UNIVERSITY OF THE FRASER VALLEY

ORIGINAL COURSE IMPLEMENTATION DATE:	January 2006
REVISED COURSE IMPLEMENTATION DATE:	September 2015
COURSE TO BE REVIEWED: (six years after UEC approval)	October 2020

Course outline form version: 11/22/13

OFFICIAL UNDERGRADUATE COURSE OUTLINE FORM

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

Course Code and Number: MATH 265 **Number of Credits:** 3 Course credit policy (105)

Course Full Title: Transition to Advanced Mathematics
Course Short Title:

Faculty: Faculty of Science **Department (or program if no department):** MATH & STATS

Calendar Description:

Students will learn to understand the language of mathematics through careful statement of definitions and construction of proofs. Important topics will be strategies for writing proofs of theorems, and how to effectively communicate mathematics to others. Upon completion of this course students will be prepared to take upper-level mathematics courses. Mathematical contexts: elementary theories of sets, integers, and the real numbers.

Note: Students with credit for MATH 214 cannot take this course for further credit.

Prerequisites (or NONE): C+ or better in either MATH 112 or MATH 118

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 214**

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 (Note: 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	45
Seminars/tutorials/workshops	
Laboratory hours	
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, etc.): Annually

Department / Program Head or Director:	Cindy Loten	**Date approved:**	August 27 2014
Campus-Wide Consultation (CWC)		**Date of posting:**	n/a
Faculty Council approval		**Date approved:**	October 3, 2014
Dean/Associate VP:	Lucy Lee	**Date approved:**	October 3, 2014
Undergraduate Education Committee (UEC) approval		**Date of meeting:**	October 24, 2014

Learning Outcomes

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

(1) read, critique, and construct elementary mathematical arguments by
  - (a) using the common elements of mathematical communication: definition, proof, example, counterexample, etc.
  - (b) employing the syntactics and semantics of propositional and elementary predicate logic
  - (c) using the standard argument forms (contradiction, induction etc)

(2) reason effectively about a mathematical proposition, work towards proof or counterexample employing reasoning techniques such as generalization, specialization, method of counterexample, alternate representation etc.

(3) communicate mathematical constructions and arguments clearly and effectively in written form, in particular:
  - (a) clearly guide a reader through an argument or construction of an example.
  - (b) assess what needs to be provided to a reader, and what may be assumed.

(4) articulate an understanding of the basic notions of elementary set theory, in particular subset, Cartesian product, functions, relations, equivalence relation, quotient structure and cardinality, by clearly stating definitions, constructing examples and counterexamples, and establishing elementary propositions.

(5) demonstrate the elementary structure of the real numbers by
  - (a) constructing simple propositions working from the axioms for the real numbers, and clearly articulating the significance of the axiomatic approach
  - (b) stating definitions and reading, critiquing and constructing elementary arguments, examples and counterexamples using concepts of order, cardinality, density, supremum.

(6) demonstrate the elementary structure of the integers, by stating definitions and reading, critiquing and constructing elementary arguments, examples and counterexamples involving concepts of primality, factorization, and modulus

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

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 Edition	Publisher	Year Published
1.	Daepp & Gorkin	Reading Writing and Proving	2☐	Springer	2011
2.	Chartrand Polimeni, Zhang	Mathematical Proofs: A Transition to Advanced Mathematics	2☐	Pearson	2007
3.			☐		
4.			☐		
5.			☐		

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

Use this section for supplies and materials for all sections of this course.

Typical Evaluation Methods and Weighting

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

The techniques of construction and communication of mathematical argument are an essential part of the course, to be covered explicitly, rather than assumed. They will be distributed throughout the course as part of the material being discussed at the time, rather than being dealt with in the abstract. In particular the following will be included:

(1) Argument forms (methods of proof): contradiction, contrapositive, direct, induction, cases etc.
(2) "How to prove it:" softer notions of how to solve a problem/construct an argument: generalization, specialization, working backwards, representation.
(3) "How to write it:" communicating an argument (guiding a reader towards your solution).
(4) Language of mathematics: this material should be covered near the beginning of the course
    (a) Logic (propositional logic), notions of converse, contrapositive etc.
    (b) Basic set theory (include infinite index sets for unions, Cartesian products etc.),
(1) (c) Quantifiers (predicate calculus) negation of statements. Proving and disproving universal and existential statements
    (c) Functions, domain, range, pre-image, surjections, injections, bijections
    (d) Relations, equivalence relations, quotient set.

(5) The integers. The integers provide a natural place to learn how to read and construct arguments, and a natural source of examples to illustrate the ideas of logic, quantifiers etc.
    (a) The integers (from the axioms)
    (b) Primes/divisibility
    (c) Modular arithmetic (example of quotient structures)

(6) The real numbers. Basic arguments/facts from analysis are covered both to provide a concrete place for the students to construct arguments, and also just to provide some basic analysis.
    (a) Axioms for the reals (and basic facts which follow, as an exercise in proof construction from axioms)
    (b) Supremum, infimum, completeness
    (c) Density of rationals, dense sets in general
    (d) Cardinality (uncountability of R, countability of Q, general cardinality arguments)
    (e) Sequences (if time) an introduction to epsilon-N arguments, basic theorems, another statement of the completeness axiom, decimal representation. (If time is short, decimal representation could be done via supremum infimum (Dedekind cuts).)