HIGHLAND COMMUNITY COLLEGE

Syllabus

MAT202 Differential Equations
5 Credit Hours (Lecture)
Prerequisites: MAT110 with a C or higher
Revision Date: 03/20/2020

Department:

Mathematics

Course Description:

This course covers standard types of ordinary differential equations of first and second order, linear equations solutions by series and Laplace transformations, systems of equations, numerical methods, and applications to science and engineering.

Course Competencies:

Upon completion of the course, the student should be able to:

1. Calculate solutions to first order and second order linear differential equations including homogeneous and inhomogeneous equations.
2. Calculate solutions to higher order linear differential equations.
3. Calculate the solution of initial value problems using Laplace Transformation method.
4. Calculate approximate solutions of differential equations using numerical methods including Euler's method and Runge-Kutta method.
5. Calculate solutions of systems of first order linear differential equations.
6. Calculate solutions of second order linear differential equations using power series.
7. Solve Boundary Value problems.

Course Content:

A. Basic Concepts of Differential Equations
    1. Basic Models
    2. Direction Fields
    3. Classification of Differential Equations
B. First Order Differential Equations
    1. Method of Integrating Factors
    2. Separable Equations
    3. Models for Applications with First Order Differential Equations
    4. Differences between Linear and Nonlinear Differential Equations
    5. Autonomous Differential Equations and Population Dynamics
    6. Exact Equations
    7. Euler Method
    8. Existence and Uniqueness Theorem
C. Second Order Linear Differential Equations
    1. Homogeneous Equations with Constant Coefficients
    2. Wronskian
    3. Complex Roots of the Characteristic Equation
    4. Repeated Roots and Reduction of Order
    5. Method of Undetermined Coefficients for Nonhomogeneous Differential Equations
    6. Method of Variation of Parameters
    7. Mechanical and Electric Vibrations
    8. Forced Vibrations

D. High Order Linear Differential Equations
    1. General Theory of nth Order Linear Differential Equations
    2. Homogeneous Equations with Constant Coefficients
    3. Method of Undetermined Coefficients
    4. Method of Variation of Parameters
E. Series Solutions of Second Order Linear Differential Equations
    1. Review of Power Series
    2. Series Solutions Near an Ordinary Point
    3. Regular Singular points and Euler's Equations
    4. Series Solutions Near and Regular Point
F. Laplace Transforms
    1. Definition of a Laplace Transform
    2. Solution of Initial Value Problems Using Laplace Transform
    3. Laplace Transform and Step Functions
    4. Differential Equations with Discontinuous Forcing Functions
    5. Impulse Functions and Convolutions
G. Systems of First Order Linear Differential Equations
    1. Introduction to Systems of First Order Linear Differential Equations
    2. Review of Matrices
    3. Linear Independence, Eigenvalues and Eigenvectors
    4. Basic Theory of systems of First order Linear Differential Equations
H. Numerical Methods for Solving Differential Equations
    1. Euler Method (Tangent Line Method)
    2. Improved Euler Method
    3. Runge-Kutta Method
I. Non-linear Differential Equations
    1. Appling Phase Plane Analysis to Competing Species
    2. Appling Phase Plane Analysis to Predator-Prey Equations
J. Boundary Value Problems

Learning Assessments:

Course competencies will be assessed by written examinations covering all course material, including regular midterm exams and a required, comprehensive final exam. Additionally, assessment may also occur through any of the following at the discretion of the instructor: regular collection of homework, in-class work, quizzes, computer labs, and various projects.

Instructional Materials:

Textbook: Zill, D. G. (2018). *Differential Equations with Boundary Value Problems* (9th ed.). Boston, MA: Cengage Learning. ISBN-13: 978-1305965799

Guidelines for Requesting Accommodations Based on Documented Disability or Medical Condition

It is the intention of Highland Community College to work toward full compliance with the Americans with Disabilities Act, to make instructional programs accessible to all people, and to provide reasonable accommodations according to the law.

Students should understand that it is their responsibility to self-identify their need(s) for accommodation and that they must provide current, comprehensive diagnosis of a specific disability or medical condition from a qualified professional in order to receive services. Documentation must include specific recommendations for accommodation(s). Documentation should be provided in a timely manner prior to or early in the semester so that the requested accommodation can be considered and, if warranted, arranged.

In order to begin the process all students **must** complete the "Disabilities Self-Identification Form" on our Disability Services website.

This form can also be accessed at the Highland Community College homepage under Students Services/Student Resources/Disability Service or by contacting the Disabilities Coordinator.

A Note on Harassment, Discrimination and Sexual Misconduct

Highland Community College seeks to assure all community members learn and work in a welcoming and inclusive environment. Title VII, Title IX, and College policy prohibit harassment, discrimination and sexual misconduct. Highland Community College encourages anyone experiencing harassment, discrimination or sexual misconduct to talk to report to the Vice President for Student Services, the Human Resources Director or complete an online report about what happened so that they can get the support they need and Highland Community College can respond appropriately.

There are both confidential and non-confidential resources and reporting options available to you. Highland Community College is legally obligated to respond to reports of sexual misconduct, and therefore we cannot guarantee the confidentiality of a report, unless made to a confidential resource. Responses may vary from support services to formal investigations. As a faculty member, I am required to report incidents of sexual misconduct and thus cannot guarantee confidentiality. I must provide our Title IX coordinator with relevant details such as the names of those involved in the incident. For more information about policies and resources or reporting options, please review our Equity Grievance Policy.