Introduction to Analysis 1
MATH471

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Students on UI Moscow campus in fall and spring: You are encouraged to make appointments with me or use my office hours (posted on my office door) to get help with the material. I'll be happy to clarify any ambiguity in the lectures and to give pointers if you are stuck on a particular problem, however, I shall not work on your homework assignment with you nor will I check your solutions for errors in my office.

All students: When a meeting is not possible, do not hesitate to communicate any issues by email. Please follow some basic email courtesy. Emails without any address or signature can be ignored.

Recommended Text: Patrick M. Fitzpatrick, *Advanced Calculus,* 2nd Edition.

Course Webpage: www.webpages.uidaho.edu/sdatta/EOmath471.html

Course topics: chapters listed below are from the above mentioned book

- Introduction (Real numbers, upper bounds and lower bounds of sets, infimum & supremum of sets, functions, real-valued functions)
- Sequences (Chapter 2)
  1. Convergence and limits of sequences
  2. Boundedness and convergence; the Monotone Convergence Theorem
  3. Subsequences; Bolzano Weiesrstrass Theorem
- Continuity and limits of functions (Chapter 3)
  1. Definition and ϵ-δ criterion for continuity
  2. Uniform continuity
  3. Extreme and Intermediate Value Theorems
  4. Limit of a function at a point and continuity
- Differentiation (Chapter 4)
  1. Differentiability of a function at a point
  2. Continuity of differentiable functions

3. Local extrema and properties of a functions at a local extrema
4. Rolle's Theorem, Mean Value Theorem, and their geometric implications

- Integration (Chapter 6)

  1. Upper and lower (Darboux) sums; upper and lower integrals
  2. Integrability and the Archimedes-Riemann Theorem
  3. Integrability of monotone and continuous functions
  4. The Mean Value Theorem of integration
  5. The First and Second Fundamental Theorems of Calculus

Additional topics if time permits:

- Approximation by Taylor polynomials (Chapter 8)

Supplemental reading:

- Jerrold Marsden, *Elementary Classical Analysis*, W H. Freeman and Company.
- Richard Goldberg, *Methods of Real Analysis*, Princeton Lectures in Analysis, Princeton University Press, 2003.

Assignments, Exams & Grading:
Your grade in the course will be based on the following:
Homework - 20%
Midterm I - 25% (after Lecture 19)
Midterm II - 25% (after Lecture 34)
Final - 30%

All exams will be closed-book, closed-notes, and calculators will not be allowed. The final exam is comprehensive.
Part of your grade will be based on neatness and correct mathematical notation. Your work should be organized and easy for me to read or else you will lose points.

Important deadlines: The following are the deadlines by which the above exams must be taken and returned by the proctor to the EO office:

For Fall:
Exam I: October 15
Exam II: November 20

For Spring:

Exam I: March 1
Exam II: April 15

For Summer:
Exam I: July 5
Exam II: July 25

Unless you have taken my permission, you should strictly abide by the dates given above. You can take a test on any day before the corresponding due date. The exams must be received by the EO office **by** the above dates, otherwise, your score for the exam will be automatically set to zero. Please make a note of the above dates so that you can make arrangements with your proctor.

As soon as you finish a lecture, work on the related problems from the assignments. You should work on the assignments alongside the lectures and turn them in as you finish. In particular, you must ensure that all HWs pertaining to a certain midterm are submitted **before** that midterm. If your assignments are poorly timed, (for example, HW 1 is submitted after Midterm 2), or turned in one batch before tests or towards the end of the semester, they will **not** be considered. Besides, in such cases, I will **not** be able to provide any feedback or inform you of your HW grades.

Please scan (if handwritten) and email me your assignments in a **single** pdf. Camera shots of pages will **not** be accepted. Write your name, course name/no., and assignment no. in the subject of the email.

Learning outcomes:

1. The students will learn the concept of convergence of sequences. They will learn about various properties of convergent and divergent sequences, convergence of bounded monotone sequences, subsequences and convergence of subsequences. They will learn to apply important theorems as the Monotone Convergence Theorem and the Bolzano Weierstrass Theorem.

2. The students will learn about limits and continuity of functions. They will be able to find the limit of a function at a point if it exists, and whether the function is continuous at a given point. They will be able to determine whether a given function is uniformly continuous.

3. The students will learn the theory behind differentiation and learn the various properties of differentiable functions. They will be able to apply Rolle's Theorem and the Mean Value Theorem to differentiable function.

4. The students will learn the fundamental properties of the Riemann integral: they will be able to find the lower and upper sums, and lower

and upper integrals of a given function, they will be able to determine integrability of a function by using the Archimedes Riemann Theorem. They will be able to apply the Fundamental Theorems of Calculus.

5. Time permitting, the students will also learn how to approximate functions by Taylor polynomials.

The tests will serve as an assessment tool for the learning outcomes.