NAU NORTHERN ARIZONA UNIVERSITY

Course Title: MAT 239 Differential Equations
Term: Summer 2023
Instructor: TBA
Course Credit: 3
Mode of Instruction: Online

Course Description:

This course represents an important branch of mathematics. Many of their properties have been understood mathematically and they have a history of being successfully applied to important problems in all areas of science and engineering. This course will introduce primarily linear, first-order, and second-order differential equations. Solution techniques for separable equations and homogeneous and inhomogeneous equations as well as a range of modeling-based applications arising in the context of engineering, physics and chemistry will be presented. The application of Laplace transforms to differential equations, systems of linear differential equations, linearization of nonlinear systems, and phase plane methods will be covered.

Course Prerequisites:

N/A

Learning Outcomes:

By the end of the course, the student should be able to:

A. Understand and create a directional field for an arbitrary first-order differential equation;

B. Use the Euler or tangent line method to find an approximate solution to a linear differential equation;

C. Solve second order homogenous linear differential equations with constant coefficients including those with complex roots and real roots;

D. Solve nonhomogeneous differential equations using the method of undetermined coefficients;

E. Solve systems of linear differential equations using matrix techniques and eigenvalues.

Course Material:

Gilbert Strang, ***Differential Equations and Linear Algebra***, 3rd Edition, 2014.

Evaluation:

- 2 Projects [20%]
- 2 Assignment [20%]
- Mid-term Exam [25%]
- Final Exam [35%]

Description of the Evaluation tasks:

Assignment/ Essay/ ... : During the term, students will be required to finish several evaluation tasks within due date. All the tasks are linked with specific course topics/outcomes and will adequately assess students' competence and learning outcomes. Students are encouraged to meet with instructor about these tasks at any point.

Mid-term/ Final Exams/ Quiz/... : There may be periodic quizzes given at the beginning of lecture sessions; the feedback from these quizzes will monitor the progress of the learners and help to set learning priorities. There will be mid-term exam/ final exam for the course. They are the basic criteria for the evaluation of students' learning outcomes and final grade.

Grading Policy:

Students are supposed to finish each online lecture. Prior to each class, students should finish the required readings. During the class time, students are encouraged to make use of

all relevant online course resources and communicate with the instructor. Students' grades are accumulated based on the cumulative evaluations.

Students' letter grade will be assigned according to the following scale:

A+ 90-100	A 85-89	A- 80-84
B+ 77-79	B 73-76	B- 70-72
C+ 67-69	C 63-66	C- 60-62
D+ 57-59	D 53-56	D- 50-52
F < 50		

Academic Integrity:

Students must strictly adhere to the university's academic integrity rule; and all essays, exams and any other form of academic assignments must adhere to these rules. Any form of plagiarism, cheating, or misappropriation of materials will be considered a violation of academic integrity and will be punishable by the university.

Withdrawal from the Course(s):

Students will be able to apply for a transfer or withdrawal within 3 days of the starting date of the course. If a withdrawal is applied for within 3 working days, the tuition fee will be fully refunded. After 3 days, the tuition fee will not be refunded. If a withdrawal is applied for in the first two weeks, it will be recorded as W (Withdraw) on the course transcript. After this initial two-week period, the class will be recorded as F (Fail).

Tentative Schedule:

1	First Order Equations
2	Four Examples: Linear versus Nonlinear

3	The Calculus You Need
4	Four Particular Solutions
5	Second Order Equations **Assignment 1**
6	Constant Coefficients A, B, C
7	Solutions to Second Order Equations
8	Graphical and Numerical Methods
9	Linearization and Stability in 2D and 3D
10	Linear Equations and Inverse Matrices **Project 1**
11	**Midterm Test**
12	Symmetric Matrices and Orthogonal Matrices
13	Vector Spaces and Subspaces
14	The Column Space of a Matrix
15	The Complete Solution to Av = b **Assignment 2**
16	Eigenvalues and Eigenvectors
17	Introduction to Eigenvalues
18	Diagonalizing a Matrix
19	Linear Systems y' = Ay
20	Second Order Systems and Symmetric Matrices **Project 2**
21	Least Squares and Projections
22	Boundary Conditions Replace Initial Conditions
23	Fourier and Laplace Transforms
24	The Laplace Transform

25	**Final Exam**