

**OFFICIAL SYLLABUS**  
**MATH 305: DIFFERENTIAL EQUATIONS I**  
Adopted - Fall 2003; Committee: Drs. R. Karimpour, C. Lu, G. Pelekanos  
Modified Fall 2009 (9<sup>th</sup> Edition)

**Catalog Description:** [Dist.NSM] First order ordinary differential equations, linear ordinary differential equations of higher order, systems of first order linear equations, applications.  
Prerequisite: 250 and PHYS 211a.

**A. Course Description**

This is an introductory course in Differential Equations. It includes a study of the theory of differential equations, solutions and initial value problems, solutions of first order differential equations (exact, linear, homogeneous, Bernoulli). Mathematical models of first order differential equations. Linear second order equations with applications and higher order differential equations. Power series or Laplace Transform solutions of linear differential equations.

**B. Course Objectives**

To develop an understanding of skills in solving differential equations and initial value problems, to develop skills in applying differential equations to physical world.

**C. Textbook**

Elementary Differential Equations and Boundary Value Problems, Eight Edition, by Boyce & Diprima.

**D. Course Outline and Topics**

i) **Chapter 1**, section 3, classification, solutions, direction fields of differential equations.

ii) **Chapter 2**, First Order Differential Equations.

Linear equations with variable coefficients, separable equations, modeling with first order differential equations, differences between linear and nonlinear equations, applications of first order equations, exact and integrating factors, the Existence and Uniqueness Theorem, first order difference equations.

iii) **Chapter 3**, Second order linear equations.

Homogeneous equations with constant coefficients, fundamental solutions, linear independence and Wronskian, complex roots, repeated roots, and reduction of order. Nonhomogeneous equations, method of undetermined coefficients, variation of parameters. Applications of homogeneous and nonhomogeneous equations such as mechanical, electrical vibrations, and forced vibrations.

iv) **Chapter 4**, Higher order linear equations.

General theory of  $n$ th order equations, homogeneous equations with constant coefficients.

v) **Chapter 5**, Series solutions of second order linear equations.

Review of power series, and series solutions near an ordinary point, part 1, Euler equations.

or **Chapter 6**, Laplace transform.

Definition of Laplace transform and solutions of initial value problems.

vi) **Chapter 7**, System of first order linear equations.

Introduction to linear system of differential equations, Review of matrices, system of linear algebraic equations, linear independence, Eigenvalues, Eigenvectors, basic theory of system of first order linear equations, homogeneous linear system with constant coefficients, complex Eigenvalues.

**Any instructor should cover all of the material specified; additional sections are optional.**