

MATH-2520: DIFFERENTIAL EQUATIONS

Cuyahoga Community College

Viewing: MATH-2520 : Differential Equations

Board of Trustees:

May 2021

Academic Term:

Fall 2021

Subject Code

MATH - Mathematics

Course Number:

2520

Title:

Differential Equations

Catalog Description:

Study of first- and higher-order differential equations focusing on using linear and nonlinear first-order differential equations, homogeneous and nonhomogeneous linear equations, simultaneous systems, linear and nonlinear differential equations, power series, Laplace and inverse Laplace transforms to solve various application problems.

Credit Hour(s):

3

Lecture Hour(s):

3

Lab Hour(s):

0

Other Hour(s):

0

Requisites

Prerequisite and Corequisite

MATH-1620 Calculus II, or departmental approval: equivalent coursework.

Outcomes

Course Outcome(s):

Solve first-order ordinary differential equations.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Quantitative Reasoning: Analyze problems, including real-world scenarios, through the application of mathematical and numerical concepts and skills, including the interpretation of data, tables, charts, or graphs.

Objective(s):

1. Solve first-order differential equations that are separable, linear, or exact.
2. Solve first-order differential equations by making the appropriate substitutions including homogeneous and Bernoulli equations.
3. Use linear and nonlinear first-order differential equations to solve application problem.

Course Outcome(s):

Solve higher-order differential equations.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Quantitative Reasoning: Analyze problems, including real-world scenarios, through the application of mathematical and numerical concepts and skills, including the interpretation of data, tables, charts, or graphs.

Objective(s):

1. Use the method of reduction of order.
2. Solve higher-order homogeneous linear equations with constant coefficients.
3. Solve higher-order nonhomogeneous linear equations with constant coefficients by the methods of undetermined coefficients and variation of parameters.
4. Use linear second-order differential equations to solve application problems.
5. Solve application problems requiring the use of higher-order differential equations with boundary conditions.
6. Perform operations with Laplace and inverse Laplace transforms to solve higher-order differential equations.

Course Outcome(s):

Estimate solutions of differential equations.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Quantitative Reasoning: Analyze problems, including real-world scenarios, through the application of mathematical and numerical concepts and skills, including the interpretation of data, tables, charts, or graphs.

Objective(s):

1. Recognize the relationship between slope fields and solution curves for differential equations.
2. Use a slope field and an initial condition to estimate a solution curve to a differential equation.
3. Approximate solutions of first-order differential equations using Euler and/or Runge-Kutta methods.
4. Use power series to solve higher-order differential equations about ordinary or singular points.

Course Outcome(s):

Explore Special Topics within Differential Equations.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Quantitative Reasoning: Analyze problems, including real-world scenarios, through the application of mathematical and numerical concepts and skills, including the interpretation of data, tables, charts, or graphs.

Objective(s):

1. Solve systems of differential equations.

Methods of Evaluation:

1. Periodic exams
2. Quizzes
3. Homework
4. In class collaborative work
5. Application projects
6. Computer/calculator application problems
7. Comprehensive final exam

Course Content Outline:

1. First-order and higher-order ordinary differential equations
 - a. Separable variables
 - b. Exact differential equations
 - c. Integrating factors
 - d. Homogeneous differential equations

- e. Bernoulli differential equations
- f. Simple higher-order differential equations
- 2. Linear differential equations
 - a. Definition
 - b. Complementary solutions
 - i. The auxiliary equation
 - ii. Auxiliary roots
 - iii. Linear independence and Wronskians
 - c. Particular solution
 - i. Undetermined coefficients
 - ii. Variation of parameters
 - iii. Linear Operators
- 3. Simultaneous differential equations and their solutions
- 4. Laplace transforms
 - a. Definition
 - b. Properties
 - c. Inverse Laplace Transforms
 - d. Solutions of simple differential equations
 - e. Solutions of simultaneous differential equations
- 5. Power series
 - a. Taylor series method
 - b. Picard's method
 - c. Method of Frobenius
- 6. Applications
 - a. Exponential growth and decay
 - b. Population logistics growth
 - c. Velocity
 - d. Solution mixtures
 - e. Two component series circuits
 - f. Chemical reactions
 - g. Whirling string
 - h. Deflection of a uniform beam
 - i. Buckled rod
 - j. Harmonic motion (spring motion)

Resources

Zill, Dennis G. *A First Course in Differential Equations*. 11th. Cengage, 2018.

Boyce, William E., DiPrima, Richard C. *Elementary Differential Equations*. 11th ed. Wiley, 2017.

Nagle, R. Kent, Saff, Edward B., Snider, Arthur David. *Fundamentals of Differential Equations*. 9th ed. Pearson, 2017.

Resources Other

1. Software supplied with textbook.
2. Various computer algebra software.

Instructional Services

OAN Number:

Ohio Transfer 36 TMM020 and Transfer Assurance Guide OMT020

Top of page

Key: 2873