CAMOSUN COLLEGE	***School of Arts & Science*** ***DEPARTMENT of MATHEMATICS and STATISTICS*** **MATH 251-Sections X01 and X02** **Matrix Algebra for Engineers** **2017 Winter**

COURSE OUTLINE

1. Instructor Information

Instructor:	Raymond Lai
Office Hours:	Monday and Wednesday 9:30am – 10:20am Tuesday and Friday 10:30am – 11:20am Thursday 12:30pm – 1:20pm
Office Location:	CBA 152
Phone:	250-370-4491
Email:	lai@camosun.bc.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

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

4. Course Content and Tentative Schedule

Complex Numbers (Part 1) [2 hours]
Section 1: Complex Numbers – Rectangular Form (Reference: Appendix C)

Vectors & Cross Product [9 hours]
Section 2: The Geometry of Vectors (Reference: Sections 1.1, 1.2)
Section 3: The Algebra of Vectors (Reference: Sections 1.1, 1.2, exploration of section 1.3)
Section 4: Lines and Planes (Reference: Section 1.3)

Systems of Linear Equations [6 hours]
Section 5: Introduction to System of Linear Equations (Reference: Sections 2.1, 2.2)
Section 6: Gaussian Elimination and Gauss-Jordan Elimination (Reference: Sections 2.1, 2.2)
Section 7: Spanning Sets and Linear Independence (Reference: Section 2.3)

Matrices [15 hours]
Section 8: Matrix Operations (Reference: Section 3.1)
Section 9: Matrix Algebra (Reference: Section 3.2)
Section 10: Inverse of a Matrix (Reference: Section 3.3)
Section 11: LU Factorization (Reference: Section 3.4)
Section 12: Subspaces and Basis (Reference: Section 3.5)
Section 13: Linear Transformations (Reference: Section 3.6 + bits from sections 6.3, 6.5, 6.6)

Eigenvalues, Eigenvectors [8 hours]
Section 14: Introduction to Eigenvalues and Eigenvectors (Reference: Section 4.1)
Section 15: Determinants (Reference: Section 4.2 + exploration)
Section 16: Eigenvalues and Eigenvectors of nxn matrices (Reference: Section 4.3)
Section 17: Similarity and Diagonalization (Reference: Section 4.4)

Orthogonality [8 hours]
Section 18: Orthogonality in $\mathbb{R}^n$ (Reference: Section 5.1)
Section 19: Orthogonal Complements and Orthogonal Projections (Reference: Section 5.2)
Section 20: The Gram-Schmidt Process and the QR Factorization (Reference: Section 5.3)
Section 21: Orthogonal Diagonalization of Symmetric Matrices (Reference: Section 5.4)

Least Squares Approximation [3 hours]
Section 22: Least Squares Approximations (Reference: Section 7.3)

Complex Numbers (Part 2) [3 hours]
Section 23: Complex Numbers – Polar Form and Exponential Form (Reference: Appendix C)

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 (7) below).

- The four term tests are tentatively scheduled to be on:
  2nd February (Thursday), 3rd March (Friday), 31st March (Friday), and 11th April (Tuesday).
- Weight of Test Grades:

Weight	30%	20%	30%	10%	5% (x 2)
Test Grade	1	2	3	4	Highest Two of 1, 2, and 3

- 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.

6. Course Policy

- Students are responsible for announcements made in class (check with your fellow students if you have to miss a class).
- Students are required to set their mobile phones on vibrate while attending class and writing term tests.

7. 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		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 at **camosun.ca** or information on conversion to final grades, and for additional information on student record and transcript notations.

Temporary Grade	Description
I	*Incomplete*: 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	*In progress*: 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	*Compulsory Withdrawal:* 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.

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.

8. Recommended Materials or Services to Assist Students to Succeed Throughout the Course

Extra help is available from the assistant at the Math Lab: TEC142.

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 on the College web site in the Policy Section.