DEPARTMENT SCIENCE

COURSE OUTLINE – Winter 2026

MA1020 (A3): Applied Linear Algebra – 3 (3-1-0) 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:	Abdel Bensouilah	PHONE:	(780) 539-2052
OFFICE:	J210	E-MAIL:	ABensouilah@NWPolytech.ca
OFFICE HOURS:	11:00 AM to 12:00 PM on Tuesdays and Thursdays, or by appointment.		

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): MA1000

COREQUISITE(S): MA1000

REQUIRED MATERIALS:

- Linear Algebra with Applications by K. Nicholson
- Use of calculators is not permitted on the tests or exams

DELIVERY MODE(S):

NORTHWESTERN POLYTECHNIC

Lecture:	A3	MW	8:30 AM –9:50 AM	E302
Seminar:	AS1	M	1:00 PM – 1:50 PM	A314

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 the transferability of this course at the Alberta Transfer Guide main page http://www.transferalberta.alberta.ca.

** For courses with alpha (letter) grading, a 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:

Quizzes & Assignments 20% (held on a weekly basis)

Quizzes will be announced one lecture prior to the quiz.

Midterms 2 × 20% (Tentatively Week 6: Wednesday Feb 11, Week 11: Wednesday Mar 18)

Final Exam 40% (Cumulative, during exam period Apr 16 - Apr 23)

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GRADING CRITERIA:

Please note that most institutions 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	95-100	C+	2.3	67-69
A	4.0	85-94	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:

Weeks	Topics	Sections in Textbook
Week 1 (Jan 5, Jan 7)	Systems of Equations	1.1
Week 2 (Jan 12, 14)	Gaussian Elimination Homogenous Systems and Applications	1.2, 1.3, 1.6
Week 3 (Jan 19, 21)	Matrices – First Properties Matrix-Vector Multiplication	2.1, 2.2
Week 4 (Jan 26, 28)	Matrix Multiplication Matrix Inverses and Applications	2.3, 2.4, 2.8

Week 5 (Feb 2, 4)	Linear Transformations Determinants and Cofactor Expansion	2.6, 3.1
Week 6 (Feb 9, 11)	Determinants and Matrix Inverses Elementary Matrices	3.2, 2.5
Week 7 (Feb 16, 18)	Winter Break	
Week 8 (Feb 23, 25)	Vector Geometry Projections and Planes	4.1, 4.2
Week 9 (Mar 2, 4)	Cross Product	4.3, 4.4
Week 10 (Mar 9, 11)	Vector Space $\mathbb{R}^n$ Linear Independence and Dimension in $\mathbb{R}^n$	5.1, 5.2
Week 11 (Mar 12, 18)	Orthogonality in $\mathbb{R}^n$ Orthogonal Complements and Projections in $\mathbb{R}^n$	5.3, 5.4, 8.1
Week 12 (Mar 23, 25)	Diagonalization Orthogonal Diagonalization	3.3, 5.5, 8.2
Week 13 (Mar 30, Apr 1)	Best Approximation and Least Squares Complex Numbers	5.6, Appendix A
Week 14 (Apr 6, 8)	The Vector Space $\mathbb{C}^n$ Introduction to Abstract Linear Algebra	8.7, Parts of Ch 6,7 and 10
Week 15 (Apr 13)	Review for final exam	

STUDENT RESPONSIBILITIES:

Students are responsible for all lecture material, labs and readings. Students are expected to practice the material by doing problems from the textbook. Assignments are not accepted if handed in late. If a midterm is missed due to illness the weight will be put on the next midterm or the final. If the final is missed due to

illness it will be deferred (see calendar for information). A doctor's note and a phone message or email will be required in both cases.

STATEMENT ON ACADEMIC MISCONDUCT:

Academic Misconduct will not be tolerated. For a more precise definition of academic misconduct and its consequences, refer to the Student Rights and Responsibilities policy available at https://www.nwpolytech.ca/about/administration/policies/index.html.

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