



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

MATH-251-DX02
Matrix Algebra for Engineers
Fall 2020

COURSE OUTLINE

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.

1. Instructor Information

(a) Instructor	Patricia (Pat) Wrean
(b) Office hours	Mon 11:30 am – 1:20 pm, Wed 12:30 – 1:20, Thurs 11:30 – 12:20
(c) Location	Online, accessed through D2L Collaborate tab or email link
(d) Phone	250-370-4542 Alternative: _____
(e) E-mail	wrean@camosun.bc.ca
(f) Website	D2L and http://wrean.ca/math251/

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

Any scientific calculator.

The set of practice exercises will be available on D2L.

Optional Text: David Poole, Linear Algebra, A Modern Introduction (Brooks/Cole, 2015), 4th edition or any earlier edition. Students interested in alternate Open Educational Resources textbooks should check the course website at <http://wrean.ca/math251> for options.

4. Course Content and Schedule

Vectors

The Geometry and Algebra of Vectors (1.1)
Length and Angle: The Dot Product (1.2)
Lines and Planes (1.3)
Exploration: The Cross Product

Systems of Linear Equations

Introduction to Systems of Linear Equations (2.1)
Direct Methods for Solving Linear Systems (2.2)
Spanning Sets and Linear Independence (2.3)
Applications (2.4)

Matrices

Matrix Operations (3.1)
Matrix Algebra (3.2)
The Inverse of a Matrix (3.3)
The LU Factorization (3.4)
Subspaces, Basis, Dimensions, and Rank (3.5)
Introductions to Linear Transformations (3.6)

Complex Numbers (Appendix C)

Eigenvalues and Eigenvectors

Introduction to Eigenvalues and Eigenvectors (4.1)
Determinants (4.2)
Exploration: Geometric Applications of Determinants
Eigenvalues and Eigenvectors of $n \times n$ matrices (4.3)
Similarity and Diagonalization (4.4)

Orthogonality

Orthogonality in \mathbb{R}^n (5.1)
Orthogonal Complements and Orthogonal Projections (5.2)
The Gram-Schmidt Process and the QR Factorization (5.3)
Orthogonal Diagonalization of Symmetric Matrices (5.4)

Distance and Approximation

Least Squares Approximation (7.3)

5. Basis of Student Assessment (Weighting)

Grade Calculation: The final grade will be calculated according to the following breakdown:

Three term tests:	55%
Assignments:	10%
Final Exam:	35%

Tests: There will be three term tests. The first time a student misses a test for any reason, the weight of the missed test will be transferred to the final exam. No documentation is required for the first absence. Further absences will be treated on a case-by-case basis.

Although you will have access to the course website and certain other resources during the test, please be aware that a thorough understanding of the course material will be required to complete the test during the time limit.

Final Exam: The final exam will cover the entire course and will be 3 hours long. As stated in the current college calendar, “students are expected to write tests and final examinations at the scheduled time and place.” Exceptions will only be considered due to emergency circumstances as outlined in the calendar. Holidays or scheduled flights are not considered to be emergencies.

Academic Integrity: The Department of Mathematics and Statistics has prepared a handout called Student Guidelines for Academic Integrity to help you interpret college policies involving student conduct, academic dishonesty, plagiarism, etc. The course website has a link to the handout on the About page. It is your responsibility to become familiar with the contents of the document and the college policies it references.

6. Grading System

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

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

Help from the Math Lab in Tech 142 is available online via Microsoft Teams. Email Duncan at mcdougald@camosun.bc.ca to request an invitation.

Students with disability-related academic barriers are encouraged to consult with the Centre for Accessible Learning (CAL) to see whether they are eligible for exam or in-class accommodations. The CAL website is <http://camosun.ca/services/accessible-learning/>.

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.

9. Territorial Acknowledgement

Camosun College campuses are located on the traditional territories of the Lkwungen and WSÁNEĆ peoples. We acknowledge their welcome and graciousness to the students who seek knowledge here.