

Math 4315/5315 – Partial Differential Equations

Semester: Fall 2021 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: TBA – Either in person or virtually in Blackboard Collaborate

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.

Lecture Format

Lectures will be F2F MWF from 12 – 12:50pm. As we are in an unusual year, we might have to alter this format. I have lecture notes on my webpage.

Wearing face masks and social distancing will be strictly adhered to.

In the event that we need to go online, the classes will be held in Blackboard's Collaborate Ultra. In this case, there will probably be news of this on UCA's webpage but I will also communicate this to you via an email (so check your emails regularly). In the case that you need to isolate, please contact me immediately so we can make provisions.

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 should be uploaded to Blackboard 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. 24, Oct. 15 and Nov. 19

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 <u>10%</u>	0% - 59% F
100%	

Final Date to Withdraw - Nov. 5, 2021

Final date to officially withdraw from Aug. 19 – Dec. 10 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 will 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. If the instructor of this class needs to be informed of your disability in order to assist with any appropriate accommodations, please contact the instructor during the first week of classes.

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

If a student discloses an act of sexual harassment, discrimination, assault, or other sexual misconduct to a faculty member (as it relates to “student-on-student” or “employee-on-student”), the faculty member cannot maintain complete confidentiality and is required to report the act and may be required to reveal the names of the parties involved. Any allegations made by a student may or may not trigger an investigation. Each situation differs and the obligation to conduct an investigation will depend on those specific set of circumstances. The determination to conduct an investigation will be made by the Title IX Coordinator. For further information, please visit: <https://uca.edu/titleix>. **Disclosure of sexual misconduct by a third party who is not a student and/or employee is also required if the misconduct occurs when the third party is a participant in a university-sponsored program, event, or activity.*

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.

Other Policies

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

Face Coverings

Wearing a cloth face covering has been shown to be one of the most effective ways to help reduce the spread of COVID-19. When we all wear face coverings, our chances of spreading the virus are dramatically reduced. This fall, students, faculty and staff will be required to wear face coverings in enclosed spaces — in classrooms, hallways, lobbies, restrooms, stairwells and elevators — and in any situation outdoors where maintaining six feet from others is not possible. However, students will not be required to wear face coverings while in their dorm room or in their own personal space. **All students are expected to comply with the University policy regarding face coverings.**

Some students may be unable to wear a face covering due to a documented medical condition. For information on face mask exemptions, visit the [UCA Disability Resource Center](#) website, email drc@uca.edu or call (501) 450-3613.

For additional information on the Covid-19 please see <https://uca.edu/coronavirus/students/>