



**CAMOSUN COLLEGE**  
**School of Arts & Science**  
**Department of Mathematics & Statistics**

**MATH-251-X01**  
**Matrix Algebra for Engineers**  
**Winter 2018**

## **COURSE OUTLINE**

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

Ω Please note: This outline will not be kept indefinitely. It is recommended students keep this outline for their records, especially to assist in transfer credit to post-secondary institutions.

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### **1. Instructor Information**

<b>(a) Instructor</b>	Raymond Lai
<b>(b) Office hours</b>	Monday 11:30pm – 12:20pm; Tuesday 9:30am – 10:20am; Thursday 10:30am – 11:20am; Friday 9:30am – 10:20am
<b>(c) Location</b>	CBA 152
<b>(d) Phone</b>	250-370-4491 <b>Alternative:</b> _____
<b>(e) E-mail</b>	lai@camosun.bc.ca
<b>(f) Website</b>	<a href="https://sites.camosun.ca/raymondlai/">https://sites.camosun.ca/raymondlai/</a>

### **2. Intended Learning Outcomes**

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

1. Perform vector operations and use vectors to write parametric equations for lines and planes.
2. Use the dot product to find projections and to find angles between vectors.
3. Solve linear systems using row reduction.
4. Perform matrix operations and give examples of matrices with specific properties.
5. Determine if a transformation is a linear transformation and find the standard matrix for a linear transformation.
6. Find the inverse of an invertible matrix and use it to solve matrix equations.
7. Construct and use elementary matrices to perform row operations.

8. Find LU decompositions.
9. Determine whether a set of vectors is a basis and be able to prove simple facts about linear independence and spans. Find the components of a vector with respect to a given basis.
10. Determine whether a set of vectors in n-dimensional Euclidean space forms a subspace.
11. Use the Gram-Schmidt process to construct an orthonormal basis.
12. Find the matrix of a linear transformation in a different basis.
13. Find matrices for general linear transformations. Determine the kernels and ranges of general linear transformations.
14. Find determinants by cofactor expansion and use Cramer's rule to solve linear systems of equations.
15. Use the cross product to find areas, volumes, and perpendicular vectors.
16. Find eigenvalues and eigenvectors of matrices and linear transformations and construct diagonal matrices for the transformations.
17. Perform operations with complex numbers including finding the n'th roots of complex numbers.

### 3. Required Materials

- (a) Texts: (Optional Reference) David Poole, *Linear Algebra: A Modern Introduction*, 4th Edition, Brooks/Cole.
- (b) Other: Any scientific (non-graphing, non-programmable) calculator.

### 4. Course Content and Schedule

(Can include: Class hours, Lab hours, Out of Class Requirements and/or Dates for quizzes, exams, lecture, labs, seminars, practicums, etc.)

#### Chapter 1: Complex Numbers (Part 1)

Section 1.1: Complex Numbers – Rectangular Form (Reference: Appendix C)

#### Chapter 2: Vectors & Cross Product

Section 2.1: The Geometry and Algebra of Vectors

(Reference: Sections 1.1, 1.2, exploration of section 1.3)

Section 2.2: Lines and Planes (Reference: Section 1.3)

#### Chapter 3: Systems of Linear Equations

Section 3.1: Solving System of Linear Equations by using Gaussian Elimination and Gauss-Jordan Elimination (Reference: Sections 2.1, 2.2)

Section 3.2: Spanning Sets and Linear Independence (Reference: Section 2.3)

#### Chapter 4: Matrices

Section 4.1: Matrix Operations (Reference: Section 3.1)

Section 4.2: Inverse of a Matrix and Matrix Algebra (Reference: Sections 3.2, 3.3)

Section 4.3: LU Factorization (Reference: Section 3.4)

Section 4.4: Subspaces and Basis (Reference: Section 3.5)

Section 4.5: Linear Transformations

(Reference: Section 3.6 + bits from sections 6.3, 6.5, 6.6)

#### Chapter 5: Eigenvalues, Eigenvectors

Section 5.1: Determinants (Reference: Section 4.2 + exploration)

Section 5.2: Eigenvalues and Eigenvectors of  $n \times n$  matrices

(Reference: Sections 4.1, 4.3)

Section 5.3: Similarity and Diagonalization (Reference: Section 4.4)

#### Chapter 6: Orthogonality

Section 6.1: Orthogonality in  $\mathbb{R}^n$  (Reference: Section 5.1)

Section 6.2: The Gram-Schmidt Process (Reference: Sections 5.2, 5.3)

Section 6.3: Orthogonal Diagonalization of Symmetric Matrices

(Reference: Section 5.4)

#### Chapter 7: Least Squares Approximation

Section 7.1: Least Squares Approximations (Reference: Section 7.3)

#### Continue Chapter 1: Complex Numbers (Part 2)

Section 1.2: Complex Numbers – Polar Form and Exponential Form

(Reference: Appendix C)

### **5. Basis of Student Assessment (Weighting)**

	Test 1	Test 2	Test 3	Test 4
Tentative Date	18 <sup>th</sup> January (Thurs)	23 <sup>rd</sup> February (Fri)	22 <sup>nd</sup> March (Thurs)	11 <sup>th</sup> April (Wed)
Weight	15%	35%	35%	15%

- Thorough understanding of the examples discussed in class and the assignments/practices will be essential for success on the term tests.
- There is no makeup for missed test (except for documented medical reasons). Requests for makeup tests due to illness must be supported by your physician's note.
- There will be no final exam.

- 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).

## 6. Grading System

- Standard Grading System (GPA)
- Competency Based Grading System

## 7. Recommended Materials to Assist Students to Succeed Throughout the Course

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 the 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).

## 8. College Supports, Services and Policies



### Immediate, Urgent, or Emergency Support

If you or someone you know requires immediate, urgent, or emergency support (e.g. illness, injury, thoughts of suicide, sexual assault, etc.), **SEEK HELP**. Resource contacts @ <http://camosun.ca/about/mental-health/emergency.html> or <http://camosun.ca/services/sexual-violence/get-support.html#urgent>

### College Services

Camosun offers a variety of health and academic support services, including counselling, dental, disability resource centre, help centre, learning skills, sexual violence support & education, library, and writing centre. For more information on each of these services, visit the **STUDENT SERVICES** link on the College website at <http://camosun.ca/>

### College Policies

Camosun strives to provide clear, transparent, and easily accessible policies that exemplify the college's commitment to life-changing learning. It is the student's responsibility to become

familiar with the content of College policies. Policies are available on the College website at <http://camosun.ca/about/policies/>. Education and academic policies include, but are not limited to, Academic Progress, Admission, Course Withdrawals, Standards for Awarding Credentials, Involuntary Health and Safety Leave of Absence, Prior Learning Assessment, Medical/Compassionate Withdrawal, Sexual Violence and Misconduct, Student Ancillary Fees, Student Appeals, Student Conduct, and Student Penalties and Fines.

**A. GRADING SYSTEMS** <http://camosun.ca/about/policies/index.html>

The following two grading systems are used at Camosun College:

**1. 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		1
0-49	F	Minimum level has not been achieved.	0

**2. Competency Based Grading System (Non GPA)**

This grading system is based on satisfactory acquisition of defined skills or successful completion of the course learning outcomes

Grade	Description
COM	The student has met the goals, criteria, or competencies established for this course, practicum or field placement.
DST	The student has met and exceeded, above and beyond expectation, the goals, criteria, or competencies established for this course, practicum or field placement.
NC	The student has not met the goals, criteria or competencies established for this course, practicum or field placement.

## B. 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 at <http://camosun.ca/about/policies/index.html> 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 are designed to have an anticipated enrollment that extends beyond one term. No more than two IP grades will be assigned for the same course.
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.