DEPARTMENT OF SCIENCE

COURSE OUTLINE – FALL 2017

MA1200 (A2/B2): Linear Algebra I – 3 (3-1-0) UT 15 Weeks, 60 Hours

INSTRUCTOR:	Dr. Brian Redmond	**PHONE:**	780-539-2093
OFFICE:	J206	**E-MAIL:**	bredmond@gprc.ab.ca
OFFICE HOURS:	Tues. 11:30 a.m.-12:50 p.m. & Thurs. 1:00-2:20 p.m.		

CALENDAR DESCRIPTION: Systems of linear equations, vectors in n-space, vector equations of lines and planes, matrix algebra, inverses and invertibility, introduction to linear transformations, subspaces of n-space, determinants, introduction to eigenvalues and eigenvectors, the dot product and orthogonality, applications in a variety of fields.

PREREQUISITE(S)/COREQUISITE: Mathematics 30-1 or equivalent.

REQUIRED TEXT/RESOURCE MATERIALS: K. Kuttler: A First Course in Linear Algebra (an Open Text). Free pdf version at: https://lyryx.com/products/mathematics/first-course-linear-algebra/

DELIVERY MODE(S):

Lectures:	A2/B2	M W	10:00-11:20 a.m.	J202
Seminar:	A2	F	10:00-10:50 a.m.	J201
	B2	F	8:30-9:20 a.m.	J202

COURSE OBJECTIVES: The aim of this course is to present the fundamental ideas and techniques of linear algebra alongside its many applications to the natural and computing sciences.

LEARNING OUTCOMES:

Chapter 1: Systems of Equations

- Relate the types of solution sets of a system of two (three) variables to the intersections of lines in a plane (the intersection of planes in three space)
- Use elementary operations to find the solution to a linear system of equations.
- Find the row-echelon form and reduced row-echelon form of a matrix.
- Determine whether a system of linear equations has no solution, a unique solution or an infinite number of solutions from its row-echelon form.
- Solve a system of equations using Gaussian Elimination and Gauss-Jordan Elimination.
- Model a physical system with linear equations and then solve.

Chapter 2: Matrices

- Perform the matrix operations of matrix addition, scalar multiplication, transposition and matrix multiplication. Identify when these operations are not defined. Represent these operations in terms of the entries of a matrix.

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- Prove algebraic properties for matrix addition, scalar multiplication, transposition, and matrix multiplication. Apply these properties to manipulate an algebraic expression involving matrices.
- Compute the inverse of a matrix using row operations, and prove identities involving matrix inverses.
- Solve a linear system using matrix algebra.
- Use multiplication by an elementary matrix to apply row operations.
- Write a matrix as a product of elementary matrices.

Chapter 3: Determinants

- Evaluate the determinant of a square matrix using either Laplace Expansion or row operations.
- Demonstrate the effects that row operations have on determinants.
- Verify the following:
  (a) The determinant of a product of matrices is the product of the determinants.
  (b) The determinant of a matrix is equal to the determinant of its transpose.
- Use determinants to determine whether a matrix has an inverse, and evaluate the inverse using cofactors.
- Apply Cramer's Rule to solve a 2×2 or a 3×3 linear system.
- Given data points, find an appropriate interpolating polynomial and use it to estimate points.

Chapter 4: $\mathbb{R}^n$

- Find the position vector of a point in $\mathbb{R}^n$.
- Understand vector addition and scalar multiplication, algebraically.
- Introduce the notion of linear combination of vectors.
- Understand vector addition, geometrically.
- Find the length of a vector and the distance between two points in $\mathbb{R}^n$.
- Find the corresponding unit vector to a vector in $\mathbb{R}^n$.
- Understand scalar multiplication, geometrically.
- Find the vector and parametric equations of a line.
- Compute the dot product of vectors, and use this to compute vector projections.
- Find the vector and scalar equations of a plane.
- Compute the cross product and box product of vectors in $\mathbb{R}^3$.
- Determine the span of a set of vectors, and determine if a vector is contained in a specified span.
- Determine if a set of vectors is linearly independent.
- Understand the concepts of subspace, basis, and dimension.
- Find the row space, column space, and null space of a matrix.

Chapter 7: Spectral Theory

- Describe eigenvalues geometrically and algebraically.
- Find eigenvalues and eigenvectors for a square matrix.
- Determine when it is possible to diagonalize a matrix.
- When possible, diagonalize a matrix.
- Use diagonalization to find a high power of a matrix.

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TRANSFERABILITY: University of Alberta, University of Calgary*, University of Lethbridge*, Athabasca University*, Augustana Faculty, University of Alberta, Concordia University College, Canadian University College, Grant MacEwan University, King's University College*

***Warning:** Although we strive to make the transferability information in this document up-to-date and accurate, **the student has the final responsibility for ensuring the transferability of this course to Alberta Colleges and Universities**. Please consult the Alberta Transfer Guide for more information. You may check to ensure the transferability of this course at Alberta Transfer Guide main page http://www.transferalberta.ca or, if you do not want to navigate through few links, at http://alis.alberta.ca/ps/tsp/ta/tbi/onlinesearch.html?SearchMode=S&step=2

** Grade of D or D+ may not be acceptable for transfer to other post-secondary institutions. **Students are cautioned that it is their responsibility to contact the receiving institutions to ensure transferability**

EVALUATIONS: Assignments: 10% Quizzes: 15% Midterm: 25% Final Exam: 50%

GRADING CRITERIA:

Please note that most universities will not accept your course for transfer credit **IF** your grade is **less than C-**.

Alpha Grade	4-point Equivalent	Percentage Guidelines		Alpha Grade	4-point Equivalent	Percentage Guidelines
A+	4.0	90-100		C+	2.3	67-69
A	4.0	85-89		C	2.0	63-66
A-	3.7	80-84		C-	1.7	60-62
B+	3.3	77-79		D+	1.3	55-59
B	3.0	73-76		D	1.0	50-54
B-	2.7	70-72		F	0.0	00-49

COURSE SCHEDULE/TENTATIVE TIMELINE:

1. Aug. 30 – Sept. 1	Introduction	Aug. 30 – first day of classes
2. Sept. 4-8	Chapter 1	Monday, Sept. 4 – Labour Day
3. Sept. 11-15	Chapter 1	
4. Sept. 18-22	Chapter 2	
5. Sept. 25-29	Chapter 2	
6. Oct. 2-6	Chapter 3	
7. Oct. 9-13	Chapter 3	Mon. Oct. 9 – Thanksgiving Day
8. Oct. 16-20	Review, midterm	**Wednesday, Oct. 18 - Midterm**
9. Oct. 23-27	Chapter 4	Wed. Oct. 25 - last day to withdraw
10. Oct. 30 – Nov. 3	Chapter 4	
11. Nov. 6-10	Chapter 4	Nov. 10-13 – Fall Break
12. Nov. 13-17	Chapter 7	
13. Nov. 20-24	Chapter 7	
14. Nov. 27 – Dec. 1	Chapter 7	
15. Dec. 4-7	Review	Dec. 7 – last day of classes
Dec. 9-19		Final Exams

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STUDENT RESPONSIBILITIES: If an assignment, quiz or exam is missed for a *valid* reason, the weight will be transferred to another component of the course; there will be no rewrites or late assignments accepted. Students are responsible for all lecture material, seminars and readings. Please check moodle regularly for course information and announcements.

STATEMENT ON PLAGIARISM AND CHEATING:

Cheating and plagiarism will not be tolerated and there will be penalties. For a more precise definition of plagiarism and its consequences, refer to the Student Conduct section of the College Calendar at http://www.gprc.ab.ca/programs/calendar/ or the College Policy on Student Misconduct: Plagiarism and Cheating at https://www.gprc.ab.ca/about/administration/policies
**Note: all Academic and Administrative policies are available on the same page.

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