



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

MATH-251-DX03
Matrix Algebra for Engineers
Winter 2021

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	George Ballinger
(b) Office hours	Mon-Fri, 10:30-11:20am
(c) Location	Online
(d) Phone	250-370-3116 (not monitored) Alternative: n/a
(e) E-mail	ballinger@camosun.bc.ca
(f) Website	georgeballinger.ca; D2L: online.camosun.ca

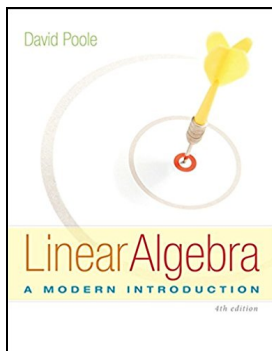
2. Intended Learning Outcomes

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

Textbook: David Poole, *Linear Algebra: A Modern Introduction*, 4th Edition, Nelson (Cengage), 2015.



Calculator: Sharp EL-531 (or EL-510R) scientific calculator recommended.

4. Course Content and Schedule

Chapters and Sections

1. Vectors
 - 1.1 The Geometry and Algebra of Vectors
 - 1.2 Length and Angle: The Dot Product
 - 1.3 Lines and Planes
Exploration: The Cross Product
2. Systems of Linear Equations
 - 2.1 Introduction to Systems of Linear Equations
 - 2.2 Direct Methods for Solving Linear Systems
 - 2.3 Spanning Sets and Linear Independence
 - 2.4 Applications
3. Matrices
 - 3.1 Matrix Operations
 - 3.2 Matrix Algebra
 - 3.3 The Inverse of a Matrix
 - 3.4 The LU Factorization
 - 3.5 Subspaces, Basis, Dimension, and Rank
 - 3.6 Introduction to Linear Transformations

Appendix C – Complex Numbers

4. Eigenvalues and Eigenvectors
 - 4.1 Introduction to Eigenvalues and Eigenvectors
 - 4.2 Determinants
Exploration: Geometric Applications of Determinants
 - 4.3 Eigenvalues and Eigenvectors of $n \times n$ Matrices
 - 4.4 Similarity and Diagonalization
5. Orthogonality
 - 5.1 Orthogonality in \mathbb{R}^n
 - 5.2 Orthogonal Complements and Orthogonal Projections
 - 5.3 The Gram-Schmidt Process and the QR Factorization
 - 5.4 Orthogonal Diagonalization of Symmetric Matrices
7. Distance and Approximation
 - 7.3 Least Squares Approximation

5. Basis of Student Assessment (Weighting)

6 Assignments:	25%*
3 Term Tests:	45%
Final Exam:	30%

* *Note:* The lowest assignment mark will be dropped when calculating the assignment average. This allows you to miss one assignment without penalty. *Late assignments will not be accepted.*

6. Grading System

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

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

Math Labs: <http://camosun.ca/services/help-centres/math-help.html>

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, Student Ancillary Fees, Academic Integrity, Grade Review & Appeals, Student Misconduct and Academic Accommodations for Students with Disabilities 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.