MATH 3220 Foundations of Analysis II

SYLLABUS

Credits: Four

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Textbook: Joseph L. Taylor, Foundations of Analysis, American Mathematical Society, Providence 2012. ISBN 978-0-8218-8984-8

Prerequisites: "C" or better in MATH 3210

General Goals: The main goal of this course is twofold: to provide students with a rigorous approach to the theory of several variable calculus and to teach them the essentials of the professional mathematician: logic, proof and the writing of a mathematical argument. This is the second course of the MATH 3210–3220 sequence on *Foundations of Analysis*, a sequence designed to develop the mathematical sophistication of students, while giving them a much deeper understanding of calculus and its foundations than can be provided by the standard courses (MATH 1210, 1220, and 2210). In this sequence, the students are given a rigorous development of calculus. The emphasis is on improving the students' ability to understand and explain concepts in a logical and complete manner and refine their skill at proofs and mathematical argument. Incidental to this goal, students gain a broad exposure to the special mathematical notation, terminology, and thought processes used by professional mathematicians. Students who finish both semesters of the sequence should have the mathematical knowledge and sophistication necessary to do well in 4000 and 5000 level mathematics courses.

Bachelor Degree Requirement Met: This course meets the BS Quantitave Intensive (QI) requirement. This course addresses the following Essential Learning Outcomes: Inquiry and Analysis, Critical Thinking, Problem Solving.

Course Description: The course begins with the definition of topology in Euclidean space. Compactness and connectedness are introduced in this context, and the Heine–Borel theorem is one of the main theorems students prove in this part of the course. The definitions of limits, continuity and convergence are revised from the topological point of view. The course moves on to give a rigorous approach to differentiation in several variables, Taylor formula, and Riemann integration on Jordan regions. This part includes keystone theorems such as the Inverse Function Theorem, the Implicit Function Theorem, Fubini's Theorem, and the Change-of-Variable formula, and applications to optimization via Lagrange multipliers, parametrizations of higher dimensional surfaces in Euclidean spaces, and computation of their tangent spaces and volumes. The course covers most or all of the following chapters from the textbook:

- Chapter 7: Convergence in Euclidean Spaces
- Chapter 8: Functions on Euclidean Spaces
- Chapter 9: Differentiation in Several Variables
- Chapter 10: Integration in Several Variables

Course Structure: This course is mainly lecture based, with the instructor presenting material at the blackboard. However, given the relatively small size of the class, students are engaged in the discussion, with the instructor often raising questions in class and actively involving the students

in the discussion. Homework is typically assigned on a weekly basis and students are often invited to present homework solutions at the blackboard, and to participate in the subsequent discussion of the solutions. Many of the homework exercises involve proving theorems or providing examples that illustrate the course material. Similar problems are given in the exams.

Grading: Grading is based on homework, mid-term exams, and a final comprehensive exam. Homework is assigned on a weekly basis; many of the homework exercises involve proving theorems or providing examples that illustrate the course material. Similar problems are given in the exams. Grading is based on the following or similar evaluation method:

- Weekly homework assignments, counting 30% toward the final grade.
- Two in-class midterms, each counting 20% toward the final grade.
- Final exam, counting 30% toward the final grade.

The lowest two homework grades are dropped.

ADA: The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. Students are encouraged to approach the instructor and the Center for Disability Services to make suitable arrangements if needing special accommodations.