NAU NORTHERN ARIZONA UNIVERSITY

Course Title: MAT 461 Partial Differential Equations

Term: Winter 2023

Instructor: TBA

Course Credit: 3

Mode of Instruction: Online

Course Description:

This course gives a comprehensive survey of modern techniques in the theoretical study of partial differential equations (PDEs). Topics cover partial differential equations, boundary value problems, Fourier series, and selected topics with applications including initial and boundary value problems, separation of variables, eigenvalues and eigenfunctions, Fourier transforms and Laplace Transforms. These tools are then applied to the treatment of basic problems in linear PDEs, including the Laplace equation, heat equation, and wave equation.

Course Prerequisites:

MAT 239 Differential Equations; MAT 316 Introduction To Linear Algebra

Learning Outcomes:

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

A. Describe the most common partial differential equations that appear in problems concerning;

B. Solve simple first order equations using the method of characteristics;

C. Demonstrate an understanding of the meaning, the order and solution of a partial differential equation, and boundary conditions;

D. Define the Fourier series and apply them to the partial differential equations;

E. Formulate maximum principles for various equations and derive consequences.

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Course Material:

Partial Differential Equations of Applied Mathematics, Erich Zauderer, Third Edition, John Wiley & Sons, Inc. Press, 2006.

Evaluation:

- 2 Quizzes [2*10%]
- 2 Essays [2*15%]
- Mid-term Exam [20%]
- Final Exam [30%]

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:

Week 1	
1	Random Walks and Partial Differential Equations
2	Laplace's Equation and Green's Function
3	First Order Partial Differential Equations
4	Characteristic Initial Value Problems
5	Classification of Equations and Characteristics **Quiz 1**

Week 2	
6	Initial and Boundary Value Problems in Bounded Regions
7	Separation of Variables
8	The Sturm-Liouville Problem
9	Properties of Eigenvalues and Eigenfunctions

10	Fourier Sine Series Fourier Cosine Series **Essay 1**
Week 3	
11	Fourier Series
12	Nonlinear Heat Equation: Stability Theory and Cauchy Problem
13	**Midterm Test**
14	Integral Transforms
15	One-Dimensional Fourier Transforms Higher-Dimensional Fourier Transforms
Week 4	
16	Hankel Transforms
17	Laplace Transforms
18	Integral Relations
19	Cauchy and Initial and Boundary Value Problems Eigenvalue Problems and Eigenfunction Expansions
20	The Integral Wave Equation **Quiz 2**
Week 5	
21	Green's Functions for Bounded Regions Green's Functions for Unbounded Regions
22	Variational and Other Methods
23	Perturbation Methods Asymptotic Methods
24	Finite Difference Methods Finite Element Methods in Two Dimensions **Essay 2**
25	**Final Exam**