UNIVERSITY OF THE FRASER VALLEY

OFFICIAL UNDERGRADUATE COURSE OUTLINE (page 1)

COURSE IMPLEMENTATION DATE: January 2006
COURSE REVISED IMPLEMENTATION DATE: September 2009
COURSE TO BE REVIEWED: August 2011
(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 444	Mathematics & Statistics	3
COURSE NAME/NUMBER	FACULTY/DEPARTMENT	UFV CREDITS

Metric Spaces
COURSE DESCRIPTIVE TITLE

CALENDAR DESCRIPTION:

Metric spaces are sets with a generalized notion of distance. This is a wide-reaching concept and it allows us to define properties such as continuity and convergence in many more settings than the real line. Topics will include examples of metric spaces, topological concepts such as open and closed sets, convergence, completeness, and continuity. Further topics will be drawn from contraction mappings, normed spaces, topological spaces, and fractals.

PREREQUISITES: **MATH 221 and either MATH 320 or MATH 340.**
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 third 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): Greg Schlitt/Erik Talvila

Department Head:	Gillian Mimmack	Date approved:	**March 5, 2007**
Supporting area consultation (UPACA1)		Date of meeting:	**March 16, 2007**
Curriculum Committee chair:	Gillian Mimmack	Date approved:	**May 23, 2007**
Dean/Associate VP:	Jackie Snodgrass	Date approved:	
Undergraduate Program Advisory Committee (UPAC) approval		Date of meeting:	**August 31, 2007**

LEARNING OUTCOMES:

Upon successful completion of this course, students will be able to:
1. State the definition of metric space, recognize metric spaces as such, establish that a given space is a metric space.
2. Be able to define the appropriate topological concepts such as connectedness, compactness, completeness, boundary, limit point. Exhibit understanding of these concepts by constructing formal arguments to establish elementary results and establishing the truth or falsity of elementary statements.
3. Discuss convergence in terms of Cauchy sequences, construct the completion of a metric space, be able to state and use the theorems regarding completeness and compactness.
4. State various definitions of continuity, and use them to establish the continuity or discontinuity of given functions. Show via elementary formal arguments an understanding of the role continuity plays in the various minor and major results (e.g. preservation of compactness under continuous functions, fixed point theorems).
5. Exhibit a good knowledge and understanding of the various applications of the theory of metric spaces (e.g. to establish the existence of solutions to integral equations).

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

This course will be primarily lecture-based.

METHODS OF OBTAINING PRIOR LEARNING ASSESSMENT RECOGNITION (PLAR):

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

☐ Other (specify): Please check online at http://www.ucfv.ca/math/challenge.htm for the departmental challenge policy.

☐ 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. Recommended texts are:
V. Bryant. 1985. Metric Spaces. Cambridge University Press.
T. W. Gamelin and R. E. Greene. 1999. Introduction to Topology. Dover.
S. Lipschutz. 1965. Schaum's Outline of Theory and Problems of General Topolgy. McGraw-Hill.
R. B. Reisel. 1983. Elementary Theory of Metric Spaces. Springer-Verlag.
W. A. Sutherland. 1975. Introduction to Metric and Topological Spaces. Oxford University Press.

SUPPLIES / MATERIALS:

STUDENT EVALUATION:

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

Assignments 40%
Term Tests 20%
Final Exam 40%

COURSE CONTENT:

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

1. Definition of metric spaces, examples.
2. Subspaces, product spaces.
3. Topology--open, closed, bounded, connected, compact, interior, boundary.
4. Equivalent metrics, isometries.
5. Sequences--convergence, Cauchy sequences.
6. Complete spaces, completions.
7. Limit points, perfect sets.
8. Continuous functions--mapping properties of functions and inverses, homeomorphisms, extreme value theorem.
9. Contraction mapping theorem--proof, applications to algebraic, differential or integral equations.
10. Topological spaces--open sets, neighbourhoods, compactness, bases, continuous functions.