Official Syllabus

552 - Theory of Ordinary Differential Equations

Adopted – Fall 2016 (Committee: Choi, Leem, Pelekanos)

Catalog Description: Linear systems of differential equations; Nonlinear autonomous systems in the plane; Self-adjoint second-Order differential equations.

Prerequisites: MATH 350, 421.

Textbook: The theory of differential equations: Classical and Qualitative, Walter G. Kelley and Allan C. Peterson, 2nd edition, Springer

Sections to be covered in the textbook:

1. First-Order Differential Equations
    1.1. Basic Results
    1.2. First-Order Linear Equations
    1.3. Autonomous Equations
    1.4. Generalized Logistic Equation (Optional)
    1.5. Bifurcation
2. Linear Systems
    2.1. Introduction
    2.2. The Vector Equation x $'$ = A(t)x
    2.3. The Matrix Exponential Function
    2.4. Induced Matrix Norm
    2.5. Floquet Theory
3. Autonomous System
    3.1. Introduction
    3.2. Phase Plane Diagrams
    3.3. Phase Plane Diagrams for Linear Systems
    3.4. Stability of Nonlinear Systems
    3.5. Linearization of Nonlinear Systems
    3.6. Existence and Nonexistence of Periodic Solutions (Optional)
4. Perturbation Methods
    4.1. Introduction
    4.2. Periodic Solutions (Optional)
5. The Self-Adjoint Second-Order Differential Equation
    5.1. Basic Definitions
    5.2. An Interesting Example
    5.3. Cauchy Function and Variation of Constants Formula
    5.4. Sturm-Liouville Problems (Optional)
    5.9. Green's Functions