Without a Solution:
Direction Fields and Autonomous First-Order DEs (Reference: section 2.1)
Section 4 Separable DEs (Reference: section 2.2)
Section 5 Linear Equations (Reference: section 2.3)
Section 6 Exact Equations (Reference: section 2.4)
Section 7 Solutions by Substitutions (Reference: section 2.5)

Unit 3: Modeling with First-Order Differential Equations

Section 8 Linear Models (Reference: sections 1.3, 2.3, 3.1)
Section 9 Nonlinear Models (Reference: sections 1.3, 2.4, 2.5, 3.2)

Unit 4: Higher-Order Differential Equations

Section 10 Solutions of Linear Equations (Reference: section 4.1)
Section 11 Reduction of Order for Second Order Differential Equations (Reference: section 4.2)
Section 12 Homogeneous Linear Equations with Constant Coefficients (Reference: section 4.3)
Section 13 NonHomogeneous Linear Equations with Constant Coefficients – Undetermined Coefficients – (Reference: section 4.4)
Section 14 Second Order NonHomogeneous Linear Equations – Variation of Parameters (Reference: section 4.6)
Section 15 Cauchy-Euler Equations (Reference: section 4.7)

Unit 5: Modeling with Higher-Order Differential Equations

Section 16 Linear Models: Initial-Value Problems (Reference: section 5.1)

Unit 6: Series Solutions of Linear Equations

Section 17 Review of Power Series (Reference: section 6.1)
Section 18 Solutions about Ordinary Points (Reference: section 6.2)
Section 19 Solutions about Regular Singular Points (Reference: section 6.3)

Unit 7: Laplace Transforms

Section 20 Laplace Transforms, Inverse Transforms and Transforms of Derivatives (Reference: sections 7.1 and 7.2)
Section 21 Translation on the *s*-Axis (Reference: section 7.3.1)

Section 22 Translation on the *t*-Axis (Reference: section 7.3.2)
Section 23 Derivatives of a Transform (Reference: section 7.4.1)
Section 24 Transforms of Integrals (Reference: section 7.4.2)
Section 25 Transform of a Periodic Function (Reference: section 7.4.3)
Section 26 The Dirac Delta Function (Reference: section 7.5)

Unit 8: Systems of Linear First-Order Differential Equations
Section 27 Homogeneous Linear Systems: Solutions and Trajectories (Reference: section 8.2)
Section 28 Nonhomogeneous Linear Systems – Variation of Parameters (Reference: section 8.3.2)

Unit 9: Modeling with Systems of First-Order Differential Equations
Section 29 Modeling with Systems of First-Order Differential Equations (Reference: section 3.3, 8.3.2)

Lectures, Reviews, Help Sessions	Tests	Holiday	Total
49 hours	4 hours	3 hours	56 hours

5. Basis of Student Assessment (Weighting)

	Test 1	Test 2	Test 3	Test 4
Tentative Date	Wed Sept 20	Tues Oct 17	Wed Nov 15	Tues Dec 5
	Tues Sept 19	Wed Oct 18	Tues Nov 14	Wed Dec 6
Weight	15%	35%	35%	15%

There is no makeup for missed test (except for documented medical reasons). There will be no final exam.
To get a C or higher in the course, you must have an overall average of 60% or higher. (See the section "Grading System" below.)

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 in 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. Study efficiently:
   - Working in groups is a smart way to learn mathematics; however, make sure you can solve problems yourself.
   - Keep and organize your work: Doing so will be a big time saver before term tests as you won't have time to redo all the exercises.
   - It is important **not** to spend too much time on a single exercise – as a general rule of thumb, if you spend 15 minutes either staring at a problem not knowing what to do or having trouble finding arithmetic mistakes you might have made, move on (bring me your work and we can go over it together – there may be typo in the answer provided, check typo corrections posted on the course website).
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).