

Syllabus

**MATH 01.236 Mathematics for Engineering Analysis II**

**CATALOG DESCRIPTION:**

Math 01.236 Mathematics for Engineering Analysis II 4 SH

(Prerequisite: Math-01.235 Math for Engineering Analysis I)

This course is a continuation of Mathematics for Engineering Analysis I. Topics includes systems of first-order ordinary differential equations, Laplace transform and partial differential equations, Fourier series, data analysis, probability, and complex analysis. A computer algebra system such as Mathematica is required.

**OBJECTIVES:** Students will demonstrate the ability to: (1) use Laplace transforms to solve ordinary differential equations; (2) solve partial differential equations using the method of separation of variables and Fourier series; (3) analyze data and model statistical experiments in terms of random variables and probability distributions; (4) evaluate derivatives of complex analytic functions and contour integrals over complex domains.

**CONTENTS:**

**1. Laplace Transforms**

- Laplace Transform and Inverse Transform
- Linearity of Laplace Transforms
- Transforms of Derivatives and Integrals,
- s-Shifting and t-Shifting,
- Unit Step Function
- Further Applications
- Dirac's Delta Function
- Differentiation and Integration of Transforms
- Convolution.
- Integral Equations and Partial Fractions
- Application to Systems of Differential Equations

**2. Partial Differential Equations**

- Basic Concepts
- Modeling: Vibrating String, Wave Equation
- Separation of Variables.
- Use of Fourier Series
- Heat Equation: Solution by Fourier Series
- Heat Equation: Solution by Fourier Integrals

### **3. Fourier Series**

- Periodic Functions.
- Trigonometric Series
- Fourier Series Function of Any Period  $p=2L$
- Even and Odd Functions
- Half-Range Expansions Fourier Integrals
- Fourier Cosine and Sine Transforms
- Fourier Transform

### **4. Data Analysis and Probability Theory**

- Data Representation
- Average and Spread
- Experiments, Outcomes, Events
- Probability
- Permutations and Combinations
- Random Variables
- Probability Distributions
- Mean and Variance of a Distribution
- Binomial, Poisson, and Hypergeometric Distributions
- Normal Distribution

### **5. Complex Analysis**

- Complex Numbers
- Complex Plane
- Polar Form of Complex Numbers
- Powers and Roots
- Derivative
- Analytic Function
- Cauchy-Riemann Equations
- Laplace's Equation
- Line Integral in the Complex Plane
- Cauchy's Integral Theorem
- Cauchy's Integral Formula

**TEXT:** Kreyszig, Erwin, Advanced Engineering Mathematics, 9th editions, John Wiley and Sons Inc., New York, 2006.