



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

MATH-251-DX01 and DX02
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

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|------------------|--|
| (a) Instructor | Leah Howard |
| (b) Office hours | DX01: Tues 1:30-2:20; Wed 2:30-3:20; Fri 2:30-3:20 on D2L DX02: Mon 3:30-4:20; Tues 3:30-4:20; Fri 1:30-2:20 on D2L |
| (c) Location | D2L |
| (d) Phone | please use email Alternative: _____ |
| (e) E-mail | HowardL@camosun.ca |
| (f) Website | www.leahhoward.com |

Free math help is also available at the MATH LAB. See the link on the course website.

Tips for Success:

- 1) Watch lecture videos regularly to stay on track
- 2) Videos will be less than 50 minutes long, so you will have extra time to drop into D2L sessions
- 3) Do suggested homework problems each time we finish a section

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 scientific calculator (non-programmable, non-graphing).

There is no required textbook. Suggested homework problems and answers are provided for free (on D2L).

Optional Text: ***Linear Algebra: A Modern Introduction, Poole, 3rd or 4th Edition***
Can be ordered from the Camosun Bookstore.

4. Course Content and Schedule

1.1 Geometry and Algebra of Vectors

1.2 Length and Angle

1.3 Lines and Planes

Cross Product

2.1 Linear Systems

2.2 Solving Systems

2.3 Spanning Sets and Linear Independence

2.4 Applications of Linear Systems

3.1 Matrix Operations

3.2 Matrix Algebra

3.3 The Inverse of a Matrix

3.4 LU Factorization

3.5 Subspaces, Basis, Dimension and Rank

3.6 Linear Transformations

4.1 Eigenvalues and Eigenvectors of 2×2 Matrices

4.2 Determinants

4.3 Eigenvalues and Eigenvectors of $n \times n$ Matrices

4.4 Diagonalization

5.1 Orthogonality

5.2 Orthogonal Complements and Projections

5.3 The Gram-Schmidt Process and QR Factorization

5.4 Orthogonal Diagonalization

Complex Numbers

7.3 Least Squares Approximation

5. Basis of Student Assessment

| | |
|---------------|--|
| 3 Assignments | worth a total of 25% of your final grade |
| 3 Tests | worth a total of 45% of your final grade |
| Final Exam | worth 30% of your final grade |

You will have 50 minutes to write each test. A thorough understanding of the course material will be required to complete the test during the time limit.

Tentative Dates

Assignments: Jan 27, Feb 24, Mar 24

Tests For Section DX01: Feb 3, Mar 3, Mar 31

Tests For Section DX02: Feb 2, Mar 2, Mar 30

The exam will be three hours long and will take place during the official exam period (April 19-27).

Academic Integrity

Academic dishonesty is NOT tolerated and the consequences can be severe.

Academic Integrity Guidelines for Assignments, Tests and Exam

You MAY use your own notes and any resources on the course website: notes, videos etc

You may NOT copy from other people (including classmates, friends/family, tutors, homework sites like Chegg)

Possible disciplinary actions include:

* You receive zero on the assignment or test

* An Academic Infraction Report is added to your academic record.

6. Grading System

Standard Grading System (GPA)

Competency Based Grading System

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

Free math help is also available at the MATH LAB. See the link on the course website.

Tips for Success:

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3) Do suggested homework problems each time we finish a section

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. |