



Department of Math, Computer Science, and Engineering Technology

Spring 2026 (Tentative)

Course: MATA 621- Applied Differential Equations

Credit Hours: 3 hrs.

Class Time & Place: Online

Professor: Dr. Weizheng Gao

Office: Dixon Hall 108

Office Hours (Tentative): R 3:30 – 6:30 pm, F 12 – 7 pm or by appointment

Phone: 2523353040

Email (preferred): wegao@ecsu.edu

Required Text(s) & Materials: No Required Text

Supplemental Textbook:

Differential Equations with Boundary-Value Problems, by Dennis Zill and Michael Cullen, 7th Edition, Brooks/Cole: Cengage Learning, 2009. PDF Version

[http://www.uop.edu.pk/ocontents/DIFFERENTIAL%20EQUATIONS%20with%20Boundary-Value%20Problemsa%20Zill%20Cullen\(1\).pdf](http://www.uop.edu.pk/ocontents/DIFFERENTIAL%20EQUATIONS%20with%20Boundary-Value%20Problemsa%20Zill%20Cullen(1).pdf)

Suggested Reading: Listed in the Bibliography

Required Software: Matlab

Note: Matlab is free online for 20 hours per month.

Course Description: This course introduces applied methods for solving ordinary and partial differential equations (ODEs and PDEs) with applications in science and engineering. Topics include first- and second-order ODEs, linear systems, eigenvalue methods, fundamental matrices, Laplace transforms, boundary value problems, and

selected PDEs (heat, wave, and Laplace equations). Emphasis is on modeling, analysis, and computational solutions using MATLAB.

Prerequisite: MATH 358 (Differential Equations) or equivalent

Learning Outcomes: Learning Outcome:

By the end of the course, students will be able to:

1. Solve first- and higher-order ordinary differential equations analytically and numerically.
2. Analyze linear systems using eigenvalues, eigenvectors, and fundamental matrices.
3. Formulate and solve boundary value problems, including Sturm-Liouville problems.
4. Apply PDE methods to model practical engineering and science problems (heat, wave, Laplace equations).
5. Implement MATLAB solutions for ODE and PDE problems.

Spring 2025 Tentative Schedule (Subject to Change)

Week 1

Syllabus

Chapter 1-Introduction to Differential Equations

Differential Equations: Types of Differential Equations

Real-Life Examples of Problems Involving Differential Equations

Area of Concentration in Electrical and Computer Engineering

Mathematical Modeling: Engineering Design Process

Mathematical Modeling

Classification of Differential Equations: Order, Degree, and Linearity

Verification of a given function is a Solution to the Differential Equation

Initial-Value Problems (IVP) and Boundary Value Problems (BVP)

Week 2

Chapter 2-First-Order Differential Equations

Linear Equations

Week 3

Separable Equations

Linear Equations and Separable Equations

Week 4

Nonlinear Differential Equations and Substitution: Bernoulli Equation

Exact Equations

Week 5

Integrating Factor Method

A Numerical Method: Euler's Method

A Numerical Method: Euler's Method (Continue)

Week 6

Chapter 3-Modeling with First-Order Differential Equations

Radioactive Decay, Population Dynamics and Continuously Compound Interest

Newton's Law of Cooling

Decay, Growth, Interest, and Newton's Law of Cooling Problems

Week 7

Electrical Circuits (RC) and (LRC)

Mixture Problems

Week 8

Mixture Problems

Mid-Term Project (must include Matlab code and results)

Week 9

Spring Break

Week 10

Chapter 4-Higher-Order Differential Equations

Preliminary Theory-Linear Equations

Homogeneous Differential Equations

Linear Dependence and Linear Independence

Wronskian of a Function

Reduction of Order

Week 11

Homogeneous Linear Equations with Constant Coefficients

Week 12

Variation of Parameters

Variation of Parameters

Week 13

Undetermined Coefficient Method

Week 14

Cauchy-Euler Equations

Week 15

Chapter 7-The Laplace Transform

Definition of the Laplace Transform

Week 16

Final Project (must include Matlab code and results)

The instructor reserves the right to adjust the course schedule and topics as needed.

Bibliography:

1. Elementary Differential Equations, William E. Boyce & Richard C. DiPrima, Ninth Edition, 2008, John Wiley & Sons. ISBN: 978-0-470-03940-3
2. Edwards, C. Henry and David E. Penney, Differential Equations and Boundary Value Problems: Computing and Modeling, 3rd ed., Pearson Education, Inc., Upper Saddle River, New Jersey, 2004.
3. Ross, Shepley, Introduction to Ordinary Differential Equations, 4th ed., John Wiley & Sons, Inc., Hoboken, NJ, 1989.
4. Trench, William, Elementary Differential Equations, 1st ed., Pearson Education, Inc., Upper Saddle River, New Jersey, 2000.
5. Zill, Dennis G., First Course in Differential Equations: The Classic, 5th ed., Pearson Education, Inc., Upper Saddle River, New Jersey, 2001.

EVALUATION

- A. There will be mid-term exams, homework assignments, and finals. Grades will be computed on the following percentage grade system:

Mid-term Project	30%
Final Project	30%
Homework	40%

B. Grading Scale

90-100%	A
80-89%	B
70-79%	C
0-69%	F

Homework Policy

- (1) Homework assignments are due at the end of each class period.
- (2) No late homework will be accepted after 24 hours have passed.
- (3) You are permitted, perhaps encouraged, to discuss homework problems with other students. This collaboration should not extend to the process of writing up solutions. The work you turn in should be written by you, in your own words, without supervision or other well-meaning influence from anyone else.
- (4) Make sure that your handwriting is readable if you include handwriting in your work. Also please include all the details. Don't just give a numerical answer, show how you derive the answer.

Other Classroom Policies:

Attendance Policy: Follow the University stipulated attendance policy in the University catalog. The student is responsible for his/her virtual class attendance. Virtual class attendance is regarded as an academic matter, and any use of attendance records in grading or other regulations is left to the instructor's discretion. At the beginning of each virtual class period, therefore, attendance will be taken. It is the individual student's responsibility to be in class on time and/or inform the instructor of any supported excuses for absences.

Classroom Decorum: Students must remain in the virtual classroom during a class meeting. You are not allowed to come in and out of the virtual classroom unless you have a network issue. Please handle your business before the virtual class or wait until after the virtual class.

Cell Phone: Please turn your cell phone in manner mode before entering the virtual classroom.

Calculator/Cell Phone/ iPad/Laptops/etc. These devices WILL NOT be allowed on Exam and they are considered as CHEATING.

TI-82, 83, or 84 series will be allowed during exams. All other versions of a graphing calculator are considered as CHEATING.

Policy on Academic Honesty:

As members of the academic community, students are expected to recognize and uphold standards of intellectual and academic integrity. The examples and definitions given below are intended to clarify the standards by which academic honesty and academically honorable conduct are to be judged. The following list is merely illustrative and is not intended to be exhaustive.

- **PLAGIARISM.** Plagiarism is presenting another person's work as one's own. It includes paraphrasing or summarizing the works of another person without acknowledgment, including submitting another student's work as one's own.
- **CHEATING.** This involves giving or receiving unauthorized assistance before, during or after an examination.
- **UNAUTHORIZED COLLABORATION.** Submission for academic credit for a work, product, or a part thereof, represented as being one's own effort that has been developed in substantial collaboration with or without assistance from another person or source is a violation.
- **FALSIFICATION.** It is a violation to misrepresent material or fabricate information in an academic exercise or assignment.
- **MULTIPLE SUBMISSIONS.** It is a violation of academic honesty to submit substantial portions of the same work for credit more than once without the explicit consent of the instructor(s) to whom the material is submitted for additional credit. In cases where there is a natural development of research or knowledge in a sequence of courses, use of prior work may be desirable or even required.

Any student discovered plagiarizing, engaged in academic dishonesty, or in any other dishonest conduct will fail the course.

Any case of academic dishonesty may be investigated and judged by the professor or, if necessary, discussed with the Academic Dean for an investigation and determination. Student appeals regarding cases of academic dishonesty may be filed with the Student Review Committee through the Office of the Academic Dean. The process for appeals can be found in the Student Handbook.

Accommodation Statement:

ECSU is on record as being committed to both the spirit and letter of federal equal opportunity legislation; reference Public Law 92-112 - The Rehabilitation Act of 1973 as amended. With the passage of federal legislation entitled the *Americans with Disabilities Act(ADA)*, pursuant to section 504 of the Rehabilitation Act, there is a renewed focus on providing this population with the same opportunities enjoyed by all citizens.

The University is required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of that disability. Student

responsibility primarily rests with informing faculty of their need for accommodation and in providing authorized documentation through designated administrative channels.

Any student in the class who has a disability that may prevent the full demonstration of ability should contact the instructor personally before the end of the first week of classes so that a discussion can be held regarding accommodations necessary to ensure full participation and facilitate individual educational opportunities.

For more information, please contact:

Felecia Brown, 500 Griffin Hall., Campus Box 814
(252) 335-3642, fdbrown@ecsu.edu

Or visit: http://www.ecsu.edu/current-students/student-affairs/counseling-testing/students_with_special_needs.html

COVID-19 Policies and Updates

Please see the ECSU Viking Compass Website for the most updated information.

<https://www.ecsu.edu/vikingcompass/>