

MATH-252 Ordinary Differential Equations

Credit Hours: 3-0

Prerequisite: None

Course Objectives: The course aims is to provide an understanding of ordinary differential equations and to introduce methods for solving them. The course is also expected to provide students with the knowledge and skills necessary for understanding of other subjects of both mathematics and other disciplines in which differential equations are involved.

Core Contents: First order ordinary differential equations, Second and higher order linear differential equations, Linear systems and stability.

Detailed Course Contents: Introduction, classification of differential equations by type, Classification of differential equations, Initial value problems (IVP), Differential equations as mathematical models, Separable variables, Linear equations, exact equations Solution by substitution, homogenous equations, Bernoulli's equation, Linear Models, Non-linear Models

Higher order linear equation: Initial value problems and boundary, value problems. Homogeneous and nonhomogeneous equations.

Undetermined coefficients-superposition approach, Undetermined coefficient annihilator approach, Variation of parameters, Cauchy-Euler equations. Modeling with Sytem of 1st order ordinary differential equations Solving systems of linear differential equations by elimination, nonlinear differential equations, Homogeneous linear systems, Eigenvalues and eigenvectors, distinct real eigenvalues, repeated eigenvalues, complex eigenvalues, autonomous systems as mathematical models.

Course Outcomes: Upon completion of this course, the student should be able to:

- Solve any type of first order differential equations.
- Set up and solve physical motion problems and problems of population dynamics with first order differential equations.
- Solve system of differential equations.
- Solve second order linear differential equations.
- Solve linear systems of equations.

Text Book: Dennis G. Zill, Michael R. Cullen: Differential equations with boundary value problems, (7th Edition), 2009, Brooks/Cole Cengage Learning, Canada.

Reference Books:

1. William E. Boyce and Richard C. Di Prima: Elementary Differential Equations and Boundary Value Problems (9th Edition), 2009.
2. V. I. Arnold, Ordinary Differential Equations, Springer, 1991.

Weekly Breakdown		
<i>Week</i>	<i>Section</i>	<i>Topics</i>
1	1.1-1.2	Introduction, classification of differential equations by type. Classification of differential equations, Initial value problems (IVP)
2	1.3, 2.2	Differential equations as mathematical models, Separable variables
3	2.3-2.5	Linear equations, exact equations. Solution by substitution, homogenous equations, Bernoulli's equation
4	3.1-3.2	Linear models, Non-linear models
5	4.1-4.3	Higher order linear equation: Initial value problems and boundary, value problems. Homogeneous and nonhomogeneous equations
6	4.4	Undetermined coefficients-superposition approach
7	4.5	Undetermined coefficient-annihilator approach
8	4.6, 4.7	Variation of parameters, Cauchy-Euler equations.
9	Mid Term Exam	
10	3.3	Modeling with System of 1 st order ordinary differential equations
11	4.8	Solving systems of linear differential equations by elimination, nonlinear differential equations
12	8.1-8.3	Homogeneous linear systems, Eigenvalues and eigenvectors, distinct real eigenvalues, repeated eigenvalues, complex eigenvalues,
13	8.4	Non-homogenous linear systems, undetermined coefficients, variation of parameters
14	10.2	Stability of Linear Systems and Phase Portraits
15	10.3	Linearization and Local Stability
16	10.4	Autonomous Systems as Mathematical Models
17		Review
18	End Semester Exam	