Course Title: Ordinary Differential Equations
Course Number: MAT 271    Number of Credits: 3
Contact hrs/wk--Lecture: 3    Lecture/Discussion _________Lab_________

Course Prerequisites: A grade of C or better in MAT 222, or equivalent.

Catalog description: Ordinary differential equations of the first and second order, series solutions, higher order linear equations, the Wronskian, Laplace transform and applications, numerical methods and boundary value problems.

Course content (list of topics normally covered):
Introductory material
- Basic Modeling
- Direction Fields
- Classification of Differential Equations

First Order Equations
- Linear Equations with Variable Coefficients
- Separable Equations
- Modeling with First Order Equations
- Differences Between Linear and Nonlinear Equations
- Autonomous Equations
- Existence and Uniqueness Theorems

Second Order Linear Equations
- Homogeneous Equations with Constant Coefficients
- Fundamental Solutions of Linear Homogeneous Equations
- Linear Independence and the Wronskian
- Nonhomogeneous Equations-Method of Undetermined Coefficients, Variation of Parameters
- Mechanical and Electrical Vibrations, Forced Vibrations

Higher Order Linear Equations

Power Series
- Review of Power Series
- Series Solutions near an Ordinary Point

The Laplace Transform
- Solution of Initial Value Problems
- Differential Equations with Discontinuous Forcing Functions, Impulse Functions

Systems of First Order Linear Equations
• Existence and Uniqueness Theorems for Linear and Nonlinear Equation
• Review of Matrices, Systems of Linear Algebraic Equations, Linear Independence, Eigenvalues, Eigenvectors
• Basic Theory of Systems of First Order Linear Equations
• Homogeneous Linear Systems with Constant Coefficients
• Fundamental Matrices
• Nonhomogeneous Linear Systems

Numerical Methods
• The Euler Method
• The Runge-Kutta Method
• Overview of Other Numerical Methods, Error analysis, and Stability

Nonlinear Differential Equations and Stability
• The Phase Plane; Linear Systems
• Autonomous Systems and Stability
• Almost Linear Systems
• Competing Species
• Predator-Prey

Boundary Value Problems
• Two-Point Boundary Valve Problems
• Fourier Series
• Separation of Variables
• Solution of Basic Partial Differential Equations

Content-based department proficiencies: The successful student will be able to:
• Recognize various types of ordinary differential equations and know what to expect of solutions to each type of equation in terms of existence, uniqueness, and qualitative behavior.
• Find analytic solutions to a variety of ordinary differential equations.
• Find analytic solutions to simple partial differential equations using separation of variables.
• Model various types of physical phenomena using differential equations.
• Understand the use of basic numerical methods, and be able to compare numerical methods using local error analysis.
• Analyze solutions of ordinary differential equations using mathematics software.

Colleges-wide proficiencies assigned to course: Students should be able to demonstrate the following:
A. Analytical skills Performance Indicators: Students should be able to:
1. Interpret and synthesize information and ideas.
4. Select and apply scientific and other appropriate methodologies.

B. Quantitative skills Performance Indicators: Students should be able to:
1. Solve quantitative and mathematical problems.
2. Interpret graphs, tables, and diagrams.

Representative textbooks used for the courses: (editions change over time)
• Elementary Differential Equations and Boundary Value Problems-7th edition, Boyce and DiPrima
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