Instructor:
Dr. Chris Lee Trexler 270D
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Office Hours:
Mon/Wed: 2:20 - 3:30pm
Tue/Thu: 1:10 - 2:40pm

Overarching Goals:

Students will be able to:

- Apply their knowledge of differential equations to real-world phenomena.
- Compare the many different techniques available for solving partial differential equations – most importantly determining which is appropriate for a given problem.
- Utilize technology to both find and visualize solutions to differential equation problems.

Ancillary Skill Goals:

Students will be able to:

- Understand the role of modeling with differential equations in problem solving.
- Find Laplace transforms and inverse transforms, and apply these to solve differential equations.
- Find the Fourier series of a function.
- Obtain power series solutions for certain classes of linear ordinary differential equations.
- Find and visualize through technology the solution of models including the wave equations and vibrating strings.
- Use the Euler and Runge-Kutta methods to numerically approximate solutions to differential equations.

Course Objectives: Very few real world problems arise in a form that has already been solved. This course will focus on the use of a transformation to reduce a difficult problem into smaller, hopefully solvable components, and then reconstructing the entire solution. While being very technical and sometimes messy, the material in this course can be applied to a wide variety of phenomena, and we will look at a number of these applications.

Text: Boyce and DiPrima, *Elementary Differential Equations and Boundary Value Problems, 10th Edition.*

Materials: As mathematics is hardly ever done correctly on the first try, all work should be done in pencil.

Technology: We will make extensive use of *Mathematica*. The college has an unlimited license that allows students to install the software on their personal computers. For download instructions, please see the page at https://webapps.roanoke.edu/www/it/mathematica/

Late Work: Unless specific permission is given in advance of the due date, no late work will be accepted.

Cell Phones: This is very simple - no cells phones are allowed to be used or even visible in our classroom. This includes before, during, and after class. If a cell phone is seen, the student will be asked to leave the classroom and the day will be counted as an unexcused absence.

Attendance: Attendance is critical to the understanding of the material in the course; it is both required and expected. Any absence that is not discussed with the instructor prior to the missed class is considered unexcused. Unexcused absences may result in the lowering of the final grade. I will assume that if you accumulate 3 unexcused absences you are not interested in completing the course and will drop you from the class (DF). When absent, excused or unexcused, you are responsible for all material covered in class. You will not be allowed to make up any work missed due to an unexcused absence.

MCSP Conversations: The Math, Computer Science and Physics department offers a series of discussions that appeal to a broad range of interests related to these fields of study. These co-curricular sessions will engage the community to think about ongoing research, novel applications and other issues that face our discipline. A calendar of events will be distributed early in the semester.

Members of this class are invited be involved with all of these meetings; however participation in **at least three** of these sessions is mandatory. After attending, students will submit within one week of the presentation a one-page paper reflecting on the discussion. This should *not* simply be a regurgitation of the content, but rather a personal contemplation of the experience.

Assignments: Homework assignments will be given daily, and you are expected to work all problems.

Quizzes/Projects: Quizzes will be given frequently, serving both as an incentive for the student to keep up, and as a gauge for the instructor to measure the understanding of the material. Quizzes will often be in the form of projects.

Tests: Two tests will be given throughout the semester.

Final Exam: The final exam will be cumulative, equally covering all material presented in the course.

Grading: A student's grade will be determined as

Tests 50% Quizzes/HW 20% Final Exam 30%

No test or quiz scores will be dropped when calculating averages. A *tentative* guideline for determination of grade will then be:

A	> 93	B	83 – 86.9	C	73 – 76.9	D	63 – 66.9
A-	90 – 93	B-	80 – 82.9	C-	70 – 72.9	D-	60 – 62.9
B+	87 – 89.9	C+	77 – 79.9	D+	67 – 69.9	F	< 60

Academic Integrity: Students are expected to adhere to the Academic Integrity policies of Roanoke College. All work submitted for a grade is to be your own work!

Cell Phone Policy: If your phone rings, the instructor gets to answer it. An audible sound signaling a text message will get your message read to the entire class.

Course Schedule - This course expects you to spend at least 12 hours of work each week inside and outside of class.

Chapter 5, Series Solutions of Second Order Linear Equations

26.	Thu	Sept 3	5.1	Review of Power Series
25.	Tue	Sept 8	5.2	Series Solutions near an Ordinary Point, Part I
24.	Thu	Sept 10	5.3	Series Solutions near an Ordinary Point, Part II
23.	Tue	Sept 15	5.4	Regular Singular Points
22.	Thu	Sept 17	5.4	Euler Equations
21.	Tue	Sept 22	5.5	Series Solutions near a Regular Singular Point, Part I
20.	Thu	Sept 24	5.6	Series Solutions near a Regular Singular Point, Part II
19.	Tue	Sept 29	**Test 1**	

Chapter 10, Partial Differential Equations and Fourier Series

18.	Thu	Oct 1	10.1	Two-Point Boundary Value Problems
17.	Tue	Oct 6	10.2	Fourier Series
16.	Thu	Oct 8	10.3 / 10.4	The Fourier Convergence Theorem / Even and Odd Functions
15.	Tue	Oct 13	10.5	Separation of Variables; Heat Conduction in a Rod
14.	Thu	Oct 15	10.6	Other Heat Conduction Problems

Fall Break

13.	Tue	Oct 27	10.7	The Wave Equation; Vibrations of an Elastic String
12.	Thu	Oct 29	10.8	Laplace's Equation
11.	Tue	Nov 3		Review
10.	Thu	Nov 5	**Test 2**	

Chapter 11, Boundary Value Problems and Sturm-Liouville Theory

9.	Tue	Nov 10	11.1	The Occurrence of Two Point Boundary Value Problems
8.	Thu	Nov 12	11.2	Sturm-Liouville Boundary Value Problems
7.	Tue	Nov 17	11.3	Nonhomogeneous Boundary Value Problems
6.	Thu	Nov 19	11.4	Singular Sturm-Liouville Problems

Chapter 8, Numerical Methods

5.	Tue	Nov 24	8.1	The Euler or Tangent Line Method
4.	Tue	Dec 1	8.2	Euler Method Improvements
3.	Thu	Dec 3	8.3	The Runge-Kutta Method
2.	Tue	Dec 8	Review	
1.	Thu	Dec 10	Review	

Thu Dec 17 8:30 – 11:30am Final Exam