ROWAN UNIVERSITY
Department of Mathematics

Master Syllabus

MATH 01361 – Introduction to Real and Complex Variables (3sh)

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

PREREQUISITES:

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

CONTENT:

1. Real and Complex Numbers
   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
   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. Functions
   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
   4.1. Definition of Derivative
   4.2. Rules of Derivative
   4.3. Cauchy-Riemann Equations

5. Integrals
   5.1. 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

SUGGESTED TEXTS:

- None

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