Course Title: Differential Equations
Course Prefix/Number: MAT 242

COURSE-SPECIFIC GRADE CALCULATION
Advanced notification of any changes will be provided to the student.

Three categories of grades will be used to compute your final average.

- Discussion Board/Class Participation – 10%
- Homework – 40%
- Tests – 50%

EXPLANATION OF SPECIFIC PROCTORED EXAM INFORMATION
For online courses, the Unit 1 Test and Unit 2 Test will be proctored. The student can use the pullout page from their calculus book (formula sheet), scratch paper and a scientific or graphing calculator. The calculator must not be a part of another device (for example, an app on a smartphone). Scratch paper should be turned in at the end of the exam.

LAB/CLASSROOM SAFETY STATEMENT
Piedmont Technical College Laboratory Safety Statement: Lab Safety Statement (www.ptc.edu/courseinfo/safety.pdf)

Classroom Safety Statement: N/A

COURSE CONTENT OUTLINE
Advanced notification of any changes will be provided to the student.

Modules/Units

Module/Unit 1

Competencies:
INTRODUCTION TO DIFFERENTIAL EQUATIONS

The student will:
- Define a derivative.
- Use rules of differentiation.
- Use the derivative as a rate of change.
- Make a connection between the first derivative and increasing/decreasing.
- Make a connection between the second derivative and concavity.

**Module/Unit 2**

Competencies:

**FIRST ORDER DIFFERENTIAL EQUATIONS**

The student will:

- Classify differential equations by linearity, order, homogeneity, and coefficients.
- Verify explicit and implicit solutions of differential equations, analyze initial-value problems and the existence and uniqueness nature of solutions with Picard’s Theorem.
- Solve first order linear differential equations with constant and variable coefficients and related initial-valued problems by the integrating factor method.
- Solve separable equations and associated initial-value problems by separation of variables.

**Module/Unit 3**

Competencies:

**MODELING WITH FIRST ORDER DIFFERENTIAL EQUATIONS**

The student will:

- Solve second-order linear homogeneous equations and related initial-valued problems through superposition, the Wronskian, D’Alembert’s method, and characteristic equations.
- Solve second-order linear non-homogeneous equations by superposition, undetermined coefficients, and variation of parameters.
• Model and solve problems involving mechanical systems, simple harmonic motion, unforced damped vibrations, forced vibration, growth and decay phenomena, mixing phenomena, cooling and heating phenomena, and motion.

• Solve high-order equations by annihilator methods.

Module/Unit 4

Competencies:

HIGHER ORDER DIFFERENTIAL EQUATIONS

The student will:

• Solve linear systems of differential equations by elimination.
• Solve homogeneous linear systems with real and complex eigenvalues.
• Solve non-homogeneous linear systems by the generalized integrating factor and variation of parameter methods using the matrix exponential and the Laplace Transform.
• Model and solve problems involving linear systems based on compartmental systems.
• Solve equations by Euler’s Method, Three-Term Taylor Series Method and the Runge-Kutta Method.

Module/Unit 5

Competencies:

THE LAPLACE TRANSFORM

The student will:

• Solve higher-order variable coefficient equations by obtaining power series solutions about ordinary and singular points.
• Find Laplace transforms of elementary functions, derivatives, and compositions.
• Calculate inverse Laplace transforms of elementary functions and functions developed by partial fractions decomposition.
• Solve initial-value problems by the Laplace Transform method.
- Find Laplace and inverse Laplace transforms of step and delayed functions.
- Solve equations with discontinuous and impulse forcing functions.
- Use convolution methods to solve initial-value problems and Volterra integral equations.