UNIVERSITY OF THE FRASER VALLEY

OFFICIAL UNDERGRADUATE COURSE OUTLINE (page 1)

COURSE IMPLEMENTATION DATE: May 1994
COURSE REVISED IMPLEMENTATION DATE: September 2009
COURSE TO BE REVIEWED: February 2012
(four years after UPAC approval) *(month, year)*

OFFICIAL UNDERGRADUATE COURSE OUTLINE INFORMATION

Students are advised to keep course outlines in personal files for future use.
Shaded headings are subject to change at the discretion of the department – see course syllabus available from instructor

MATH 316	MATHEMATICS & STATISTICS	3
COURSE NAME/NUMBER	FACULTY/DEPARTMENT	UFV CREDITS

Numerical Analysis
COURSE DESCRIPTIVE TITLE

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: MATH 112, knowledge of a programming language acceptable to the department, and either MATH 221 or MATH 152.
COREQUISITES:
PRE or COREQUISITES:

SYNONYMOUS COURSE(S):
(a) Replaces:
(b) Cross-listed with:
(c) Cannot take: for further credit.

SERVICE COURSE TO: *(department/program)*

TOTAL HOURS PER TERM: **60**

STRUCTURE OF HOURS:

Lectures:	**60**	Hrs
Seminar:		Hrs
Laboratory:		Hrs
Field experience:		Hrs
Student directed learning:		Hrs
Other (specify):		Hrs

TRAINING DAY-BASED INSTRUCTION:
Length of course:
Hours per day:

OTHER:
Maximum enrolment: **36**
Expected frequency of course offerings: Every second year
(every semester, annually, every other year, etc.)

WILL TRANSFER CREDIT BE REQUESTED? (lower-level courses only)	☐ Yes	☐ No
WILL TRANSFER CREDIT BE REQUESTED? (upper-level requested by department)	☐ Yes	☒ No
TRANSFER CREDIT EXISTS IN BCCAT TRANSFER GUIDE:	☐ Yes	☒ No

Course designer(s):
Department Head: Gillian Mimmack — Date approved: August 27, 2007
Supporting area consultation (UPACA1) — Date of meeting: Sept 21, 2007
Curriculum Committee chair: Barbara Moon — Date approved: January 18, 2008
Dean/Associate VP: Wanda Gordon — Date approved:
Undergraduate Program Advisory Committee (UPAC) approval — Date of meeting: February 1, 2008

LEARNING OUTCOMES:

This course introduces students to some basic numerical techniques for solving equations in one variable and for linear systems, numerical differentiation and integration, and approximating solutions of ordinary differential equations. Students also learn how error can be estimated and approximation can be improved. Students are also required to implement some of the algorithms and to use some existing software packages.

This course is designed to enable students to:

1. understand the inherent limitations of floating point representation and machine accuracy.
2. become acquainted with the mathematics behind some of the basic classical techniques for finding solutions to numerical problems.
3. become acquainted with some basic algorithms in approximation theory.

METHODS: *(Guest lecturers, presentations, online instruction, field trips, etc.)*

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

METHODS OF OBTAINING PRIOR LEARNING ASSESSMENT RECOGNITION (PLAR):

☐ Examination(s) ☐ Portfolio assessment ☐ Interview(s)

☒ Other (specify): Course Challenge

☐ PLAR cannot be awarded for this course for the following reason(s):

TEXTBOOKS, REFERENCES, MATERIALS:

[Textbook selection varies by instructor. An example of texts for this course might be:]

The textbook is chosen by a departmental curriculum committee. Recent text used:
Burden and Faires. *Numerical Analysis*. 5th edition. PWS.

STUDENT EVALUATION:

[An example of student evaluation for this course might be:]

The weighting of the various components may vary from instructor to instructor and from year to year, although there must be at least two midterms, and the comprehensive final exam must be worth from 30% to 50% of the final grade. A student must obtain at least 40% on the final exam in order to pass this course.

Quizzes	10%
Assignments	10%
Tests (2)	40%
Final Exam	40%

COURSE CONTENT:

[Course content varies by instructor. An example of course content might be:]

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. Numerical differentiation
   e. Richardson's extrapolation

f. Elements of numerical integrability
g. Initial value problems for ordinary differential equations
h. Elementary theory of initial value problems
i. Euler's method
j. Higher-order Taylor methods
k. Runge-Kutta methods
l. Stability and stiff differential equations

3. 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

4. Approximation theory
    a. Discrete least squares approximation
    b. Orthogonal polynomials and least squares approximation