CUMBERLAND COUNTY COLLEGE

Course: MA 220 Differential Equations

Credits: 4

Prerequisites
MA 210

Description
Topics include first order linear equations with constant and variable coefficients, solutions by infinite series, Laplace transforms and numerical methods. Other topics include existence and uniqueness theorems, phase plane and equilibrium points as well as modeling real world problems by using differential equations.

Learning Outcomes
At the completion of this course, students will be able to:

- Classify differential equations in terms of ordinary or partial, order and linearity
- Verify a solution by substitution into the differential equation
- Determine whether a first order linear initial value problem has a unique solution over a given interval
- Apply initial conditions to a general solution to find a unique solution
- Determine a differential equation for a variety of application problems by applying modeling methods: Modeling with First Order and Higher Order differential equations, Series solutions of linear equations, and Laplace Transforms

Topical Outline

- Differential Equations and their Solutions
    - Classification of Differential Equations
    - Solutions of Differential Equations
    - Initial-value problems and existence uniqueness for first order initial value problems
    - Modeling applications as Differential Equations
- Solving First-Order differential equations.
    - Separable equations. Exact differential equations
    - First order linear equations by variation of parameters an and by integration factors
    - Solutions by substitution and Homogeneous equations
    - Bernoulli differential equations
- Numerical Methods of approximating the solution of first order differential equations
    - Direction Fields
    - Euler's Method

    - Improved Euler's Method
    - Runge-Kutta Method
- Modeling with First-Order Differential Equations
    - Newton’s law of cooling, mixture and dynamics
    - Logistic, flow rates and velocity
- Systems of linear and nonlinear differential equations
    - Combined mixture problems
    - Predator-Prey models
    - Numerical estimation of solution curves
- Higher-Order Differential Equations
    - Terminology and preliminary theory
    - Linear independence and a general solution
    - Reduction of order
    - Solving homogeneous linear equations with constant coefficients
    - Undetermined coefficients
    - Variation of Parameters
    - Cauchy-Euler equation
    - Solving systems of linear equations
- Modeling with higher-order Differential Equations
    - Undamped vibration system
    - Damped vibration system
    - Driven motion
    - Nonlinear equations
    - Diabetes and a Glucose Tolerance Test
- Infinite series solutions
    - Review of Power series
    - Power series solutions
    - Method of Frobenius
- The Laplace Transform
    - Definition and general properties
    - Inverse transform and the transform of a derivative
    - Using to solve initial value problems
    - Solving systems of linear equations

Required Texts and Other Materials

A First Course in Differential Equations with Modeling Applications by Zill 8th edition: Thomson.

Student Assessment
Assessment may be accomplished through projects, portfolios, online assignments, exams, presentations and/or papers.

Academic Integrity
Plagiarism is cheating. Plagiarism is presenting in written work, in public speaking, and in oral reports the ideas or exact words of someone else without proper documentation. Whether the act of plagiarism is deliberate or accidental [ignorance of the proper rules for handling material is no excuse], plagiarism is, indeed, a "criminal" offense. As such, a plagiarized paper or report automatically receives a grade of **ZERO** and the student may receive a grade of **F** for the semester at the discretion of the instructor.

Available Resources
If you are having difficulty with work in this class, tutoring is available through the Success Center. If you think that you might have a learning disability, contact Project Assist at 856.691.8600, x1282 for information on assistance that can be provided to eligible students.

(List availability of open labs and/or writing center)

Before Withdrawing From This Course
If a student experiences adverse circumstances while enrolled in this course and considers withdrawing, s/he should see an advisor (division or advisement center) BEFORE withdrawing from the class. A withdrawal may cause harmful repercussions to completion rate standards and overall GPA which can limit or eliminate future financial aid in addition to causing academic suspension.