

Common Course Outline
MATH 259
Elementary Differential Equations
3 Semester Hours

The Community College of Baltimore County

Description

This course is an elective course for Mathematics and Computer Science majors; a required course for Engineering majors. Included are techniques for solving first order differential equations, second and higher order differential equations, initial value problems, and solving differential equations by using numerical methods, Laplace Transform. Among the applications studied are exponential growth and decay, physical vibrations, electric circuits, falling bodies and more. Prerequisites: Calculus II (MATH 252)

Overall Course Objectives

Upon successfully completing the course, students will be able to:

1. Formulate real-world problems in mathematical forms such as Newton's Law of Cooling. (I, II, III, V, VI, 1, 2, 3, 4, 5, 6, 7)
2. Solve the first order linear differential equations, and Initial Value Problems. (I, II, IV, 1, 2, 3, 4, 5, 6, 7)
3. Solve Bernoulli differential equations using substitution method and first order differential equations. (I, III, V, 1, 2, 3, 4)
4. Solve separable differential equations, Exact differential equations, and Homogeneous differential equations. (I, III, V, 1, 2, 3, 4)
5. solve some application problems such as natural growth and decay problems, cooling and heating problems using separable differential equations. (I, II, III, V, VI, 1, 2, 3, 4, 5, 6, 7)
6. Find the family of curves that intersects a given family of curves orthogonally at each point by solving differential equations. (I, III, V, 1, 2, 3, 4)
7. Solve the second and higher order linear differential equations with constant coefficients. (I, II, III, 1, 2, 3, 4)
8. Formulate mathematical models of mechanical systems and electrical circuits by second order differential equations. (I, II, III, V, VI, 1, 2, 3, 4, 5, 6, 7)
9. Solve nonhomogeneous differential equations using the method of undetermined coefficients. (I, II, III, 1, 2, 3, 4)
10. Solve the initial value problem by using Laplace transform. (I, II, III, 1, 2, 3, 4)
11. Discuss the existence and uniqueness theorems of ordinary differential equations. (I, 1, 2)
12. Use Euler's method to solve a differential equation numerically. (I, IV, V, 4)
13. Articulate a solution to mathematical problems. (II, 2)
14. Apply appropriate technology to the solution of mathematical problems. (IV, 4, 5)
15. Construct a solution to real world problems using problem methods individually and in groups. (II, III, V, VI, 2, 3, 7)
16. Examine the mathematical contributions made by people from diverse cultures throughout history. (V, 5)

Major Topics

- I. Introduction
 - A. Classification of Differential Equations
 - B. Historical Remarks
- II. First order differential Equations
 - A. Linear equations
 - B. Further discussion of linear equations
 - C. Separable equations
 - D. Difference between linear and nonlinear equations
 - E. Modeling with linear equations; applications
 - F. Exact equations and integrating factors
 - G. Homogeneous equations
 - H. The existence and uniqueness theorem
- III. Second order linear equations
 - A. Homogeneous equations with constant coefficients
 - B. Fundamental solutions of linear homogeneous equations
 - C. Linear independence and the Wronskian
 - D. Complex roots and repeated roots of the characteristic equation
 - E. Nonhomogeneous equations; method of undetermined coefficients
 - F. Variation of parameters
- IV. Higher order linear equations
 - A. General theory of nth order linear equations
 - B. Homogeneous equations with constant coefficients
 - C. The method of undetermined coefficients
 - D. The method of variation of parameters
- V. The Laplace transform
 - A. Definition of Laplace Transform
 - B. Solution of initial value problems
 - C. Differential equations with discontinuous forcing functions
 - D. The convolution integral
- VI. Numerical methods
 - A. The Euler or tangent line method
 - B. Errors in numerical procedures
 - C. Improvements on the Euler method

Course Requirements (General Education Goal #VII)

Students will be given opportunity to collaborate via group work and/or oral presentation of problem solutions. There will be multiple opportunities for the instructor to assess student progress in the course through classwork and/or homework.

Grading: Grading procedures will be determined by the individual faculty member but will include the following:

Tests, Exams, and/or Quizzes: There will be at least two exams. Individual faculty will notify students of the testing procedures to be used.

Comprehensive Final Exam: The course will include a comprehensive final exam, which may include a final project.

Final Grades: Grades will be determined by individual faculty members.

The Community College of Baltimore County is committed to providing a high-quality learning experience that results in growth in knowledge, attitudes, and skills necessary to function successfully as a transfer student, in a career and as a citizen. To accomplish this goal, we maintain high academic standards and expect students to accept responsibility for their individual growth by attending classes, completing all homework and other assignments, participating in class activities and preparing for tests.

We take seriously our responsibility to maintain high-quality programs and will periodically ask you to participate in assessment activities to determine whether our students are attaining the knowledge, attitudes and skills appropriate to various courses and programs. The assessment activities may take many different forms such as surveys, standardized or faculty-developed tests, discussion groups or portfolio evaluations. We ask that you take these activities seriously so that we can obtain valid data to use for the continuous improvements of CCBC's course and programs.

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