> **KENNESAW STATE UNIVERSITY**
> **COLLEGE OF SCIENCE AND MATHEMATICS**
> **DEPARTMENT OF MATHEMATICS**
> ***Spring Semester 2022***
> ***MATH 2306: Ordinary Differential Equations (Sections 53 and 54)***

1. BASIC INFORMATION

Instructor: Dr. Timothy Faver
Email: `tfaver1_AT_kennesaw.edu` (this is the best way to contact me)
Website: `https://tefaver.com/math-2306-ordinary-differential-equations`
Lecture time/location: Section 53 — MWF 11:15 am – 12:05 pm, Math Room D112
                              Section 54 — MWF 12:20 – 1:10 pm, Math Room D112
Office: D248 (Office phone: 470-578-6954, but please use email)
Office hours: M 2:00 pm – 3:00 pm, W 3:00 pm – 4:00 pm (all via Teams)

Learning outcomes. Upon completing this course, students will be able to

1. Solve special types of first-order ordinary differential equations including equations which are linear and separable, and use these methods to solve applied problems.

2. Solve second- and higher-order homogeneous and nonhomogeneous linear ordinary differential equations, and use these methods to solve applied problems.

3. Solve a system of linear ordinary differential equations with constant coefficients.

4. Find Laplace transforms and inverse Laplace transforms and apply these to solve linear ordinary differential equations.

5. Find the Fourier series of a function, including Fourier cosine and sine series.

Course materials.

• *Fundamentals of Differential Equations (Ninth Edition)* by R. Kent Nagle, Edward B. Saff, and Arthur David Snider (Pearson 2018). An older edition is probably fine. There is a longer version with "and Boundary Value Problems" in the title; this version is also fine.

• Lecture notes will be posted and updated (more or less) daily to the course website. Please alert me to typos and errors.

• Problem sets will be completed online via WeBWorK, and some additional assignments will be submitted on D2L.

• You should have some loose paper on hand for each class, as I will periodically ask you to submit in-class work as an attendance check.

2. Practical and Philosophical Matters

Facts of life about differential equations.

• This course has six to ten (maybe twelve) "big ideas." We will frequently study the same problem/equation/concept from multiple perspectives. If it feels like we are being repetitive, we probably are, but for a good reason. Trust me.

• There is a relatively small group of differential equations that we can solve "explicitly" in the sense that we have a formula[1] for the solution. Many of our equations will, broadly, look alike. Beyond this group, pretty much every differential equation requires its own specialized treatment — but frequently one can invoke some techniques from the special group of equations that we will exhaustively study in Math 2306.

• Notation can be nightmarish. The symbols y', $\frac{dy}{dx}$, $y^{(1)}$, and $\partial_x[y]$ can all mean the derivative of y with respect to x. We will not always, or perhaps even usually, call our functions y; sometimes x is a function, and sometimes the independent variable is t. When working through problems in WeBWorK or in the textbook, you will need to read carefully and maybe use context clues to understand the notation. It is not a bad thing if notation changes from problem to problem.

Daily class structure.

• Most of our classes will involve my lecturing, your individual work on problems during lecture pauses, and our large group discussion. (I am not sure that any of us are keen on close and personal small-group activities in the present Age of Omicron.)

• You will have a far more nourishing time if you use our in-class pauses to work on the actual problem that I provide. This will give you an immediate sense of what you understand and what you find confusing, which will further guide our group discussion and your subsequent, individual study. Sometimes I will collect your in-class work (see below about attendance).

• You are most welcome to ask questions at any point during our discussions and to share suggestions, (math-related) opinions, and ideas. There will likely be multiple valid ways to solve any problem that we meet.

Office hours.

• During office hours, we can discuss specific examples, problems, or techniques from class, the lecture notes, or the textbook. More broadly, we can talk about your study habits, time management, and reading skills. Before coming to office hours, you should think carefully about what you want to discuss so that we use our time efficiently and effectively.

• All office hours will be held online via Teams. Links will be on D2L.

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[1]Having a formula for something does not mean that we understand that thing. Understanding something does not necessarily demand a formula.

• If my office hours conflict with your other classes, we can make an appointment for a different time. If the currently scheduled office hours conflict with the availability of students who most frequently want to see me, I may change the weekly hours to accommodate the preferences of the majority. If I need to cancel some of a week's regularly scheduled office hours, I will try to hold additional office hours at other times that week.

Email communication.

• We can resolve many issues via email. Feel free to send me a photo of work and indicate where you're stuck. Often a short hint from me can make a big difference for you.

• Please use "Math 2306" in the subject of your email. I filter emails and may miss, or respond very slowly to, emails without this header.

• Please use your `students@kennesaw.edu` email — no D2L emails, please.

How to succeed.

• Talk to me. Talk to your classmates. Read the notes. Read the book. Talk to me.

• You should plan on spending around nine (9) hours per week outside of class thinking about Math 2306. This will involve working problems, reading the text and notes, and communicating with me and classmates.

• The weekly WeBWorK problems are the bare minimum of the problems that you should do to understand the material. You probably need at least double the amount that I will assign in WeBWorK, and you can find this extra practice in the recommended problems in the text. If you are stuck on a required WeBWorK problem, try solving some book problems.

• Here are some basic questions to test your mastery of a concept. Can you work through a problem without reference to notes/book/other sources? Can you explain your steps without hesitation to a (hypothetical) classmate? Do you understand why each step works, not merely the symbolic mechanics of it?

How to fail.

• Start your WeBWorK problem sets very late on Fridays.

• Do work for this class only one day a week for a really long, continuous stretch of time.

• Only come to class when there is an exam.

• If you do come to class, don't ask questions and don't talk to me after class. Don't email me questions, either.

• Students who fail (my) classes tend to be the ones (1) who never come to class, never submit homework, and only attempt exams or (2) who do have regular attendance but who never speak up in or outside of class.

3. Grading

Your final grade will be based on daily attendance, weekly problem sets, three in-class exams (one per month), the final exam in May, and a short essay.

Attendance (5%).

• I will take daily attendance on the 42 non-exam days of the term. Each day that you are present will add a point to your attendance score. At the end of the term, I will take your final attendance score out of 39. Thus you have three automatically excused absences (one week's worth of class time).

• To record attendance, on some days I will simply check the course roster. On other days, you will submit work on a short in-class problem, and your submission will credit you with attendance. I will not grade this work for correctness — you will likely have just met the topic — and it is fine to write me a note saying "I find this step confusing and don't know where to go from here" or "I probably could do this, but I don't remember this auxiliary topic from prior calculus."

• Depending on the nature of an absence, it may or may not be "excused." Important family commitments, feeling ill, covid exposure, emergency car trouble, legal issues, and university-sponsored athletics or trips are all sufficient reasons for an excused absence. Making up work in another class, oversleeping, traffic, and vacations (...early spring break...) are not.

• If you feel that your absence merits an excuse, please email me with the reason for your absence. You can obtain attendance credit by reading that day's lecture notes and including in your email (1) a question about something that you don't understand from that day's discussion or, if you feel that you understand everything, (2) a comment about something that seems interesting, or frustrating, or weird, or anything that evokes an emotional reaction in you. To receive the attendance credit, you need to send the email before you next return to class. An excused absence without (1) or (2) in the email will not receive credit.

Problem sets (25%).

• Twelve weekly problem sets will be assigned on WeBWork. Links and login information will be sent via email and posted on D2L and the course website.

• Problem sets are due on Friday nights at 11:59 pm. Late assignments will not be accepted, but your lowest two scores will be dropped when calculating your final problem set score. **If life outside Math 2306 makes completing work within Math 2306 difficult, please talk with me at once.**

• WeBWork allows unlimited repeat attempts on problems until you get the correct answer, and so you should be able to achieve (nearly) full credit on the problem sets. As with any online math problem system, the WeBWork syntax may take you some time to master. A correct answer "on paper" may require specific phrasing to translate to a correct WeBWork

submission. Waiting until the last minute to start, or to submit electronically, your WeBWork problems will only bring unhappiness.

• Readings and additional recommended problems from the textbook will be assigned each week. The readings offer additional examples and perspectives beyond what we discuss in class. Doing the recommended problems will strengthen you well beyond what you will achieve with WeBWorK alone. **Doing only the WeBWorK problems will not give you sufficient practice to achieve mastery of the course topics.**

• One syllabus quiz will be assigned via D2L during the first week of class and included in the problem set score. This quiz will not be dropped from your problem set score and cannot be delayed, but everyone should get full credit on this quiz.

• Your final problem set score will be

$$\frac{\text{Syllabus quiz } + \text{ Ten highest WeBWorK scores}}{11}.$$

Exams (65%).

• There are three in-class exams and a final exam. See the calendar for their dates. The final exam will only be given at the university-specified time, which cannot be changed.

• The in-class exams will tentatively cover the topics that we discuss in the following time intervals.
    Exam 1: Monday, January 10 – Friday, January 28.
    Exam 2: Monday, January 31 – Friday February 25.
    Exam 3: Monday, March 14 – Friday April 1.
The final exam is cumulative. The weights of the different exams (summing to 65%) are discussed in the final grade table below.

• I will provide a study guide by the Friday before each exam (Friday, April 22, for the final). Each exam will be scored out of 100 points. The in-class portion of each exam will be scored out of 95 points. You will obtain the remaining 5 points by submitting to D2L a short reflection on the exam topics. This reflection will be due by 11:59 pm on the Monday before the exam (Monday, April 25, for the final), and it will help both you and me identify topics that we need to review. Additional details on each reflection will be available with the study guide on the Friday before the exam.

• In order to be excused from an exam, you must (1) notify me before the start of the exam (or as soon after as the circumstances allow) and (2) provide official documentation (a doctor's note, a quarantine notice or proof of covid test, a note from your employer, etc.) excusing your absence in a timely manner. If you meet both of these conditions, then you will take a make-up exam during finals week. Dates and times for the make-up exam are also on the calendar. Personal travel (vacations, an early spring break) is not a valid reason to miss an exam.

• To recognize and reward improvement in study habits over the course of the term, your

lowest in-class exam grade can be replaced by your final exam grade if the final exam grade is higher than your lowest in-class exam grade.

Essay (5%). There are many, many, many more worthwhile differential equations than we can or will solve this term. With some guidance from me, you will select a differential equation that we are not studying in class and write a brief report ($\leq$ 2 pages) about it. I will provide further details on this assignment in February, by which point we will have a basic vocabulary for differential equations.

Final grade formula. Your final numerical grade will be determined by the following weights.

Item	Weight
Attendance	5%
Essay	5%
Problem sets	25%
Lowest in-class exam*	10%
Middle in-class exam	15%
Highest in-class exam	20%
Final exam	20%

*_This grade will be replaced by your final exam score if your final exam score is higher._

Your final letter grade will be determined by the interval to which your final numerical grade belongs.

Numerical grade	**[90,100]**	**[80,90)**	**[70,80)**	**[60,70)**	**[0,60)**
Letter grade	A	B	C	D	F

4. Calendar

You are responsible for knowing all of the due dates for assignments and scheduled dates for exams listed below. WeBWorK and D2L submissions are due at 11:59 pm on the stated day.

W January 12:	Syllabus quiz due on D2L
F January 14:	Problem Set 1 due on WeBWork
M January 17:	No class — Martin Luther King, Jr. Day
F January 21:	Problem Set 2 due on WeBWork
F January 28:	Problem Set 3 due on WeBWork
M January 31:	Exam 1 reflection due on D2L
F February 4:	EXAM 1
F February 11:	Problem Set 4 due on WeBWork
F February 18:	Problem Set 5 due on WeBWork
F February 25:	Problem Set 6 due on WeBWork
M February 28:	Exam 2 reflection due on D2L
F March 4:	EXAM 2
March 7 – 11:	No class — Spring Break
T March 15:	Last day to withdraw without academic penalty
F March 18:	Problem Set 7 due on WeBWork
F March 25:	Problem Set 8 due on WeBWork
F April 1:	Problem Set 9 due on WeBWork
M April 4:	Exam 3 reflection due to D2L
F April 8:	EXAM 3
F April 15:	Problem Set 10 due on WeBWork
W April 20:	Essay due on D2L
F April 22:	Problem Set 11 due on WeBWork
M April 25:	Last day to withdraw for the term with a WF
M April 25:	Final exam reflection due on D2L
F April 29:	Problem Set 12 due on WeBWork
M May 2:	Last day of classes
W May 4:	SECTION 53 FINAL EXAM, 10:30 am – 12:30 pm
W May 4:	Exam 1/2/3 make-up 3:30 pm – 4:20 pm
R May 5:	Exam 1/2/3 make-up 9:00 am – 9:50 am
F May 6:	SECTION 54 FINAL EXAM, 1:00 pm – 3:00 pm

If you are having a problem with the course, or if there is something outside Math 2306 that is affecting your Math 2306 experience, please come talk to me (after class, via email, during office hours, by appointment). It is very likely that we can find a mutually palatable resolution to your problem. Waiting will probably not make things better.

5. Formal Matters

Federal, BOR and KSU Student Policies.
https://cia.kennesaw.edu/instructional-resources/syllabus-policy.php

KSU student resources.
https://cia.kennesaw.edu/instructional-resources/syllabus-resources.php

Academic integrity statement. Every KSU student is responsible for upholding the provisions of the Student Code of Conduct, as published in the Undergraduate and Graduate Catalogs. Section 5c of the Student Code of Conduct addresses the university's policy on academic honesty, including provisions regarding plagiarism and cheating, unauthorized access to university materials, misrepresentation/falsification of university records or academic work, malicious removal, retention, or destruction of library materials, malicious/intentional misuse of computer facilities and/or services, and misuse of student identification cards. Incidents of alleged academic misconduct will be handled through the established procedures of the Department of Student Conduct and Academic Integrity (SCAI), which includes either an "informal" resolution by a faculty member, resulting in a grade adjustment, or a formal hearing procedure, which may subject a student to the Code of Conduct's minimum one semester suspension requirement.

Course catalogue description.
3 Class Hours 0 Laboratory Hours 3 Credit Hours
Prerequisite: A grade of "C" or better in MATH 2202
An introduction to the theory of ordinary differential equations (ODEs), methods of solving first and higher order linear differential equations and linear systems, some applications in the sciences and engineering, the Laplace transform and its application in solving differential equations and linear systems, stability analysis and Euler's numerical algorithm.

COVID statements.

Course delivery. KSU may shift the method of course delivery at any time during the semester in compliance with University System of Georgia health and safety guidelines. In this case, alternate teaching modalities that may be adopted include hyflex, hybrid, synchronous online, or asynchronous online instruction.

COVID-19 illness. If you are feeling ill, please stay home and contact your health professional. In addition, please email your instructor to say you are missing class due to illness. Signs of COVID-19 illness include, but are not limited to, the following:

- Cough
- Fever of 100.4 or higher
- Runny nose or new sinus congestion
- Shortness of breath or difficulty breathing
- Chills
- Sore throat
- New loss of taste and/or smell

COVID-19 vaccines are a critical tool in "Protecting the Nest." If you have not already, you are strongly encouraged to get vaccinated immediately to advance the health and safety of our campus community. As an enrolled KSU student, you are eligible to receive the vaccine on campus. Please call (470) 578-6644 to schedule your vaccination appointment or you may walk into one of our student health clinics.

For more information regarding COVID-19 (including testing, vaccines, extended illness procedures and accommodations), see KSU's official Covid-19 website.

Face coverings. Based on guidance from the University System of Georgia (USG), all vaccinated and unvaccinated individuals are encouraged to wear a face covering while inside campus facilities. Unvaccinated individuals are also strongly encouraged to continue to socially distance while inside campus facilities, when possible.