Syllabus for Real and Complex Analysis

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Class Meetings: MW 12:30pm to 1:45pm, James 2102

Office Hours: TR 9:30 – 10:30am, W 8:00 to 9:00am and 11:00 am – 12:00pm, and by appointment. Email is the best way to communicate with me. Please use your Rowan e-mail address for all communications.

Prerequisite: Calculus III (Math 01 230) and Linear Algebra (Math 01 210), each with a grade of C- or better.

Text: We will use lecture notes and course materials available online:

References: For Real Part: https://www.jirka.org/ra/realanal.pdf and for Complex Part: http://math.sfsu.edu/beck/papers/complex.pdf

Catalog Description: The course introduces the basic ideas of real analysis: sequences, continuity, differentiability, and their rigorous treatment, and introduces the basic elements of complex analysis up to derivatives rules.

Objectives There are two main objectives of this course. First, it will lay the foundations of real number system through sequences. Second, it introduces the complex number systems and functions of a complex variable. This course will achieve the following Departmental goals:

- Develop the ability to use and understand mathematical symbols and solve mathematical problems.
- Be able to recognize, understand, and verify proofs of theorems.
- Be able to create proofs to theoretical problems. .
- Be able to analyze a situation from multiple points of view including graphically, algebraically, and numerically.
- Be able to communicate mathematical ideas both orally and in written form.
- Be able to learn mathematics independently.
- Understand the historical context of mathematics

Content: The following topics will be covered. The order in which the topics will covered may vary. As we progress through the course, it may be necessary to cover the real variables first and then the complex variables in separate chapters.

1. Real and Complex Numbers **(3 weeks)**
   - 1.1. Preliminaries
   - 1.2. The Real Numbers as a Field,
   - 1.3. Absolute Values and Intervals
   - 1.4. Completeness and Archimedean Properties
   - 1.5. The Complex Numbers and Their Basic Properties
   - 1.6. Geometric Properties of Complex Numbers

2. Sequences **(3 weeks)**
   2.1. The epsilon-N Definition of Limit of a Sequence
   2.2. Limit Theorems
   2.3. Cauchy Sequences and the Completeness Property
   2.4. Monotone Convergence Theorem and Bolzano-Weierstrass Theorem,
   2.5. Sequences of Complex Numbers

3. Continuity **(3 weeks)**
   3.1. Limits and Continuity of Real Valued Functions of Real Variable
   3.2. Intermediate Value Theorem and Extreme Value Theorem
   3.3. Functions of a Complex Variable:
      3.3.1. Polynomials
      3.3.2. Power Functions
      3.3.3. Trigonometric Functions
      3.3.4. Exponential and Logarithmic Functions
   3.4. Limits and Continuity of Functions of a Complex Variable

4. Derivatives **(3 weeks)**
   4.1. Definition of Derivative
   4.2. Rules of Derivative
   4.3. Cauchy-Riemann Equations

5. Integrals **(2 weeks)**
   5.1. The Riemann Sums and the Fundamental Theorems of Calculus
   5.2. Curves and Parameterization of Curves
   5.3. Integrals of Functions of Complex Variables
   5.4. Properties of Integrals of Complex Valued Functions
   5.5. Cauchy's Theorem and the Cauchy Integral Formula

Grading Policy: Students will be graded based on three tests **(80% of grade)** and homework (**20 % of grade).**

Test 1 (30%): Covers topics in chapters 1 and 2
Test 2 (25%): Covers topics in chapters 3
Test 3 (25%): Covers topics in chapters 4 and 5.

Note: Your overall grade will be computed as follows:

T1*0.30+T2*0.25+T3*0.25+0.068*(HW1+HW2+HW3).

Numerical grades will be converted to letter grades by the following scale.

A(A-) = 90 to 100, B(-,+)= 80 to 89, C(-,+)= 70 to 79, D(-,+)= 60 to 69, F= 0 to 59

Attendance Policy: Attendance is mandatory. An attendance sheet will be passed around at the beginning of each class period. Please write your signature next to your printed name on the list. If you are absent/tardy from a class, you must submit a note requesting that the absence/tardiness be excused by the next class meeting. If you miss a class, it is your responsibility to study the section(s) covered and do the homework. If you are absent the day of a regularly scheduled test, a grade of zero is automatically recorded as your test score. You will be permitted to make up this zero only when you can confirm that you were absent for reasons beyond your control.

Some Important Rowan University Policies:

Please revise the Rowan University Academic Policies here
https://sites.rowan.edu/deanofstudents/forms/handbook.html

You can get more information about Rowan's Attendance Policy here:
https://confluence.rowan.edu/display/POLICY/Attendance+Policy

Academic Honesty: Cheating on a test or assignment seriously undermines the integrity of the academic system and will not be tolerated. Although a student is not cheating, he or she is expected to refrain from actions that could be suspicious. Using common sense on your part should avoid unnecessary embarrassment. Please read Rowan University's Academic Integrity Policy at the link:
https://confluence.rowan.edu/display/POLICY/Academic+Integrity+Policy

Students with Disabilities and Special Needs: Please speak with me as early in the semester as possible so that we can make appropriate accommodations for you. If necessary, you can also contact the Office of Special Services.

Rowan University's Statement on Diversity (from DEI): Rowan University promotes a diverse community that begins with students, faculty, staff and administration who respect each other and value each other's dignity. By identifying and removing barriers and fostering individual potential, Rowan will cultivate a community where all members can learn and grow. The Rowan University community is committed to a safe environment that encourages intellectual, academic, and social interaction and engagement across multiple intersections of identities. At Rowan University, creating and maintaining a caring community that embraces diversity in its broadest sense is among the highest priorities.

For more on this visit: https://sites.rowan.edu/diversity-equity-inclusion/about/index.html