Math 4315/5315 – Partial Differential Equations

Semester: Fall 2022 CRN 20366/15797
Meeting times: MWF 12:00 –12:50pm
Room: MCS 212
Instructor: Dr. Danny Arrigo
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Office location: MCS 201
Office telephone No.: 450-5668
Office hours: MTWR 2-4pm.
Textbook: An Introduction to Partial Differential Equations by Daniel Arrigo - Morgan
Claypool Publisher 2017 ISBN 1681732548

Cellphones: Please turn **off** all cell phones before class!

Introductory Remarks
Partial differential equations (PDEs) arise in modeling numerous phenomena in science and engineering. The goal of this course is to convey something of the flavor of the subject of PDEs and their use in applications. For example, considering the heat flow in a rod, it will be shown how partial differential equations arise in modeling this physical situation and how the interpretation of their solutions helps one to understand the actual phenomena.

Course Description:
This course introduces techniques for solving and second order partial differential equations. Topics include linear, quasi-linear and nonlinear first order partial differential equations and the method of characteristics, second order linear partial differential equations and the separation of variables of the heat equation, wave equations, and Laplace's equations. Applications include heat conduction, steady state temperatures, and vibrating strings and membranes. Lecture. Prerequisites: MATH 2371 and MATH 3331. Fall.

Student Learning Outcomes:
Upon completing the course, the student will be familiar with some of the modeling assumptions and derivations that lead to the heat, wave and Laplace's equation. Be able to solve first order partial differential equations using the method of characteristics, be able to classify second-order PDEs as elliptic, hyperbolic or parabolic, be able to transform to standard form, be able to solve analytically, using the method of separation of variables, the heat and wave equations (in one space variable) and Laplace's equation (in two space variables) on rectangular domains.

Course Outline:
Review of some topics of Calc III and ODEs
Chapter 1. Introduction to differential equations with modeling applications
Model derivations: Heat equation, wave equation and Laplace's equation
Chapter 2. First-order equations: constant coefficient, variable coefficient, quasi-linear and nonlinear

Chapter 3. Second-order equations: linear equations, canonical form and the method of characteristics, the Wave equation and D'Alembert's solution
Chapter 4. Fourier series
Chapter 5. Separation of variables: heat equation, superposition principle, Laplace's equation on rectangular domains and circular (if time permits) domains and the wave equation.

Grades
Your grade for this course will be determined by homework, tests, and a project involving a seminar and paper. Your homework will be assigned regularly and collected Friday's by 4:30pm. The homework will count as 15% of your final grade. There will be 3 tests throughout the semester counting 60% of your final grade. There will be two scheduled meetings with the instructor to discuss projects, 5% of the grade. The remaining 20% of your final grade will reside in a paper and seminar.

Seminar: Students will form a group of one or two and give a 10 minute seminar to the entire class. The subject matter of the seminar is to present a mathematical model (*i.e.* a PDE) drawn from science or engineering. The seminar is to entail the formation of the model, mathematical analysis and conclusions (or lack of). The seminar may also be a topic related to this course that has not been covered in class. The seminars will be conducted the week after Thanksgiving.

Paper: This will consist of a write up of the seminar with considerably more details than in the seminar itself (with references).

The following are the *tentative* dates for the tests (there will be no make-up tests):
Tests: Sept. 23, Oct. 14 and Nov. 18

Grade		Grade Scale	
Homework:	15%	90% - 100%	A
Tests (3)	60%	80% - 89%	B
Meetings	5%	70% - 79%	C
Seminar	10%	60% - 69%	D
Paper	10%	0% - 59%	F
	100%		

Final Date to Withdraw - Nov. 16, 2022
Final date to officially withdraw from Aug. 25 – Dec. 16 classes from the university with a W grade unless already dropped for non-attendance. After this date, no withdrawals are permitted and no W grades are recorded.

Attendance
Attendance is highly recommended. If you are absent for approximately 10% without a valid excuse, where appropriate, you may be dropped from the course. It is a good idea to form small groups to work together in doing homework problems. You will learn from each other and your progress will be more rapid. However, joint work (or copying) during tests and exams is forbidden.

University policy on Academic Integrity and Academic Misconduct
The University of Central Arkansas affirms its commitment to academic integrity and expects all members of the university community to accept shared responsibility for maintaining academic integrity. Students in this course are subject to the provisions of the university's Academic Integrity Policy, approved by the Board of Trustees as Board Policy No. 709 on February 10, 2010, and published in the *Student Handbook*. Penalties for academic misconduct in this course may include a failing grade on an assignment, a failing grade in the course, or any other course-related sanction the instructor determines to be appropriate. Continued enrollment in this course affirms a student's acceptance of this university policy.

Plagiarism
Plagiarism can be defined as the use of someone else's words without proper acknowledgement of that use.   If you use someone else's words or the written words of the instructor in the assignment, you must put them in quotations and provide a reference for the source. Paraphrasing the words of others by only changing a few words is also considered plagiarism. For more information about plagiarism, please see UCA's statement on plagiarism at http://uca.edu/academicaffairs/files/2012/08/Plagiarism.pdf.   Plagiarism is academic misconduct and will result in appropriate disciplinary action.

The Americans with Disabilities Act statement
The University of Central Arkansas adheres to the requirements of the Americans with Disabilities Act. If you need an accommodation under this Act due to a disability, please contact the UCA Disability Resource Center, 450-3613.

Building Emergency Plan statement
An Emergency Procedures Summary (EPS) for the building in which this class is held will be discussed during the first week of this course. EPS documents for most buildings on campus are available at http://uca.edu/mysafety/bep. Every student should be familiar with emergency procedures for any campus building in which he/she spends time for classes or other purposes.

The Title IX disclosure
In furtherance of its core values— academic vitality, integrity, and diversity—UCA is dedicated to promoting a campus community free from discrimination. Title IX of the Education Amendments Act of 1972 requires all educational institutions to address gender-based discrimination on campus, and UCA implements these Federal requirements through a fair, consistent, and appropriate process of investigation and adjudication. Please see UCA's Title IX website (https://uca.edu/titleix/) for the university's policy, relevant forms, training opportunities, and related information.

Departmental Policy
Use of cell phones (including texting), MP3 players, web browsers, ear buds/plugs is NOT ALLOWED during class time. Cell phones must be set to silent/vibrant mode while in class. Instructors may also disallow use of any other technology not relevant to the instruction. Use of any type of laptop during class time requires consent of the instructor.

Covid-19
All students are expected to know and comply with university policy related to Covid-19. For information and resources, see https://uca.edu/coronavirus/.

Other Policies
Students should familiarize themselves with all policies listed in the UCA *Student Handbook,* such as the Sexual Harassment Policy and Academic Policies.