# MATH 410: ADVANCED CALCULUS I

Spring 2014

*SYLLABUS*

Course Description: Math 410-411 is a two term introduction to the theory of functions on the real line. The goal of the course is to empower students with the techniques of analysis while illuminating how these techniques can return surprising, useful, and powerful results in a familiar setting.

The course begins with the Axiom of Completeness and its equivalents. We then construct a rigourous theory of limits and apply it to the notion of convergence. After a brief tour of topology of real line, we will turn our attention to deep questions left unaddressed in the calculus sequence, including: Can we characterize the set of points at which a function might be discontinuous? Is the limit of a sequence of continuous functions itself continuous? We know from the Fundamental Theorem of Calculus that all continuous functions are integrable, but we also know that these are not the *only* integrable functions which are integrable; can we characterize the class of integrable functions?

Math 410 discusses chapters 1-4 of the text. Math 411 addresses the rest.

Prerequisites: Math 245 or other robust proofs course, or consent of the instructor. To be well-rewarded by the course, it would be better for students to have had several abstract, proof-based courses.

Text: *Understanding Analysis*, by S. Abbott, published by Springer.

Class Meetings: TTh 12:30-1:45 in Burruss 126.

Professor: Elizabeth Θ Brown, PhD., brownet@jmu.edu, (540) 568-8763, Roop 122, http://educ.jmu.edu/∼brownet

Office Hours: T 2-3:13, 5-5:30 and W 12:20-1:10 in Roop 122.

On-line Course Materials: On-line course materials, including a copy of this syllabus and assignments will be posted on the course web site,
http://educ.jmu.edu/∼brownet/410/

Exams: There will be a written exam in class on Thursday, February 27 and an oral exam scheduled outside of class the week of April 7.

There will be no make-up exams, except in cases of what I construe to be documented emergencies.

Grading, Exercises, and Attendance: Semester grades will be based on discussion and homework, midterms, and the final.

Homework assessment will alternate by week, between written solutions handed in by Thursday class and verbal discussion during scheduled small group meetings.

Students who miss more than three class meetings will recieve an F in the class.

Classroom Conduct: Cell phone use, including texting, is out of the question. Students texting in class will be asked to leave.

Honor Code: Violation of the JMU honor code is in essence theft from other students, and will be treated with corresponding gravity. Collaboration with other students from class on homework is encouraged. Exams must be individual efforts.

Special Circumstances: Any student who requires special arrangements because of a physical, mental, psychiatric, religious or other situation should speak with me during the first week of class. Our conversation will remain confidential, except for communication with the Office of Disability Services, if necessary. Please also see me if relevant new circumstances arise during the term.

University Policies: A complete statement of university policies concerning syllabi can be found at: www.jmu.edu/syllabus.

Course Goals as a List:

(1) To further students' understanding of mathematical method, the logical structure of the subject, and stylistic conventions of mathematical argument. Logical structure pertains to the precise relationships between axiom, definition, theorem, and proof. Stylistic conventions include pellucid language, as well as exactness, elegance, and efficiency of expression. Students will realize these goals by:
   (a) Giving orderly, cogent, reasoned arguments about the content of the course.
   (b) Writing logically robust proofs and solutions to problems.
   (c) Using theorems, ideas, and intuition from the course content to make and critically evaluate relevant conjectures in the context of class discussion.

(2) For students to achieve conceptual understanding of, and fluency in applying, the following:
   (a) Definitions, basic theory, and intuition of a rigourous notion of limits and convergence.
   (b) Definitions and preliminary understanding of topology of the real line.