

Syllabus

MATH 01.235 Mathematics for Engineering Analysis I

CATALOG DESCRIPTION:

Math 01.235 Mathematics for Engineering Analysis I 4 SH

(Prerequisite: Math 01.230 Calculus III or Math 01.141 Accelerated Calculus II)

This course gives a comprehensive introduction to linear algebra and ordinary differential equations. It includes solving linear systems of equations, matrices, determinants, vector spaces, eigenvectors/eigenvalues, separable and exact first-order differential equations, second and higher order differential equations, systems of differential equations, and numerical methods. A computer algebra system such as Mathematica is required.

OBJECTIVES: Students will demonstrate the ability to: (1) perform matrix operations, evaluate determinant, eigenvalues and eigenvectors of a matrix; (2) solve separable and exact differential equations; (3) use integrating factors to solve first order differential equations; (4) use numerical methods to solve linear systems and differential equations; (5) solve second and higher-order differential equation; (6) solve systems of differential equations.

CONTENTS:

1. Linear Algebra: Matrices, Vectors, Determinants

- Basic Concepts Matrix Addition, Scalar Multiplication Matrix Multiplication
- Linear Systems of Equations, Gauss Elimination, General Properties of Solutions
- Inverse of a Matrix, Determinants Rank in Terms of Determinants, Cramer's Rule Eigenvalues,
- Vector Space, Linear Independence, Rank of a Matrix
- Eigenvalues and Eigenvectors. Properties of Eigenvectors, Diagonalization, Applications of Eigenvalue Problems
- Linear Systems: Solution by Iteration Linear Systems: Ill-Conditioning, Norms

2. First-Order Differential Equations

- Basic Concepts and Ideas
- Separable Differential Equations
- Modeling: Separable Equations
- Exact Differential Equations
- Integrating Factors
- Linear Differential Equations
- Modeling: Electric Circuits
- Power Series Method
- Methods for First-Order Differential Equations Multistep Methods

3. Second and Higher-Order Differential Equations

- Homogeneous Linear Equations
- Homogeneous Equations with Constant Coefficients
- Complex Exponential Function
- Modeling: Free Oscillations (Mass-Spring System)
- Euler-Cauchy Equation
- Nonhomogeneous Equations Solution by Undetermined Coefficients

- Nonhomogeneous Equations Solution by Variation of Parameters
- Modeling: Forced Oscillations. Resonance
- Modeling of Electric Circuits

4. System of Differential Equations

- Introductory Examples,
- Basic Concepts and Theory
- Homogeneous Linear Systems with Constant Coefficients
- Nonhomogeneous Linear Systems

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