

COURSE OUTLINE (proposed)

MATH 260 Differential Equations 3 Semester Hours

HOWARD COMMUNITY COLLEGE

Description

In this course, students will develop the skills necessary to use the basic methods of solving differential equations. The student will be asked to solve linear and specific non-linear differential equations. The Laplace transform, power series solutions and undetermined coefficients will be included. Calculus III is recommended. **Prerequisite: MATH 150 or equivalent.** (3 hours weekly)

Overall Course Objectives

Upon successful completion of this course, the student will be able to:

1. Recognize an ordinary differential equation and classify it in order to choose an appropriate method to solve the equation.
2. Solve easier application problems, which may be linear or non-linear. The student will be exposed to problems such as those that deal with electronics, half-life and population growth and decay, Newton's law of cooling, mixtures, the law of mass action, the logistic function, and simple harmonic oscillations in all of its forms.
3. Use given initial values in order to solve for a particular solution and determine if the solution is unique.
4. Use the techniques of separable variables, homogeneous equations, exact equations, integrating factor, Bernoulli, Ricatti and Clairaut in order to solve a differential equation.
5. Determine if two given families of curves are orthogonal trajectories of one another or find the orthogonal trajectory of a given family of curves. The families may be in either rectangular or polar form.
6. Find the Wronskian of a list of functions to help determine their independence.
7. Use the superposition principle in finding a general or complete solution to a differential equation.
8. Construct a second solution to a differential equation from a given solution.
9. Use a characteristic equation, with roots given, to determine the complimentary solution to a homogeneous linear differential equation with constant coefficients.
10. Use the "variation of parameters" technique to solve linear non-homogeneous differential equation which can have variable coefficients.
11. Investigate the Cauchy-Euler, Bessel's and Legendre's differential equation.
12. Use power series techniques to solve differential equations around ordinary points. (Power series solutions around regular singular points will be demonstrated.)
13. Find a Laplace transform and an inverse Laplace transform of a given function.
14. Use the Laplace translation theorems, a table of basic Laplace and inverse Laplace transforms, and the Laplace transforms of derivatives to solve n^{th} order linear differential equations with constant coefficients which have initial conditions given.
15. Solve a system of linear differential equations with constant coefficients using either the differential operator or Laplace transforms.

Major Topics

- I. Introductory Topics
 - A. Basic Definitions
 - B. Families of Curves
 - C. Initial Conditions/Boundary Value Conditions
 - D. Unique Solutions
 - E. Introduction to Applications
- II. Techniques to Solve Differential Equations
 - A. Separable Variables
 - B. Homogeneous Equations
 - C. Exact Equations
 - D. Linear Equations and the Integrating Factor
 - E. The Equations of Bernoulli, Ricatti and Clairaut
- III. Solving Applications
 - A. Orthogonal Trajectories
 - B. Growth and Decay
 - C. Cooling, Circuits and Mixtures
- IV. Higher Order Differential Equations
 - A. Independence and the Wronskian
 - B. The Superposition Principle
 - C. Constructing Solutions
 - D. Characteristic Equations
 - E. Differential and Annihilator Operators or Undetermined Coefficients
 - F. Variation of Parameters
- V. Applications
 - A. Simple Harmonic Motion in All Its Forms
 - B. Logistic Function
 - C. Law of Mass Action or Cooling
- VI. Differential Equations With Variable Coefficients
 - A. Cauchy-Euler Equation
 - B. Power Series Solutions
 - C. Bessel's Equation
 - D. Legendre's Equation
- VII. Using Laplace Transforms
 - A. Laplace Transforms and Inverse Transforms
 - B. Translation Theorems
 - C. Transformation of Derivatives
 - D. Solution of a Differential Equation Using Laplace Transforms
- VIII. Systems
 - A. Using Differential Operators -or-
 - B. Using Laplace Transforms

Course Requirements

Grading/exams: Although grading procedures will be determined by individual faculty, it will include unit exams and a comprehensive final exam.

A graphing calculator such as the TI83+ is required.

Other Course Information

Meets College definition for: Arts and Sciences Elective, General Electives (undesigned), Math Elective