ORIGINAL COURSE IMPLEMENTATION DATE:	May 1994
REVISED COURSE IMPLEMENTATION DATE:	September 2023
COURSE TO BE REVIEWED (six years after UEC approval)**:**	December 2028

Course outline form version: 09/08/2021

OFFICIAL UNDERGRADUATE COURSE OUTLINE FORM

Note: The University reserves the right to amend course outlines as needed without notice.

Course Code and Number: MATH 316

Number of Credits: 3 Course credit policy (105)

Course Full Title: Numerical Analysis

Course Short Title: Numerical Analysis

Faculty: Faculty of Science

Department (or program if no department): Mathematics & Statistics

Calendar Description:

The construction, analysis, and implementation of numerical methods to mathematical problems. These problems include examples from linear algebra, calculus, non-linear equations, the approximation of functions, and ordinary differential equations.

Prerequisites (or NONE):	MATH 112 and one of MATH 152 or MATH 221.
Corequisites (if applicable, or NONE):	NONE
Pre/corequisites (if applicable, or NONE):	COMP 150 or COMP 152.

Antirequisite Courses *(Cannot be taken for additional credit.)*

Former course code/number:

Cross-listed with:

Equivalent course(s):

(If offered in the previous five years, antirequisite course(s) will be included in the calendar description as a note that students with credit for the antirequisite course(s) cannot take this course for further credit.)

Typical Structure of Instructional Hours

Lecture/seminar	30
Supervised laboratory hours (computer lab)	20
Total hours	**50**

Scheduled Laboratory Hours

Labs to be scheduled independent of lecture hours: ☒ No ☐ Yes

Course Details

Special Topics course: **No**

(If yes, the course will be offered under different letter designations representing different topics.)

Directed Study course: **No**

(See policy 207 for more information.)

Grading System: **Letter grades**

Delivery Mode: **May be offered in multiple delivery modes**

Expected frequency: **Every other year**

Maximum enrolment (for information only)**: 36**

Prior Learning Assessment and Recognition (PLAR)

PLAR is available for this course.

Transfer Credit *(See* ***bctransferguide.ca****.)*

Transfer credit already exists: **Yes**

Submit outline for (re)articulation: **No**

(If yes, fill in transfer credit form.)

Department approval	**Date of meeting:**	October 2022
Faculty Council approval	**Date of meeting:**	November 4, 2022
Undergraduate Education Committee (UEC) approval	**Date of meeting:**	December 16, 2022

Learning Outcomes *(These should contribute to students' ability to meet program outcomes and thus Institutional Learning Outcomes.)*

Upon successful completion of this course, students will be able to:

1. Explain floating-point number systems and arithmetic on such systems.
2. Describe the inherent limitations of floating-point representations.
3. Quantify the errors that arise in applying numerical methods to mathematical problems.
4. Evaluate the rate of convergence of a sequence of numerical approximations.
5. Demonstrate the convergence of approximations using computer calculations.
6. Implement a variety of basic algorithms using a suitable computer language.
7. Identify examples of problems that are ill-conditioned.
8. Assess different numerical methods for a given mathematical problem.

Recommended Evaluation Methods and Weighting *(Evaluation should align to learning outcomes.)*

Final exam:	30%	Assignments:	20%	Quizzes/tests:	30%
Lab work:	20%		%		%

Details: Students must achieve at least 40% on the final exam in order to receive credit for this course.

NOTE: The following sections may vary by instructor. Please see course syllabus available from the instructor.

Texts and Resource Materials *(Include online resources and Indigenous knowledge sources. Open Educational Resources (OER) should be included whenever possible. If more space is required, use the Supplemental Texts and Resource Materials form.)*

	Type	Author or description	Title and publication/access details	Year
1.	Textbook	Explorations in Numerical Analysis Python edition	Exploration in Numerical Analysis, Python edition, World Scientific	2021
2.	Textbook	Burden, Faires, & Burden	Numerical Analysis,Brooks/Cole	2016
3.	OER book	Leon Brin	Tea Time Numerical Analysis	2016
4.				

Required Additional Supplies and Materials *(Software, hardware, tools, specialized clothing, etc.)*

Students will make use of a computing platform such as Maple or Python.

Course Content and Topics

1. Floating-point number systems
   a. Floating-point representations of real numbers
   b. Roundoff error analysis
   c. Floating-point arithmetic and cancellation error
2. Solutions of equations in one variable
   a. The Bisection method
   b. Fixed-point iteration
   c. The Newton Method
   d. Error analysis for iterative methods
3. Interpolation and polynomial approximation
   a. Interpolation and the Lagrange polynomial
   b. Divided differences
   c. Numerical differentiation and integration
   d. Richardson's extrapolation
4. Solutions of initial value problems
   a. Elementary theory of initial value problems
   b. Euler's method
   c. Higher-order Taylor methods
   d. Runge-Kutta methods
   e. Stability and stiff differential equations
5. Iterative techniques in matrix algebra
   a. Norms of vectors and matrices
   b. Eigenvalues and eigenvectors
   c. Iterative techniques for solving linear systems
   d. Error estimates and iterative refinement
6. Approximation Theory
   a. Discrete least squares approximation
   b. Orthogonal polynomials and least squares approximations