University of Arkansas – Fort Smith
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General Syllabus

MATH 2914 Differential Equations

Credit Hours: 4   Lecture Hours: 4   Laboratory Hours: 0

Prerequisite: MATH 2854 Calculus II

Effective Catalog: 2020~2021

I. Course Information

A. Catalog Description
Topics include first-order equations, first-order and higher-order linear equations, Laplace transforms, systems of linear equations, and eigenvectors.

II. Student Learning Outcomes

A. Subject Matter
Upon completion of this course, the student will be able to:

1. Solve first-order differential equations.
2. Solve linear differential equations of higher order using undetermined coefficients and variation of parameters.
3. Use Laplace transforms to solve differential equations.
4. Solve linear systems of differential equations by elimination, Laplace transforms, and by using eigenvectors.
5. Solve application problems using differential equations.

B. University Learning Outcomes
This course enhances student abilities in the following areas:

Analytical Skills
Critical Thinking Skills: Students will use concepts of differential equations to identify types of differential equations and correctly apply differential equations to model real-world phenomena across multiple disciplines.

Communication Skills (written and oral)
Students will compose coherent documents that effectively communicate solutions and applications of differential equations.

Ethical Decision Making
Students will identify ethical dilemmas wherever present in real-world differential equation applications and apply ethical frameworks to resolve such dilemmas.

III.   **Major Course Topics**

A. First-order Differential Equations and Their Applications
    1. Separable equations
    2. Linear equations
    3. Exact equations
    4. Solution by substitutions
B. Linear Equations of Higher Order; Undetermined Coefficients and Variation of
    1. Parameters
    2. Homogeneous equations
    3. Nonhomogeneous equations
    4. Homogeneous linear equations with constant coefficients
    5. Undetermined coefficients method
    6. Variation of parameters
    7. Cauchy-Euler equations
C. Applications of Second-order Differential Equations
    1. Spring/Mass system
    2. Initial-value problem
    3. Boundary-value problem
    4. Nonlinear models
D. Laplace Transforms
    1. Definition of the Laplace transform
    2. Inverse transforms and transforms of derivatives
    3. Operational properties I
    4. Operational properties II
    5. The Dirac Delta function
E. Systems of Linear Differential Equations; Eigenvectors
    1. Homogeneous linear system
    2. Nonhomogeneous linear system
    3. Matrix exponential