

## Course Syllabus: MATH 17 – Differential Equations and Linear Algebra

**MATH 17-52028**

Hybrid

Instructor: Steven Zook

Phone: (559) 638-3641 ext. 3279

Office Hours:

MW 1:00 – 1:50 pm;

TTh 11:00 – 11:50 am

**Reedley College**

Spring 2024

Email: [steven.zook@reedleycollege.edu](mailto:steven.zook@reedleycollege.edu)

Office: MSCI 129

[Virtual Office \(click to open zoom\)](#)

F 9:00 – 9:50am

### **Meeting Days and Location:**

MW 9:30am – 10:50am, FNR 4

### **Course Description:**

Differential Equations and Linear Algebra is the study of first order ordinary differential equations, including separable, linear, homogeneous of degree zero, Bernoulli and exact equations with applications and numerical methods. Topics include: solutions to higher order differential equations using undetermined coefficients, variation of parameters, and power series, with applications, solutions to linear and non-linear systems of differential equations, including numerical solutions, matrix algebra, solutions of linear systems of equations, and determinants, vector spaces, linear independence, basis and dimension, subspace and inner product space, including the Gram-Schmidt procedure, linear transformations, kernel and range, eigenvalues, eigenvectors, diagonalization and symmetric matrices.

### **Course Prerequisites:**

MATH 6

### **Course Advisories:**

English 1A or 1AH

### **Student Learning Outcomes:**

*Upon completion of this course, students will be able to:*

1. Perform matrix computation, use matrices to solve linear systems of equations, and determine the base of a vector space
2. Find solutions to first order and higher order differential equations and apply them to various application problems
3. Find eigenvalues and eigenvectors, determine if a matrix is diagonalizable
4. Find the solutions to systems of differential equations using eigenvalue/eigenvector matrix methods
5. Use Laplace transforms to find the solution to initial value problems

*Student Learning Outcomes are statements about what the discipline faculty hope you will be able to do at the end of the course. This is NOT a guarantee: the ultimate responsibility for whether you will be able to do these things lies with you, the student. In addition, the assessment of Student Learning Outcomes is done by the department in order to evaluate the program as a whole, and not to evaluate individual faculty performance.*

## Course Outline:

*In the process of completing this course, students will learn about:*

1. First order differential equations including separable, homogeneous, exact, and linear
2. Existence and uniqueness of solutions
3. Applications of first order differential equations such as circuits, mixture problems, population modeling, orthogonal trajectories, and slope fields
4. Second order and higher order linear differential equations
5. Fundamental solutions, independence, Wronskian
6. Nonhomogeneous equations
7. Applications of higher order differential equations such as the harmonic oscillator and circuits
8. Methods of solving differential equations including variation of parameters, Laplace transforms, and series solutions
9. Systems of ordinary differential equations Techniques for solving systems of linear equations including Gaussian and Gauss-Jordan elimination and inverse matrices
10. Matrix algebra, invertibility, and the transpose
11. Relationship between coefficient matrix invertibility and solutions to a system of linear equations and the inverse matrices
12. Special matrices: diagonal, triangular, and symmetric
13. Determinants and their properties
14. Vector algebra for  $R^n$
15. Real vector spaces and subspaces, linear independence, and basis and dimension of a vector space
16. Matrix-generated spaces: row space, column space, null space, rank, nullity
17. Change of basis
18. Linear transformations, kernel and range, and inverse linear transformations
19. Matrices of general linear transformations
20. Eigenvalues, eigenvectors, eigenspace
21. Diagonalization including orthogonal diagonalization of symmetric matrices
22. Dot product, norm of a vector, angle between vectors, orthogonality of two vectors in  $R^n$
23. Orthogonal and orthonormal bases: Gram-Schmidt process.

## Required Text:

LibreText, [Differential Equations and Linear Algebra \(click to access textbook\)](#). This text is required for reading, study, and homework. It is completely FREE and you can download a PDF version for offline use. You may choose to have a print copy for about \$40 + shipping/taxes etc. Let me know if you are interested in this option and I can help you out (if you need it)!

## Office Hours:

I will be holding regular and virtual office hours. I want to be available to you if you need assistance outside of class. Please visit me during the scheduled times for drop-in questions. You may come unannounced during those times. If the scheduled office hours do not suit your schedule, you may arrange a time to meet with me by sending me an email. Please don't hesitate to take advantage of these since I want you to succeed – it's what I am here for.

This semester some of my office hours are in person in my office in the new math and science building (MSCI 129); the others are virtual at the following link: [Virtual Office](#)

**Communication:**

There are a variety of ways to reach me. I will do my best to respond to messages and emails that are received Monday-Friday between 9am and 5pm as soon as possible, but no later than 24 hours. If you don't hear back from me in 24 hours, assume I did not receive your message/email and please resend it. On weekends, please give me additional time - I will respond to messages/emails received over the weekend (after Friday 5pm) on Monday mornings. Please identify yourself in the email with your full name and course number (e.g. Steven Zook, MATH 17-52028).

**Preferred:**

1. Message me using the "Inbox" feature in Canvas.
2. Email me directly: [steven.zook@reedleycollege.edu](mailto:steven.zook@reedleycollege.edu)
3. Visit me in my office: MSCI 129
4. Drop by my virtual office (zoom) during my scheduled office hour: [Virtual Office](#)
5. Consider posting a general course question in the Q&A discussion thread on Canvas.

**Other:**

6. Call me on my office phone: 559.638.3641 extension 3279. If leaving a message, please let me know your full name and the course you are taking along with a call-back number.

**Attendance and Drop Policy:**

The primary way that you "attend" class is by participating in class discussions and completing assignments (homework and exams). It is important that students regularly and consistently participate in the course from the very beginning. For this reason I have the following guidelines for when I may drop students from the course. If I intend to drop you, I will always message you a warning before I do, so don't be anxious about being dropped "out of the blue". If you do have missing assignments, I encourage you to reach out to me, so we can make a plan to get you on track - the sooner the better!

1. Start strong! Complete **all assignments** during the first two weeks of class. If you miss an assignment during the first two weeks, I may drop you from the course.
2. If you miss **more than ten (10) assignments**(discussion, homework, exam, etc.) during the first 9 weeks of the semester, I may drop you from the course for poor attendance.

**Drop Deadline:**

Friday, March 8

**Assignments:**

1. Homework assignments can be worked on any time before they are due. I will accept late homework; however, it is so important to complete the homework before you take the exams.
2. Discussions that are submitted late will only earn points for the initial post (3 out of 5 points possible). Since your classmates depend on your thoughtful, consistent, and timely participation, you will not receive credit for responses to classmates that are late.
3. Exams cannot be made up late for any reason. However, to safeguard against any unavoidable and unforeseen circumstances, I drop the lowest exam score. I do allow you to take an exam early, if it is prearranged.

### **Assignment Categories and Weighting:**

| <i>Assignment</i> | <i>Weighting</i> |
|-------------------|------------------|
| Homework          | 20%              |
| Discussions       | 10%              |
| Exams             | 70%              |

### **Final Grades:**

| <i>Letter Grade</i> | <i>Percent</i> |
|---------------------|----------------|
| A                   | 90 – 100       |
| B                   | 80 – 89        |
| C                   | 70 – 79        |
| D                   | 60 – 69        |
| F                   | 0 – 59         |

### **Special Needs Requests:**

If you have a verified need for an academic accommodation or materials in alternate media (i.e., Braille, large print, electronic text, etc.) per the Americans with Disabilities Act (ADA) or Section 504 of the Rehabilitation Act, please contact me as soon as possible.

### **Plagiarism and Academic Honesty:**

Please refer to the policies in the 2023-2024 Reedley College catalog, pages 48, 49. Academic honesty is of utmost importance and the college policies will be followed.