NAU NORTHERN ARIZONA UNIVERSITY

Course Title: MAT 399 Special Topics
Term: Summer 2023
Instructor: TBA
Course Credit: 3
Mode of Instruction: Online

Course Description:

The course covers the following major concepts and theorems: Axioms of the real numbers, supremum, infimum, upper limits, open and closed sets in nR, compactness, the Bolzano-Weierstrass and Heine-Borel Theorems, continuity and differentiability of functions, the Riemann Integral, The L' Hôpital' s Rule, The Taylor' s and the Mean Value Theorems, and metric spaces. This course is designed to provide fundamental concepts of analysis, including classical theory of functions of a real variable, differentiation and integration of real functions, as well as some fundamental topics in general topology and metric space theory. Emphasis will be placed on the understanding of the proofs and the applications of the major theorems.

Course Prerequisites:

N/A

Learning Outcomes:

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

A. Demonstrate competence with elementary properties of sets by proving identities involving union and intersection and Cartesian Products of sets;

B. Use mathematical induction to prove results involving natural numbers;

C. Have competence with properties of real numbers by finding supremum and infimum of sets and using the completeness property of real numbers;

D. Understand the proofs and the applications of the major theorems.

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Course Material:

Michael E. Taylor, ***Partial Differential Equations I: Basic Theory***, 2rd Edition, 2011.

Evaluation:

- 2 Quizzes [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	Basic Theory of ODE and Vector Fields
2	Fundamental local existence theorem for ODE
3	Flows and vector fields
4	Hamiltonian system

5	The Laplace Equation and Wave Equation **Assignment 1**
6	Vibrating string and membranes
7	The divergence of a vector field
8	The Laplace operator on a Riemannian manifold
9	More general hyperbolic equations;energy estimates
10	Fourier Analysis, Distributions, and Constant-Coefficient Linear PDE **Quiz 1**
11	**Midterm Test**
12	Harmonic functions and holomorphic functions in the plane
13	Radial distributions and principle value distributions
14	Sobolev Spaces
15	The Complex Interpolation Method **Assignment 2**
16	Sobolev spaces on compact manifolds
17	Linear Elliptic Equations
18	The weak and strong maximum principles
19	The Riemann mapping theorem
20	Linear Evolution Equations **Quiz 2**
21	Outline of Functional Analysis
22	Duality
23	Manifolds, Vector Bundles, and Lie Groups
24	Lie Groups
25	**Final Exam**