

MAT 275: Modern Differential Equations – Fall 2024

Faculty Information

Instructor: David Polletta

Email: david.polletta@asu.edu

Office Hours: T/TH 1:00pm – 2:30pm in Zoom room <https://asu.zoom.us/j/9805715332> **Office:** ECA 337

Class Meets: M/W 4:30pm – 5:45pm in WCPH 190

Course Information

Course Catalogue Description: Introduces differential equations, theoretical and practical solution techniques. Applications. Problem solving using MATLAB.

Prerequisites: The official prerequisite is MAT 266 with a grade of C or better. However, it is strongly recommended students take MAT 267 (Calculus III) prior to taking this class.

Indirect Prerequisites: Calculus 2 (MAT 266 and MAT 271) builds on Calculus 1. Both classes build on precalculus (MAT 170, 171 or equivalent).

MAT 275 students are expected to be fluent in the laws governing polynomials, rational, exponential, logarithmic, trigonometric and inverse trigonometric functions, and in differentiation and integration as taught in calc 1 and calc 2. Students are expected to be practiced in the method of **partial fractions** as taught in calculus 2.

This course fulfills the ASU **Mathematics** General Studies requirement. Students completing a Mathematics course will be able to:

1. Demonstrate an understanding of mathematical relationships from multiple perspectives, such as functions from graphical, numerical, and analytic points of view.
2. Apply mathematical skills in the solution of real-life problems.

Textbook and Online Homework

Textbook: *Elementary Differential Equations OR Elementary Differential Equations with Boundary Value Problems*, by Boyce dePrima - WileyPLUS, 11th edition. Students can rent the e-book directly from Wiley.

The textbook is suggested for supplemental study, but not required for the course.

Homework: a paid subscription to Edfinity is required. Please follow these steps:

1. **Important:** Upgrade to the latest version of Google Chrome or Firefox on a Windows/Mac computer. Other browsers such as Safari may cause issues when you access Edfinity via Canvas.
2. Log into your Canvas course.
3. Click **on the Edfinity link in the Course Navigation Menu (on the left side of Canvas)** to launch into Edfinity - you will automatically be signed into Edfinity. You **should not** sign up directly on edfinity.com
4. The first time you access Edfinity, you will be prompted to either pay using a debit/credit card (\$35) **OR** enter an access code. If you need to purchase through the Bookstore due to financial aid or scholarship, you can use this link: <https://www.bkstr.com/arizonastatestore/search/keyword/9781734662740>. The code will be emailed to you within 2-3 days of purchasing, but you can use the trial access while waiting.

5. Please enroll directly on Edfinity. This guarantees you the best price available (\$35). If (and only if) you are on financial aid, purchase Edfinity access codes through the bookstore. Remember, enrolling on Edfinity is the most cost-effective option. There is a 2-week grace period during which you may drop the course and receive a refund.

Calculators

A graphing calculator is recommended. Graphing calculators which perform symbolic manipulation (e.g. TI89, Casio FX2 or 9970G) are not allowed for tests. The allowed calculators are TI83, TI83+, TI84, TI84+, TI85, TI86, TI36xPro, CASIO FX9750GII, CASIO FX-CG10, TI- Inspire CX (note that TI-Inspire CX-CAS is **not** allowed).

Use of Artificial Intelligence Materials: In this course, all assignments must be completed by the student. Artificial Intelligence (AI), including ChatGPT and other related tools used for creating of text, images, computer code, audio, or other media, are not permitted for use in any work in this class. Use of these generative AI tools will be considered a violation of the [ASU Academic Integrity Policy](#), and students may be sanctioned for confirmed, non-allowable use in this course.

Course Learning Outcomes

At the completion of this course, students will be able to:

1. Sketch and interpret direction fields for first order Ordinary Differential Equations (ODEs) and sketch integral curves.
2. Find equilibrium (constant) solutions of autonomous ODEs and classify them as stable, unstable or semi-stable.
3. Verify, by substitution, that a given function is a solution of a given ODE.
4. Given the general solution of an ODE, use initial conditions to find the particular solution.
5. Classify differential equations by their order and linearity.
6. Derive differential equations that model simple applied problems.
7. Use the method of integrating factor to integrate linear first order ODEs.
8. Solve separable equations and determine the interval of validity of the solution.
9. Given a first order Initial Value Problem (IVP), use the appropriate theorems to determine existence and uniqueness of solutions, along with the interval the solution is guaranteed to exist and be unique.
10. Use Euler's method (and/or improved Euler's method) to derive recursive approximations for a given IVP.
11. Use the characteristic equation to solve linear homogeneous ODEs with constant coefficients.
12. Use the Wronskian to determine linear independence of solutions of high order DEs.
13. Given a second order linear Initial Value Problem (IVP), use the appropriate theorems to determine the interval the solution is guaranteed to exist and be unique.
14. Apply the method of undetermined coefficients for finding a particular solution of non-homogeneous DEs.
15. Derive and interpret solutions of ODEs modeling damped and undamped mechanical vibrations with or without forcing term.
16. Compute Laplace transform using the definition and/or using the table.
17. Compute inverse Laplace Transforms.
18. Solve ODEs using the Laplace transform.
19. Write a piecewise function in terms of unit step functions and solve ODEs involving piecewise continuous forcing terms.
20. Use the Laplace transform to solve ODEs involving the impulse function.
21. Write a linear system of differential equations in vector-matrix form.
22. Write higher order linear ODEs as a first order system of ODEs.
23. Use the Wronskian to determine whether solutions of a linear system of a DE are linearly independent.
24. Use the eigenvalue method to solve homogeneous linear system of ODEs with constant coefficients.

25. Use MATLAB ODE solvers to solve IVPs.

Student Success

To be successful:

- attend class
- read announcements
- read and respond to course email messages as needed
- complete assignments by the due date specified
- communicate regularly with your instructor and peers
- create a study and/or assignment schedule to stay on track
- plan to allocate at least 10 hours per week of coursework (Arizona Board of Regents require 135 total hours of coursework for a 3-credit course).
- **tutoring services** can be found through the Tutor Search tab <https://tutoring.asu.edu/>. You can also find support at the [Math Tutoring center](#) and the [Engineering Tutor Center](#).

Methods of Evaluation

Assignment	Percentage
Exam 1: Covers 1.1-1.3, 2.1-2.5, 2.7, 3.1 (Wednesday, September 25) Exam 2: Covers 3.1-3.5, 3.7-3.8, 6.1, 6.2 (Wednesday, October 30) There are no retakes or "corrections", and no lowest grade will be dropped, nor will you receive extra credit assignments to erase the consequences of a bad test.	45%
FINAL (Comprehensive, 1.1-3.8, 6.1-6.5, 7.1-7.6, 7.8)	30%
Edfinity Online Homework will be submitted online via the internet using the homework system Edfinity. No extension of due dates will be given.	12.5%
MATLAB LABS There will be six MATLAB lab reports due during the semester worth 40 points each, plus a LAB 0 which is extra credit. Lab 0 is 20 points extra credit, but there is a cap of $252/240 = 105\%$ for your Matlab grade. (No lab is dropped.) The instructional videos for the labs and the pdf files with the examples and exercises are posted in Canvas in the MATLAB Module. Labs 1-6 must be submitted through the Assignment feature in Canvas in pdf format. The due dates for the lab reports are listed in this syllabus. The full credit deadline will be Friday at 11:59pm of the date listed. There will be a 2.5% penalty per day for late Labs turned in over the weekend. No late labs will be accepted after 11:59pm on Sunday (48 hours after the Friday deadline). Students should watch the videos on their own. A Teaching Assistant will be available to provide help if needed. There will also be open lab hours in the evening in ECA 221. <u>You are not required to purchase MATLAB.</u> All ASU students can download MATLAB through MyApps. Go to MyASU → MyApps and then search for Matlab to download it to your computer. In addition, Matlab is installed on campus computers, so you can use it there.	12.5%

Grading

Your grade will be determined based on the following grading schema:

Grade	Percentage	Grade	Percentage	Grade	Percentage	Grade	Percentage
A+	100% - 97%	B+	87% - 89.9%	C+	76% - 79.9%	D	60% - 69%
A	96.9% - 93%	B	83% - 86.9%	C	70% - 75.9%	E	Below 60%
A-	92.9% - 90%	B-	80% - 82.9%				

Grading Procedure

Grades reflect your performance on assignments and adherence to deadlines. Grades are based only on academic work and are calculated using the same criteria for all students. It is highly unethical to bring to your instructor's attention the possible impact of your mathematics grade on your future plans, including graduation, scholarships, jobs, etc. The instructor may exercise an option to withdraw you from the course if they think you are compromising the ability to assess your work independently of any other consideration.

The Y grade is **not** an option for this class.

Tentative Schedule

Fall 2024			
Week	Dates	Sections	Comments
1	8/22 – 8/23	1.1 Some Basic Mathematical Models	
2	8/26 – 8/30	1.1 Direction Fields 1.2 Solutions of Some Differential Equation	Aug. 28: add deadline MATLAB LAB 0: due on Friday, 8/30
3	9/03 – 9/06	1.3 Classification of Differential Equations 2.2 Separable Equation	Labor Day Holiday: Monday, 9/2 Wed., Sept. 04: drop deadline MATLAB LAB 1 due Fri. 9/6
4	9/09 – 9/13	2.1 Linear Equations; Method of Integrating Factors 2.3 Modeling with First Order Equations 2.5 Autonomous Equations and Population Dynamics	
5	9/16 – 9/20	2.4 Difference between linear and nonlinear equations 2.7 Numerical Approximations: Euler's methods 3.1 Homogeneous Equations with Constant Coefficients	MATLAB LAB 2 due Fri. 9/20 8.2 is not on the exam, but is needed for Lab 3
6	9/23 – 9/27	3.2 Solutions of Linear Homogeneous Equations; The Wronskian Test 1 (Wednesday, 9/25)	Test 1: Sections 1.1-1.3, 2.1-2.5, 2.7, 3.1
7	09/30 – 10/04	3.3 Complex roots of the Characteristic Equation 3.4 Repeated Roots, Reduction of Order 3.7 Mechanical and Electrical Vibrations	MATLAB LAB 3 due Fri. 10/04
8	10/07 – 10/11	3.7 Mechanical and Electrical Vibrations (continued) 7.1 Convert higher order DE's into a system of 1 st order equations 3.5 Method of Undetermined Coefficients	
9	10/14 – 10/18	3.5 Method of Undetermined Coefficients (continued) 3.8 Forced vibrations	Fall Break 10/14-10/15 MATLAB LAB 4 due Fri. 10/18
10	10/21 – 10/25	6.1 Definition of the Laplace Transform 6.2 Solution of Initial Value Problem	

Fall 2024			
11	10/28 – 11/01	Review Test 2 (Wednesday, 10/30) 6.3 Step Functions	Test 2: Sections 3.2-3.5, 3.7, 3.8, 6.1, 6.2
12	11/04 – 11/08	6.3 Step Functions 6.4 Differential equation with Discontinuous Forcing Functions 6.5 Impulse Functions	Wednesday, 11/6: Withdrawal deadline MATLAB LAB 5 due Fri. 11/08
13	11/12 – 11/15	7.1 Introduction to Linear First Order Systems 7.2 Review of Linear Algebra	Veterans Day (observed) Monday, 11/11
14	11/18 – 11/22	7.4 Basic Theory of Systems of First Order Equations 7.3 Linear Algebraic Equations; Linear Independence, Eigenvalues, Eigenvectors 7.5 Homogeneous Linear Systems with Constant Coefficients	MATLAB LAB 6 due Fri. 11/22
15	11/25 – 11/27	7.6 Complex Eigenvalues	Thanksgiving Holiday 11/28-11/29
16	12/02 – 12/06	7.8 Repeated Eigenvalues Final Exam Review	Classes end Friday 12/06
17	12/09 – 12/13	Final Exam <i>Cumulative</i> – Monday, December 9 from 4:50pm – 6:40pm https://registrar.asu.edu/final-exam-schedule	

Cell phones and Electronic Devices

Any student who accesses a phone or any internet-capable device during an exam for any reason, automatically receives a score of zero on the exam. All such devices must be turned off and put away and made inaccessible during the exam. Accessing any such device for any reason will result in a score of 0 for the exam. This includes smart watches. Your instructor reserves the right to ask you to remove your watch during an exam. Notes or "cheat sheets" are not allowed during exams.

Late or Missed Assignments

Notify the instructor **BEFORE** an assignment is due if an urgent situation arises and you are unable to submit the assignment on time. Follow the appropriate University policies to request an [accommodation for religious practices \(https://www.asu.edu/aad/manuals/acd/acd304-04.html\)](https://www.asu.edu/aad/manuals/acd/acd304-04.html) or to accommodate a missed assignment [due to University-sanctioned activities \(https://www.asu.edu/aad/manuals/acd/acd304-02.html\)](https://www.asu.edu/aad/manuals/acd/acd304-02.html).

Communicating With the Instructor

Canvas Discussion Board

We will be using the discussion board in Canvas for questions about the course. The system is highly catered to getting you help fast and efficiently from classmates and the instructor. Prior to posting a question, please check the syllabus, announcements, and existing posts. If you do not find an answer, post your question. You are encouraged to respond to questions of your classmates. It is recommended to use the discussion board even if you do not have any questions, as you might benefit from the posts of your classmates and instructor. Email questions of a personal nature to your instructor (david.polletta@asu.edu).

Student Rules of Engagement:

- All questions related to classwork should be posted to the Canvas Discussion Board. Any homework or classwork questions emailed directly to the instructor will not be answered. Email should be used only for private communications with the instructor.
- Please include a couple lines of your work. You may also photograph your written work and insert the image within the post. Please trim the image size if possible.
- Please be courteous at all times. No vulgar, demeaning, or aggressive language will be tolerated. Do not use the

discussion board to air grievance or to campaign.

- Do not use the discussion board for personal messages. In such cases, email the instructor directly. Stay on topic. Do not use the discussion board for discussions not related to this class.
- Keep a civil and friendly atmosphere. The Canvas Discussion Board works best when we have a lot of students willing to engage the forum.
- Never discuss the content of exams on the discussion board; not before, and not after the due date. Email exam content- and grade-related questions to the instructor.
- Please do not expect immediate replies. Instructors usually check the forum daily. In the meantime, other students are encouraged to add feedback and commentary. Instructors may also deliberately stay in the background to promote student-led discussions.
- Do not use the discussion board to link to or promote third-party forum sites not affiliated with ASU.

Failure to adhere to these requirements may result in your posting privileges being revoked.

Email

ASU email is an [official means of communication \(http://www.asu.edu/aad/manuals/ssm/ssm107-03.html\)](http://www.asu.edu/aad/manuals/ssm/ssm107-03.html) among students, faculty, and staff. Students are expected to read and act upon email in a timely fashion. Students bear the responsibility of missed messages and should check their ASU-assigned email regularly. Please **do not** use the Canvas inbox for messages. ***All instructor correspondence will be sent to your ASU email account.***

Academic Integrity

Academic honesty is expected of all students in all examinations, papers, and laboratory work, academic transactions, and records. Please be aware that the School of Mathematics and Statistical Sciences (SoMSS) takes academic dishonesty in any form as a very serious matter. We are obliged to investigate all such cases and if the evidence warrants it, we send the case up to the Dean's Office for review. The possible sanctions include, but are not limited to, appropriate grade penalties, course failure (indicated on the transcript as a grade of E), course failure due to academic dishonesty (indicated on the transcript as a grade of XE), loss of registration privileges, disqualification, and dismissal. For more information, see <http://provost.asu.edu/academicintegrity>.

Copyrighted Materials

Students must refrain from uploading to any course shell, discussion board, or website used by the course instructor or other course forum, material that is not the student's original work, unless the students first comply with all applicable copyright laws; faculty members reserve the right to delete materials on the grounds of suspected copyright infringement. **The content of this course, including lectures and other instructional materials, are copyrighted materials. Students may not share outside the class, including uploading, selling, or distributing course content or notes taken during the conduct of the course.** Any recording of class sessions is authorized only for the use of students enrolled in this course during their enrollment in this course. Records and excerpts of recordings may not be distributed to others. Any (parts of) exams, assignment, reports, or solutions to these, from current or previous semester, posted to any website not affiliated with ASU will result in academic integrity disciplinary actions against the students posting them and the students using them.

Additional Course Policies

- Students are responsible for assigned material whether or not it is covered in class. Students are responsible for material covered in class whether or not it is in the text. Working regularly on assigned problems and *attending class* are essential in order to do well. Expect to spend at least 6-10 hours weekly on homework/labs. You are expected to read the text, preferably before the material is covered in class.
- Make-up exams are at the discretion of the instructor and only in case of documented emergency. In any case, no make-up exams will be given unless the student has notified the instructor through email before the test is given.
- Cellular phones can be used in class only for classroom related activities (zoom polls, online quizzes). Quizzes may be given in class unannounced.
- No late HW will be accepted, and no make-up quizzes will be given.

- All E-mail communication must be done from your ASU account. Due to FERPA (Family Educational Rights and Privacy Act), E-mails received from other accounts will not be answered.

Disability Resources

Establishing Eligibility for Disability Accommodations: Students who feel they will need disability accommodations in this class but have not registered with the Student Accessibility and Inclusive Learning Services (SAILS, formerly called DRC) should contact SAILS immediately. SAILS staff can also be reached at: 480-965-1234 (V), 480-965-9000 (TTY). Their hours are 8:00 AM to 5:00 PM, Monday through Friday. For additional information, visit: <https://eoss.asu.edu/accessibility/>

Qualified students who will require accommodations in this class are encouraged to make their requests to me at the beginning of the semester either during office hours or by appointment. Prior to receiving such accommodations for our class, verification of eligibility from the Student Accessibility and Inclusive Learning Services (SAILS) is required. Such disclosed information is confidential.

Policy Against Threatening Behavior

All incidents and allegations of violent or threatening conduct by an ASU student (whether on-or off campus) must be reported to the ASU Police Department (ASU PD) and the Office of the Dean of Students. If either office determines that the behavior poses or has posed a serious threat to personal safety or to the welfare of the campus, the student will not be permitted to return to campus or reside in any ASU residence hall until an appropriate threat assessment has been completed and, if necessary, conditions for return are imposed. ASU PD, the Office of the Dean of Students, and other appropriate offices will coordinate the assessment in light of the relevant circumstances. For more information, please visit <https://eoss.asu.edu/dos/Safety> , <https://eoss.asu.edu/dos/srr/codeofconduct> and <https://eoss.asu.edu/dos/safety/RespondBehavior> .

Reporting Title IX Violations

Title IX is a federal law that provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed on the basis of sex can seek support, including counseling and academic support from the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find information and resources at <https://sexualviolenceprevention.asu.edu/faqs>. **As a mandated reporter, instructors are obliged to report any information they become aware of** regarding alleged acts of sexual discrimination, including sexual violence and dating violence. ASU Counseling Services, <https://eoss.asu.edu/counseling> is available if you wish to discuss any concerns confidentially and privately.

Policy on Sexual Discrimination

Arizona State University is committed to providing an environment free of discrimination, harassment, or retaliation for the entire university community, including all students, faculty members, staff employees, and guests. ASU expressly prohibits discrimination, harassment, and retaliation by employees, students, contractors, or agents of the university based on any protected status: race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity, and genetic information.

As a mandated reporter, I am obligated to report any information I become aware of regarding alleged acts of sexual discrimination, including sexual violence and dating violence. ASU Counseling Services, <https://eoss.asu.edu/counseling>, is available if you wish to discuss any concerns confidentially and privately.

Other SoMSS and University Policies and Procedures

Final Exam Make Up Policies: The [final exam schedule](#) will be strictly followed. Except to resolve those situations described below, no changes may be made in this schedule without prior approval of the Dean of the college in which the course is offered. Under this schedule, if a conflict occurs, or a student has more than three exams on one day, the instructors may be consulted about an individual schedule adjustment. If necessary, the matter may be pursued further with the appropriate dean(s). This procedure applies to conflicts among any combination of Downtown Phoenix campus, Tempe campus, Polytechnic campus, West campus, and/or off campus class. Make-up exams will NOT be given for reasons of a non-refundable airline tickets, vacation plans, work schedules, weddings, family reunions, and other such activities. Students should consult the final exam schedule before making end-of-semester travel plans. Exceptions to the schedule and requests for make-up examinations can be granted only by the

Department Chair, Associate Department Chair or the Director of First Year Mathematics, and for one of the following reasons:

1. Religious conflict (e.g., the student celebrates the Sabbath on Saturday)
2. The student has more than three exams scheduled on the same day as the math final
3. There is a time conflict between the math final and another final exam

Incomplete: A grade of incomplete will be awarded only in the event that a documented emergency or illness prevents the student who is doing acceptable work from completing a **small** percentage of the course requirements. The guidelines in the current [Student Service Manual](#) regarding a grade of incomplete will be strictly followed. The form for an incomplete request is at <https://students.asu.edu/forms/incomplete-grade-request>. Once the student completes their part, they should bring it to the instructor for approval.

Ethics: Grades are based only on academic work and are calculated using the same criteria for all students. It is highly unethical to bring to your instructor's attention the possible impact of your mathematics grade on your future plans, including graduation, scholarships, jobs, etc. The instructor may exercise an option to withdraw you from the course if they think you are compromising the ability to assess your work independently of any other consideration.

Syllabus Disclaimer

The syllabus is a statement of intent and serves as an implicit agreement between the instructor and the student. Every effort will be made to avoid changing the course schedule, but the possibility exists that unforeseen events will make syllabus changes necessary. **Remember to check your ASU email and the course site often. Any in-class, canvas or e-mail announcements is considered official addendum to this syllabus.**