UNIVERSITY OF CALGARY

FACULTY OF SCIENCE
Department of Mathematics and Statistics

Mathematics 445 /447	Analysis II / Honours Analysis II

(see Section 3.5C of Faculty of Science www.ucalgary.ca/pubs/calendar/current/sc-3-5.html and Course Descriptions: http://www.ucalgary.ca/pubs/calendar/current/course-main.html)

Syllabus

Topics	**Number of hours**
Sequences of functions; pointwise and uniform convergence; Weierstrass M-test.	6
Topology of metric spaces and normed linear spaces. *p*-norms on R^n and Minkowski's inequality.	6
Compactness, connectedness, completeness and continuity; the contraction mapping principle; the Baire category theorem.	6
Continuous functions on a compact metric space; approximations of continuous functions: Stone-Weierstrass theorem; the Arzela-Ascoli theorem.	3
Linear transformations and matrix norms.	3
Differentiability on R^n: the Jacobian, the chain rule, the mean value theorem, the inverse function theorem and the implicit function theorem.	8
Additional topics and/or applications selected by course instructor.	4
Total Hours	**36**

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Updated 15 Dec 2016 by R. Hamilton

Math 445/447- Analysis II/Honours Analysis II
Course Outcomes

Overview

This course aims to formalize the analogies between the real numbers and other spaces with similar structure. In particular, students will generalize many of the notions in the Analysis I course to more general settings including Euclidean space, spaces of functions and spaces of linear transformations. Honour students in Math 447 are expected to produce a higher level of rigour on written tests and solve more difficult and open-ended assignment problems.

Subject specific knowledge

By the end of this course, students are expected to

1. state the axioms of a metric space and deduce conclusions from these axioms.
2. show that many of the spaces encountered so far in mathematics are examples of metric spaces.
3. construct a formal epsilon argument for the convergence of a sequence in a metric space.
4. identify the key topological features of metric spaces and their subspaces.
5. verify the completeness of several foundational metric spaces.
6. state and prove the Baire category theorem and its equivalents.
7. state the axioms of a normed linear space and provide several examples.
8. state the contraction mapping theorem, the Arzela-Ascoli theorem, and the Stone- Weierstrass theorem for functions defined on compact metric spaces. Apply these theorems to examples of approximating continuous functions with simpler functions.
9. define the notions of differentiability, partial derivatives and the Jacobian matrix for multivariate functions.
10. state and apply the implicit function theorem.

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