DEPARTMENT of Science

COURSE OUTLINE – Winter 2023

MA 1020 (A3, AS1): Applied Linear Algebra – 3 (3-1-0) UT 60 Hours for 15 Weeks

Northwestern Polytechnic acknowledges that our campuses are located on Treaty 8 territory, the ancestral and present-day home to many diverse First Nations, Metis, and Inuit people. We are grateful to work, live and learn on the traditional territory of Duncan's First Nation, Horse Lake First Nation and Sturgeon Lake Cree Nation, who are the original caretakers of this land.

We acknowledge the history of this land, and we are thankful for the opportunity to walk together in friendship, where we will encourage and promote positive change for present and future generations.

INSTRUCTOR:	Dr. Brian Redmond	**PHONE:**	780 296 0055
OFFICE:	L215	**E-MAIL:**	bredmond@nwpolytech.ca
OFFICE HOURS:	TBA		

CALENDAR DESCRIPTION:
Vectors and matrices, solution of linear equations, equations of lines and planes, determinants, matrix algebra, orthogonality and applications (Gram-Schmidt), eigenvalues and eigenvectors and applications, complex numbers will be covered in the course.

PREREQUISITE(S)/COREQUISITE:
MA 1000

REQUIRED TEXT/RESOURCE MATERIALS:
Linear Algebra with Applications by K. Nicholson
Lyryx Account: Please follow this link and instruction to register.
Calculators are not permitted.

DELIVERY MODE(S):
On campus, f2f. Lectures are Tuesdays and Thursdays 10:00 AM – 11:20 AM in J226 and seminars are Mondays 10:00 AM – 10:50 AM in H211.

COURSE OBJECTIVES:
The aim of this course is to present the fundamental ideas, techniques, and applications of linear algebra.

Copyright © 2022, Northwestern Polytechnic and its licensors.

LEARNING OUTCOMES:

At the completion of this course, a student will be able to:

- Solve systems of linear equations using Gauss-Jordan elimination
- Perform matrix arithmetic: addition, subtraction, scalar and matrix multiplication, transposition, inversion, etc.
- Calculate determinants using cofactor expansion and row/column reduction
- Use Cramer's rule and polynomial interpolation in simple applications
- Express an invertible matrix as a product of elementary matrices
- Add and subtract intrinsic vectors and compute dot products, cross products, projections, angles, areas, and volumes in 2- and 3-space
- Solve geometric problems involving points, lines, and planes
- Determine linear independence of vectors and find bases for and dimensions of subspaces of $\mathbb{R}^n$
- Use the Gram-Schmidt algorithm to find orthonormal bases for subspaces of $\mathbb{R}^n$
- Compute eigenvalues and eigenvectors and perform diagonalization and orthogonal diagonalization (with applications to conics)
- Compute the pseudo-inverse of a matrix, the best-approximation (least-squares) solution to inconsistent systems, and least-squares error
- Perform elementary arithmetic with complex numbers in both standard and polar form, and compute roots of unity
- Compute complex inner products, eigenvalues, and eigenvectors in $\mathbb{C}^n$
- Generalize basic knowledge of $\mathbb{R}^n$ and $\mathbb{C}^n$ to abstract real and complex inner product spaces and abstract linear transformations

TRANSFERABILITY:

Please consult the Alberta Transfer Guide for more information. You may check to ensure the transferability of this course at the Alberta Transfer Guide main page http://www.transferalberta.ca.

** 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:	20%
Midterm:	30%
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

Copyright © 2022, Northwestern Polytechnic and its licensors.

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:

Tentative Timeline (subject to change):

Week	**Topics**	**Approximate Sections in Textbook**	**Important Dates**
2 January – 8 January	Lecture 1: Systems of Equations	1.1	Course begins on Thursday, January 5
9 January – 15 January	Lecture 2: Gaussian Elimination Lecture 3: Homogenous Systems and Applications	1.2, 1.3, 1.6	Lyryx Assignment #1 Due: Friday, January 13
16 January – 22 January	Lecture 4: Matrices – First Properties Lecture 5: Matrix-Vector Multiplication	2.1, 2.2	Lyryx Assignment #2 Due: Friday, January 20
23 January – 29 January	Lecture 6: Matrix Multiplication Lecture 7: Matrix Inverses and Applications	2.3, 2.4, 2.8	Lyryx Assignment #3 Due: Friday, January 27
30 January – 5 February	Lecture 8: Linear Transformations Lecture 9: Determinants and Cofactor Expansion	2.6, 3.1	Lyryx Assignment #4 Due: Friday, February 3
6 February – 12 February	Lecture 10: Determinants and Matrix Inverses Lecture 11: Elementary Matrices	3.2, 2.5	Lyryx Assignment #5 Due: Friday, February 10
13 February – 19 February	Lecture 12: Vector Geometry Lecture 13: Projections and Planes	4.1, 4.2	Lyryx Assignment #6 Due: Friday, February 17
20 February – 26 February	Winter Break		
27 February – 5 March	Lecture 14: Cross Product	4.3, 4.4	**Midterm: Tuesday, February 28**
6 March – 12 March	Lecture 15: Vector Space $\mathbb{R}^n$ Lecture 16: Linear Independence and Dimension in $\mathbb{R}^n$	5.1, 5.2	Lyryx Assignment #7 Due: Friday, March 10

Copyright © 2022, Northwestern Polytechnic and its licensors.

13 March – 19 March	Lecture 17: Orthogonality in $\mathbb{R}^n$ Lecture 18: Orthogonal Complements and Projections in $\mathbb{R}^n$	5.3, 5.4, 8.1	Lyryx Assignment #8 Due: Friday, March 17
20 March – 26 March	Lecture 19: Diagonalization Lecture 20: Orthogonal Diagonalization	3.3, 5.5, 8.2	Lyryx Assignment #9 Due: Friday, March 24
27 March – 2 April	Lecture 21: Best Approximation and Least Squares Lecture 22: Complex Numbers	5.6, Appendix A	Lyryx Assignment #10 Due: Friday, March 31
3 April – 9 April	Lecture 23: The Vector Space $\mathbb{C}^n$ Lecture 24: Introduction to Abstract Linear Algebra	8.7, Parts of Chapters 6, 7, and 10	Lyryx Assignment #11 Due: Thursday, April 6
10 April – 16 April	Review		Lyryx Assignment #12 Due: Friday, April 14
17 April – 23 April	Final exam period		
24 April – 30 April	Final exam period		

STUDENT RESPONSIBILITIES:
Please expect to spend a minimum of 10 hours per week doing homework.

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 Northwestern Polytechnic Calendar at https://www.nwpolytech.ca/programs/calendar/ or the Student Rights and Responsibilities policy which can be found at https://www.nwpolytech.ca/about/administration/policies/index.html.

**Note: all Academic and Administrative policies are available on the same page.

Additional Information (Optional):

Instructors may add whatever they want here.

Copyright © 2022, Northwestern Polytechnic and its licensors.