Math 307 – Linear Algebra & Differential Equations (3)

Course Description:

Introduction to linear algebra, application of eigenvalue techniques to the solution of differential equations. Students may receive credit for only one of Math 307 and 311.

Pre: 242 or 252A, or consent.

Topics:

I. Matrices and Determinants (3 weeks): systems of linear equations, matrices, matrix operations, inverse matrices, special matrices and their properties, and determinants.

II. Vector spaces (3 weeks): vector spaces, subspaces, spanning sets, linear independence, bases, dimension, null space, row and column spaces, Wronskian.

III. Linear transformation, eigenvalues and eigenvectors (5 weeks): linear transformations, algebra of linear transformations, matrices for linear transformations, eigenvalues and eigenvectors, similar matrices, diagonalization, Jordan normal form.

IV. System of differential equations (3 weeks): theory of systems of linear differential equations, homogeneous systems with constant coefficients, the diagonalizable case, nondiagonalizable case, nonhomogeneous linear systems, applications to 2×2 and 3×3 systems of nonlinear differential equations.

V. As time allows: converting differential equations to first order systems, linearization of 2×2 nonlinear systems, stability, instability, predator-prey equations.

Course Objectives and Student Learning Outcomes: Upon completion of this course the student will

- have an understanding of the basic concepts of linear algebra
- know the principal results in the theory.
- be able to compute examples.
- apply linear algebra to solve problems.

- be able to solve systems of linear differential equations via eigenvalue / eigenvector methods.

Program Objectives: Linear algebra is one of the basic and foundational topics in mathematics. It is applied in many other fields. The course is intended for non-majors who need to understand the basic principles and apply them in to solve systems of linear differential equations.