MATH-2520: DIFFERENTIAL EQUATIONS

Cuyahoga Community College

Viewing: MATH-2520: Differential Equations

Board of Trustees:
June 2019

Academic Term:
Fall 2019

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.

I. ACADEMIC CREDIT

Academic Credit According to the Ohio Department of Higher Education, one (1) semester hour of college credit will be awarded for each lecture hour. Students will be expected to work on out-of-class assignments on a regular basis which, over the length of the course, would normally average two hours of out-of-class study for each hour of formal class activity. For laboratory hours, one (1) credit shall be awarded for a minimum of three laboratory hours in a standard week for which little or no out-of-class study is required since three hours will be in the lab (i.e. Laboratory 03 hours). Whereas, one (1) credit shall be awarded for a minimum of two laboratory hours in a standard week, if supplemented by out-of-class assignments which would normally average one hour of out-of-class study preparing for or following up the laboratory experience (i.e. Laboratory 02 hours). Credit is also awarded for other hours such as directed practice, practicum, cooperative work experience, and field experience. The number of hours required to receive credit is listed under Other Hours on the syllabus. The number of credit hours for lecture, lab and other hours are listed at the beginning of the syllabus. Make sure you can prioritize your time accordingly. Proper planning, prioritization and dedication will enhance your success in this course.

The standard expectation for an online course is that you will spend 3 hours per week for each credit hour.

II. ACCESSIBILITY STATEMENT

If you need any special course adaptations or accommodations because of a documented disability, please notify your instructor within a reasonable length of time, preferably the first week of the term with formal notice of that need (i.e. an official letter from the Student Accessibility Services (SAS) office). Accommodations will not be made retroactively.
III. ATTENDANCE TRACKING

Regular class attendance is expected. Tri-C is required by law to verify the enrollment of students who participate in federal Title IV student aid programs and/or who receive educational benefits through other funding sources. Eligibility for federal student financial aid is based in part on enrollment status.

Students who do not attend classes for the entire term are required to withdraw from the course(s). Additionally, students who withdraw from a course or stop attending class without officially withdrawing may be required to return all or a portion of their financial aid based on the date of last attendance. Students who do not attend the full session are responsible for withdrawing from the course(s).

Tri-C is responsible for identifying students who have not attended a course before financial aid funds can be applied to students’ accounts.

Therefore, attendance is recorded in the following ways:

- For in-person and blended-learning courses, students are required to attend the course by the 15th day of the semester (or equivalent for terms shorter than five weeks) to be considered attending. Students who have not met all attendance requirements for in-person and blended courses, as described herein, within the first two weeks or equivalent, will be considered not attending.
- For online courses, students are required to login at least two times per week and submit one assignment per week for the first two weeks of the semester, or equivalent to the 15th day of the term. Students who have not met all attendance requirements for online courses, as described herein, within the first two weeks or equivalent, will be considered not attending.

At the conclusion of the first two weeks of a semester or equivalent, instructors report any registered students who have "Never Attended" a course. These students will be administratively withdrawn from that course. However, after the time period in the previous paragraphs, if a student stops attending a class or wants or needs to withdraw, for any reason, it is the student’s responsibility to take action to withdraw from the course. Students must complete and submit the appropriate Tri-C form by the established withdrawal deadline.

Tri-C is required to ensure that students receive financial aid only for courses that they attend and complete. Students reported for not attending at least one of their registered courses will have all financial aid funds held until confirmation of attendance in registered courses has been verified. Students who fail to complete at least one course may be required to repay all or a portion of their federal financial aid funds and may be ineligible to receive future federal financial aid awards. Students who withdraw from classes prior to completing more than 60 percent of their enrolled class time may be subject to the required federal refund policy.

If illness or emergency should necessitate a brief absence from class, students should confer with instructors upon their return. Students having problems with coursework due to a prolonged absence should confer with the instructor or a counselor.

IV. LEARNING OUTCOMES ASSESSMENT

Occasionally, in addition to submitting assignments to their instructors for evaluation and a grade, students will also be asked to submit completed assignments, called ‘artifacts,’ for assessment of course and program outcomes and the College’s Essential Learning Outcomes (ELOs). The artifacts will be submitted in Blackboard or a similar technology. The level of mastery of the outcome demonstrated by the artifact DOES NOT affect the student’s grade or academic record in any way. However, some instructors require that students submit their artifact before receiving their final grade. Some artifacts will be randomly selected for assessment, which will help determine improvements and support needed to further student success. If you have any questions, please feel free to speak with your instructor or contact the Learning Outcomes Assessment office.

V. CONCEALED CARRY STATEMENT

College policy prohibits the possession of weapons on college property by students, faculty and staff, unless specifically approved in advance as a job-related requirement (i.e., Tri-C campus police officers) or, in accordance with Ohio law, secured in a parked vehicle in a designated parking area only by an individual in possession of a valid conceal carry permit.

As a Tri-C student, your behavior on campus must comply with the student code of conduct which is available on page 29 within the Tri-C student handbook, available athttp://www.tri-c.edu/student-resources/documents/studenthandbook.pdf. You must also comply with the College’s Zero Tolerance for Violence on College Property available athttp://www.tri-c.edu/policies-and-procedures/documents/3354-1-20-10-zero-tolerance-for-violence-policy.pdf

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):
(Optional) 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 special classes of equations such as Cauchy-Euler, Bessel, and Legendre equations.
2. 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 La Place 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


**Resources Other**
1. Software supplied with textbook.
2. Various computer algebra software.

**Instructional Services**

**OAN Number:**
TMM020 & 0MT020

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