UNIVERSITY OF THE FRASER VALLEY

**ORIGINAL COURSE IMPLEMENTATION DATE:** September 1993

**REVISED COURSE IMPLEMENTATION DATE:** September 2016

**COURSE TO BE REVIEWED: (six years after UEC approval)** October 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 112 **Number of Credits:** 4 Course Credit Policy 105

**Course Full Title:** Calculus II

**Course Short Title (if title exceeds 30 characters):**

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

**Calendar Description:**
Calculus I is concerned with finding the characteristics of change of a given quantity. In Calculus II, we examine the change in the reverse: if we know the way a quantity changes, can we determine what the quantity is? Topics include techniques of integration; application of the definite integral to various problems such as areas, volumes, average value of a function, and others from the natural and social sciences; approximate integration methods; improper integrals and their applications; an introduction to differential equations; polynomial approximations to functions; and sequences and series.

Note: Students with credit for MATH 118 cannot take this course for further credit.

**Prerequisites (or NONE):** MATH 111 with a C or better.

**Corequisites (if applicable, or NONE):**

**Pre/corequisites (if applicable, or NONE):**

**Equivalent Courses (cannot be taken for additional credit)**

Former course code/number:

Cross-listed with:

Equivalent course(s): MATH 118, MATH 116

*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:** 75

**Typical structure of instructional hours:**

| | |
|---|---|
| Lecture hours | 75 |
| Seminars/tutorials/workshops | |
| Laboratory hours | |
| Field experience hours | |
| Experiential (practicum, internship, etc.) | |
| Online learning activities | |
| Other contact hours: | |
| **Total** | **75** |

**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 offerings**: At least twice a year

| | | |
|---|---|---|
| **Department / Program Head or Director:** Cynthia Loten | **Date approved:** | May 25, 2015 |
| **Campus-Wide Consultation (CWC)** | **Date of posting:** | September 25, 2015 |
| **Faculty Council approval** | **Date approved:** | September 2015 |
| **Dean/Associate VP:** Lucy Lee | **Date approved:** | Summer 2015 |
| **Undergraduate Education Committee (UEC) approval** | **Date of meeting:** | October 2, 2015 |

**Learning Outcomes**

Building upon their knowledge of differential calculus, successful students will be able to:

1. express the definite integral as a limit of Riemann sums;
2. interpret the definite integral as an area;
3. explain the Fundamental Theorem of Calculus;
4. apply the Fundamental Theorem of Calculus to evaluate definite integrals;
5. demonstrate proficiency in using various techniques of integration;
6. use definite integrals to model and solve problems in a variety of situations;
7. test the convergence of improper integrals;
8. identify separable first order differential equations;
9. solve separable first order differential equations;
10. model simple real-world situations with first order differential equations;
11. explain the concepts of convergence and divergence of a sequence and of a series;
12. use various tests to determine convergence (absolute and conditional) and divergence of series;
13. recognize the function represented by a power series;
14. construct the power series representation of a function;
15. determine the radius of convergence of a power series;
16. carry out analyses and calculations both with and without technological support.

In the course of mastering the concepts and techniques of this first year calculus course, the student should develop an appreciation of what mathematics is and how the skills honed through the study of mathematics are useful in other disciplines.

**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)**

Lectures are interspersed with problem sessions; evaluation includes assignments, midterms, and a three-hour comprehensive final. Graphing calculators will be used. In addition, mathematical software may be used.

**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)**

The text is chosen by a departmental curriculum committee. Recent text used:

| | Author Surname, Initials | Title (article, book, journal, etc.) | Current Ed. | Publisher | Year |
|---|---|---|---|---|---|
| **1.** | Stewart, J | Single Variable Calculus, Early Transcendentals | 7th | Brooks/Cole | 2012 |
| **2.** | Stewart, J | Study Guide for Single Variable Calculus (Optional) | 7th | Brooks/Cole | 2012 |
| **3.** | Stewart, J | Student Solutions Manual for Stewart's Single Variable Calculus: Early Transcendentals (Optional) | 7th | Brooks/Cole | 2012 |
| **4.** | | | ☐ | | |
| **5.** | | | ☐ | | |

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

A graphing calculator (without a computer algebraic system) will be required.

**Typical Evaluation Methods and Weighting**

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

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

**Details (if necessary):** 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. Students must obtain at least 40% on the final exam to pass the course.

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

**Typical Course Content and Topics**

Exact course content and ordering may vary slightly from year to year but will encompass the following:

I. Integrals:
   1. brief review of derivatives and antiderivatives
   2. areas and distances
   3. definite integrals

4. indefinite integrals and net change theorem
5. approximate integration* including Riemann sums, trapezoid and midpoint rules and, as time permits, Simpson's rule and/or error analysis
6. improper integrals

II. Applications: constructing Riemann sums and evaluating integrals in a wide variety of settings, including
1. area
2. volume
3. average value of a function
4. further applications to be chosen from work, arc length, area of a surface of revolution, and other applications from the natural and social sciences

III. Techniques of Integration:
1. integration by parts
2. integration by substitution (including trigonometric substitutions)
3. trigonometric integrals
4. integration of rational functions by partial fractions

IV. Differential Equations:
1. direction fields*
2. Euler's method*
3. separable equations
4. applications to growth and decay problems*, including exponential, and logistic models
5. modelling real-world situations with initial-value problems
6. further applications, as time permits*: Newton's law of cooling and/or predator-prey systems

V. Infinite Sequences and Series:
1. sequences and series
2. series convergence tests (including divergence test, integral test, ratio test, alternating series test)
3. Taylor series* and applications and determining interval of convergence
4. polynomial approximations and, as time permits, error estimation

* While graphing calculators or other technology are used throughout the course, they are particularly useful in helping students explore these concepts.