



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:	<ul style="list-style-type: none">Monday to Thursday: 11:30am – 12:20pmFriday 12:30pm – 1:20pm
Office Location:	CBA 152
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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 (Sections 1 – 2)

Section 1 Definitions and Terminology (Reference: section 1.1)

Section 2 Initial-Value Problems (Reference: section 1.2)

First-Order Differential Equations (Sections 3 – 7)

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)

Modeling with First-Order Differential Equations (Sections 8 – 10)

Section 8 Linear Models (Reference: sections 1.3, 3.1)

Section 9 Nonlinear Models (Reference: sections 1.3, 3.2)

Section 10 Modeling with Systems of First-Order Des (Reference: section 3.3)

Higher-Order Differential Equations (Sections 11 – 16)

Section 11 Preliminary Theory of Linear Equations (Reference: section 4.1)

Section 12 Reduction of Order (Reference: section 4.2)

Section 13 Homogeneous Linear Equations with Constant Coefficients (Reference: section 4.3)

Section 14 Undetermined Coefficients – Superposition Approach (Reference: section 4.4)

Section 15 Variation of Parameters (Reference: section 4.6)

Section 16 Cauchy-Euler Equations (Reference: section 4.7)

Modeling with Higher-Order Differential Equations (Sections 17 – 18)

Section 17 Linear Models: Initial-Value Problems (Reference: section 5.1)

Section 18 Nonlinear Models (Reference: section 5.3)

Series Solutions of Linear Equations (Sections 19 – 21)

Section 19 Review of Power Series (Reference: section 6.1)

Section 20 Solutions about Ordinary Points (Reference: section 6.2)

Section 21 Solutions about Regular Singular Points (Reference: section 6.3)

Laplace Transforms (Sections 22 – 29)

Section 22	Definition of the Laplace Transform (Reference: section 7.1)
Section 23	Inverse Transforms and Transforms of Derivatives (Reference: section 7.2)
Section 24	Translation on the s -Axis (Reference: section 7.3.1)
Section 25	Translation on the t -Axis (Reference: section 7.3.2)
Section 26	Derivatives of a Transform (Reference: section 7.4.1)
Section 27	Transforms of Integrals (Reference: section 7.4.2)
Section 28	Transform of a Periodic Function (Reference: section 7.4.3)
Section 29	The Dirac Delta Function (Reference: section 7.5)

Systems of Linear First-Order Differential Equations (Sections 30 – 32)

Section 30	Preliminary Theory – Linear Systems (Reference: section 8.1)
Section 31	Homogeneous Linear Systems (Reference: section 8.2)
Section 32	Nonhomogeneous Linear Systems – Variation of Parameters (Reference: section 8.3.2)

Lectures, Reviews, Help Sessions	Tests	Holiday	Total
49 hours	4 hours	2 hours	55 hours

5. Basis of Student Assessment (Weighting)

To get a C or better in the course, you must get an overall average of 60% or higher; your numerical grade will be computed using your grades of the term tests, which is then converted to a letter grade using the standard Camosun grade scale (see Grading System (6) below).

- The four term tests are tentatively scheduled to be on:
13th Oct (Thursday), 3rd Nov (Thursday), 24th Nov (Thursday), and 8th Dec (Thursday).
- Among the first three test grades, the highest two will count for 30% each and the lowest will count for 25%, the grade of test 4 will count for 15%.
- Thorough understanding of the examples discussed in class and the assignments/exercises will be essential for success on the term tests.
- There is no makeup for missed test (except for documented medical reasons)

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	<i>Incomplete:</i> 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	<i>In progress:</i> 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 3 rd course attempt or at the point of course completion.)
CW	<i>Compulsory Withdrawal:</i> 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

- Do not skip classes.
- Start working on the exercises as soon as we finish a section.
- It is important to understand the principles involved rather than to memorize a method of solution – try variations of questions.
- 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).
- 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).