NetMath

DEPARTMENT OF MATHEMATICS

Math 447 XGR: Complex Variables (3 credits)

Note: This section is restricted to students enrolled in UIUC Online Engineering Graduate Degree Programs.

Course Description:

Careful development of elementary real analysis for those who intend to take graduate courses in Mathematics. Topics include completeness property of the real number system; basic topological properties of n-dimensional space; convergence of numerical sequences and series of functions; properties of continuous functions; and basic theorems concerning differentiation and Riemann integration. Credit is not given for both MATH 447 and either MATH 424 or MATH 444.

Prerequisite: MATH 241 or equivalent; junior standing; MATH 347 or MATH 348

Course Objectives:

Introduction to real analysis is a gateway. The idea is to find balance between rigorous proofs and real understanding. This principle is the core of mathematics at all levels. Be prepared to learn to write proofs. Be prepared to accept a little absract but clarifying approach to well known, and not so well known topics related to calculus.

Course Content:

1. Real Numbers
   Natural numbers
   Abelian groups
   Grothendieck's construction
   Integers
   Fields
   Rational numbers
   Ordered fields
   Completeness
   Peano's axiom
   Uncountability of real numbers

2. Sequences
   Limits
   Monotone sequences
   Subsequences
   Bolzano-Weierstrass
   Limsup and liminf
   Application to continuous functions

3. Metric Spaces
        Metric spaces
        Cauchy sequences
        Completeness
        Sequential compactness and total boundedness
        Open, closed and compact sets
        Application to Heine-Borel and continuity of inverses
        Connectes sets
        Intermediate value theorem

4. Spaces of Continuous Functions
        Uniform continuity
        C(K) is a complete metric space
        Dini's theorem, application
        Interchanging differentiation and limit

5. Differentiation
        Rolle's lemma and the mean value theorem
        Differentiation of power series

6. Integration
        Definition
        Interchanging limits
        Fundamental theorem and application to power series

Format:

- This is an online course featuring video lectures from the UIUC Spring 2018 course taught by Professor Marius Junge.
- Text: Kenneth Ross. (2013). *Elementary Analysis: The Theory of Calculus* (2nd Edition). Springer.
- Students must be able to view assignments online, write out solutions, then scan or take a photo of their written work and upload it to Moodle.
- This course requires multiple exams that may be taken online.
- Detailed information about how to access exams will be available within the course site.