Prepared by the Department of Mathematics

Date of Departmental Approval: December 4, 2017
Date Approved by Curriculum and Programs: January 24, 2018 **Effective: Fall 2018**

1. **Course Number:** **MAT270**
   Course Title: **Differential Equations**

2. **Description:**
   This introductory course in ordinary differential equations is designed for students majoring in mathematics, natural sciences, or engineering. Topics include first order differential equations, linear second order differential equations, Laplace transforms, and planar systems. Emphases are given to analytic methods, existence and uniqueness of solutions, and modeling.

3. **Student Learning Outcomes:** Upon successful completion of this course, students are able do the following:
   - Solve first order differential equations by direct integration, substitution, and integrating factor methods.
   - Find the general solution of a homogeneous linear second order differential equation with constant coefficients.
   - Apply the method of undetermined coefficients, variation of parameters, and Laplace transforms to solve nonhomogeneous linear second order differential equations
   - Analyze application problems by qualitative methods.

4. **Credits:** 3 credits

5. **Satisfies General Education Requirement:** No

6. **Prerequisite:** A grade of C- or higher in MAT250

7. **Semester Offered:** Spring

8. **Suggested General Guidelines for Evaluation:** Comprehensive final examination, hour tests, problems, cases, and quiz papers.

9. **General Topical Outline:**

MAT270 Differential Equations

I. Introduction and First Order Differential Equations
   A. Solution by Direct Integration
   B. Existence and Uniqueness of Solutions
   C. Separation Equations and Applications
   D. Linear First Order Equations
   E. Substitution Methods
   F. Exact Equations and Integrating Factors
   G. Applications – Motion with Variable Acceleration

II. Linear Equations of Higher Order
   A. General Solutions of Linear Equations
   B. Homogeneous Equations with Constant Coefficients
   C. Applications: Forced Oscillations and Resonance
   D. Endpoint Problems and Eigenvalues

III. Power Series Solutions of Linear Equations
   A. Series Solutions Near Ordinary Points
   B. Regular Singular Points
   C. Method of Frobenius – Exceptional Cases
   D. Bessel's Equation

IV. The Laplace Transform
   A. Laplace and Inverse Transforms
   B. Transformation and Initial Value Problems
   C. Translation and Partial Fractions
   D. Derivatives, Integrals, and Products of Transformations
   E. The Periodic and Piece-Wise Continuous Forcing Functions
   F. Impulses and Delta Function

V. Linear Systems of Differential Equations
   A. Method of Elimination
   B. Linear Systems and Matrices
   C. Eigenvalue Method for Homogeneous Linear Equations
   D. Non-homogeneous Linear Systems

VI. Systems of Linear Equations
   A. Differential Operators and the Operator Method
   B. Linear Systems and Matrices

VII. Introduction to Partial Differential Equations
   A. Separation of Variables – Heat Conduction Applications
   B. Bessel's Functions – application to Vibrating Strings and Membranes