MAT 285 Differential Equations

COURSE DESCRIPTION:

Prerequisite(s): MAT 272
Corequisite(s): None

This course provides an introduction to topics involving ordinary differential equations. Emphasis is placed on the development of abstract concepts and applications for first-order and linear higher-order differential equations, systems of differential equations, numerical methods, series solutions, eigenvalues and eigenvectors, and LaPlace transforms. Upon completion, students will be able to demonstrate understanding of the theoretical concepts and select and use appropriate models and techniques for finding solutions to differential equations-related problems with and without technology. *This course has been approved for transfer under the CAA as a premajor and/or elective course requirement.*

Course Hours Per Week: Class, 2. Lab, 2. Semester Hours Credit, 3.

LEARNING OUTCOMES:

Upon completing requirements for this course, the student will be able to:

1. Find general solutions to first-order, second-order, and higher-order homogeneous and non-homogeneous differential equations by manual and technology-based methods
2. Identify and apply initial and boundary values to find particular solutions to first-order, second-order, and higher order homogeneous and non-homogeneous differential equations by manual and technology-based methods, and analyze and interpret the results
3. Select and apply appropriate methods to solve differential equations; these methods will include, but are not limited to, undetermined coefficients, variation of parameters, eigenvalues and eigenvectors, LaPlace and inverse LaPlace transforms
4. Select and apply series techniques to solve differential equations; these techniques will include but are not limited to Taylor series
5. Select and apply numerical analysis techniques to solve differential equations; these techniques will include but are not limited to Euler, Improved Euler, and Runge-Kutta
6. Demonstrate proficiency in using CAS technology to analyze, solve and interpret the various applications

OUTLINE OF INSTRUCTION:

I. First-Order Differential Equations
   A. Existence and uniqueness of solutions
   B. Separable equations and singular solutions
   C. Linear equations
   D. Applications of first-order equations
   E. Slope fields and phase portraits
   F. Numerical methods--Euler, improved Euler, and Runge-Kutta

II. Linear Equations of Higher Order
   A. Homogeneous linear equations with constant coefficients
   B. General solutions of linear equations—theory
   C. Initial value problems vs. boundary value problems
   D. Mechanical vibrations

E. Nonhomogeneous equations—undetermined coefficients
F. Forced oscillations and resonance
G. Nonhomogeneous equations—variation of parameters
H. Series solutions

III. Linear Systems of Differential Equations
A. The method of elimination
B. The eigenvalue method for homogeneous systems
C. Phase portraits for two-dimensional systems
D. Applications

IV. Laplace Transform Methods
A. Laplace transforms and inverse transforms
B. Initial-value problems
C. Translation and partial fractions
D. Impulses and delta functions

REQUIRED TEXTBOOK AND MATERIAL:

The textbook and other instructional material will be determined by the chair/instructor.