UNIVERSITY OF THE FRASER VALLEY

OFFICIAL UNDERGRADUATE COURSE OUTLINE (page 1)

COURSE IMPLEMENTATION DATE:	January 2006
COURSE REVISED IMPLEMENTATION DATE:	September 2012
COURSE TO BE REVIEWED:	September 2011
(six years after UEC 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 265	SCIENCE/MATH & STATS	3
COURSE NAME/NUMBER	FACULTY/DEPARTMENT	UFV CREDITS

Transition to Advanced Mathematics

COURSE DESCRIPTIVE TITLE

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 better prepared to take upper-level mathematics courses. The mathematical contexts are the elementary theories of sets, integers, and the real numbers, which themselves form an essential background for subsequent courses. This course is a prerequisite for the mathematics major degree and an important course for anyone studying mathematics.

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

PREREQUISITES:	C+ or better in either MATH 112 or MATH 118
COREQUISITES:	
PRE or COREQUISITES:	

SYNONYMOUS COURSE(S):

(a) Replaces: ________

(b) Cross-listed with: ________

(c) Cannot take: **MATH 214** for further credit.

SERVICE COURSE TO: *(department/program)*

TOTAL HOURS PER TERM: **45**

STRUCTURE OF HOURS:

Lectures:	**45**	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: Annually

(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):	**Greg Schlitt / Erik Talvila / Ian Affleck**		
Department Head:	**Greg Schlitt**	Date approved:	**December 15, 2011**
Supporting area consultation	**(Pre-UEC)**	Date of meeting:	**February 3, 2012**
Curriculum Committee chair:	**Norm Taylor**	Date approved:	**January 27, 2012**
Dean/Associate VP:	**Ora Steyn**	Date approved:	**February 10, 2012**
Undergraduate Education Committee (UEC) approval		Date of meeting:	**March 2, 2012**

LEARNING OUTCOMES:

Upon successful completion of this course, students will be able to:
(1) read, critiqique, 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) be able to clearly guide a reader through an argument or construction of an example.
    (b) anticipate 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 an understanding of 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.
    (c) recognizing the complex numbers (as an extension of the reals), calculating effectively with them, and demonstrating elementary properties.
(6) demonstrate an understanding of 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

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

The course will be primarily lecture-based

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. Examples for this course might be:]*

The text is chosen by a departmental curriculum committee.

Recommended texts are: Daepp & Gorkin. 2000. Reading, Writing and Proving, A Closer Look at Mathematics. Springer
Galovich. 1993. Doing Mathematics. Brooks/Cole.

SUPPLIES / MATERIALS:

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

Assignments	20%
Quizzes	20%
Tests	30%
Final Exam	30%

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

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

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 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.

Course content continued:

(3) "How to write it:" communicating an argument (guiding a reader towards your solution).
(4) Language of mathematics: this material would 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, Cartesion products etc.), functions.
- (c) Relations, equivalence relations, quotient set.
- (d) Quantifiers (predicate calculus) negation of statements. Proving and disproving universal and existential statements.

An example: 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)

An example: 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))