UNIVERSITY OF THE FRASER VALLEY

ORIGINAL COURSE IMPLEMENTATION DATE: May 1994
REVISED COURSE IMPLEMENTATION DATE: September 2015
COURSE TO BE REVIEWED: (six years after UEC approval) January 2021
Course outline form version: 05/29/14

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 (if title exceeds 30 characters):

Faculty: Faculty of Science **Department (or program if no department):** Mathematics and Statistics

Calendar Description:

This course covers the construction and application of numerical computing solutions to mathematical problems that include applications of linear algebra, differentiation and integration, non-linear equations, the approximation of functions, and ordinary differential equations.

Prerequisites (or NONE): MATH 112 and one of the following: MATH 221 or MATH 152.

Corequisites (if applicable, or NONE):

Pre/corequisites (if applicable, or NONE): COMP 150 or COMP 152.

Equivalent Courses (cannot be taken for additional credit)
Former course code/number:
Cross-listed with:
Equivalent course(s):
Note: Equivalent course(s) should be included in the calendar description by way of a note that students with credit for the equivalent course(s) cannot take this course for further credit.

Transfer Credit
Transfer credit already exists: ☐ Yes ☒ No
Transfer credit requested (OReg to submit to BCCAT):
☐ Yes ☒ No (if yes, fill in transfer credit form)
Resubmit revised outline for articulation: ☐ Yes ☐ No
To find out how this course transfers, see **bctransferguide.ca**.

Total Hours:45
Typical structure of instructional hours:

Lecture hours	36
Seminars/tutorials/workshops	
Laboratory hours	9
Field experience hours	
Experiential (practicum, internship, etc.)	
Online learning activities	
Other contact hours:	
Total	**45**

Special Topics
Will the course be offered with different topics?
☐ Yes ☒ No
If yes, different lettered courses may be taken for credit:
☐ No ☐ Yes, repeat(s) ☐ Yes, no limit
Note: The specific topic will be recorded when offered.

Maximum enrolment (for information only): 36

Expected frequency of course offerings (every semester, annually, every other year, etc.): every second year

Department / Program Head or Director: Cynthia Loten	**Date approved:**	October 27 2014
Campus-Wide Consultation (CWC)	**Date of posting:**	January 23, 2014
Faculty Council approval	**Date approved:**	Nov. 28, 2014
Dean/Associate VP: Lucy Lee	**Date approved:**	Nov. 14, 2014
Undergraduate Education Committee (UEC) approval	**Date of meeting:**	January 30, 2015

Learning Outcomes

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

1. Explain machine accuracy and the inherent limitations of floating point representation;
2. Quantify the errors that arise in applying numerical methods to mathematical problems;
3. Evaluate the rate of convergence of a sequence of numerical approximations;
4. Demonstrate the convergence of approximations using computer calculations;
5. Accurately implement a variety of basic algorithms on a computer;
6. Identify examples of problems that are ill-conditioned;
7. Assess different numerical methods for a given mathematical problem.

Prior Learning Assessment and Recognition (PLAR)

☒ Yes ☐ No, PLAR cannot be awarded for this course because

Typical Instructional Methods (guest lecturers, presentations, online instruction, field trips, etc.; may vary at department's discretion)

This course is primarily lecture- and lab-based instruction. Evaluation includes quizzes, tests, and a final exam.

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

Typical Text(s) and Resource Materials (if more space is required, download supplemental Texts and Resource Materials form)

	Author Surname, Initials	Title (article, book, journal, etc.)	Current Ed.	Publisher	Year
1.	Burden and Faires	Numerical Analysis	☒	Brooks/Cole	2011
2.			☐		
3.			☐		

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

Typical Evaluation Methods and Weighting

Final exam:	40%	Assignments:	10%	Midterm exam:	30%	Practicum:	%
Quizzes/tests:	10%	Lab work:	10%	Field experience:	%	Shop work:	%
Other:	%	Other:	%	Other:	%	Total:	100%

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

Grading system: Letter Grades: ☒ Credit/No Credit: ☐ Labs to be scheduled independent of lecture hours: Yes ☐ No ☒

Typical Course Content and Topics

1. Solutions of equations in one variable
   a. The bi-section method
   b. Fixed-point iteration
   c. The Newton Method
   d. Error analysis for iterative methods
2. Interpolation and polynomial approximation
   a. Interpolation and the Lagrange polynomial
   b. Divided differences
   c. Numerical differentiation and integration
   d. Richardson's extrapolation
3. 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
4. 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
5. Approximation Theory
   a. Discrete least squares approximation
   b. Orthogonal polynomials and least squares approximations