

Elementary Differential Equations
Spring 2023 CRN: 16315 Credit Hours: 3
Math 2860 Sec. 02 MWF 10:00 - 10:55 PM Room: Rocket Hall 1551

Instructor: Dr. David Gajewski
Office: University Hall 3014
Office Hours: T 3:30-4:30, W 1-2, R 12:30-2:30 and 3:30-4:30, F 1-2:30, and also by appointment.
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CATALOG DESCRIPTION

An introduction to the analysis and solution of ordinary differential equations with emphasis on the fundamental techniques for solving linear differential equations.

PREREQUISITES

Minimum grade of C- in Math 2850 or Math 2950. Students who enroll in Math 2860 but have not passed either prerequisite may be administratively dropped from the class.

TEXTBOOK: *Elementary Differential Equations*, Tenth Edition, by Boyce and Deprima (ISBN:9780470458327)

QUIZZES

There will be weekly quizzes. The material on the quiz will be drawn from the daily (uncollected) homework assignments. The lowest two quiz scores will be dropped.

TESTS AND FINAL EXAM

There will be 3 tests one after each 4 weeks. Tentatively they will be held on February 17, March 24, and April 21. The final is comprehensive and will be held on **Monday May 1 2023, 10:15-12:15pm** in the regular classroom. Please note that the final exam may not be taken early under any circumstances in accordance with department policy.

GRADING AND EVALUATION

% Score	Grade
90-100	A range
80-89	B range
70-79	C range
60-69	D range
< 60	F

Note that minus and plus grades will be awarded for grades within 2.5% of the lower and upper ends of the given ranges respectively, e.g. B- for 80-82.49, B for 82.50-87.49, B+ for 87.5-89.99. Also note that there are not A+ grades at The University of Toledo.

Component	points
Quizzes	15%
Three (3) Exams	60%
Final Exam	25%

IMPORTANT DATES

The instructor reserves the right to change the content of the course material if he perceives a need due to postponement of class caused by inclement weather, instructor illness, etc., or due to the pace of the course.

Last day to add/drop this class: Tuesday January 31, 2023

Last day to withdraw from this class with a grade of W: Friday March 24, 2023

MISSED CLASS POLICY

If circumstances occur in accordance with “The University of Toledo Missed Class Policy” (found at http://www.utoledo.edu/facsenate/missed_class_policy.html) result in a student missing a quiz, test, exam or other graded item, the student must contact the instructor in advance by phone, e-mail or in person, provide official documentation to back up his or her absence, and arrange to make up the missed item as soon as possible.

INSTITUTIONAL CLASSROOM ATTENDANCE POLICY

Please be aware that the university has implemented an attendance policy, which requires faculty to verify student participation in every class a student is registered at the start of each new semester/course. For this course, if you have not attended/participated in class (completed any course activities or assignments) within the first 14 days, I am required by federal law to report you as not attended. Unfortunately, not attending/participating in class impacts your eligibility to receive financial aid, so it is VERY important that you attend class and complete course work in these first two weeks. Please contact me as soon as possible to discuss options and/or possible accommodations if you have any difficulty completing assignments within the first two weeks.

ACADEMIC DISHONESTY

Any act of academic dishonesty as defined by the University of Toledo policy on academic dishonesty (found at <http://www.utoledo.edu/dl/students/dishonesty.html>) will result in an F in the course or an F on the item in question, subject to the determination of the instructor. In particular, tests, quizzes and exams must be entirely the student’s own work and any use of outside websites, apps, technology or persons to assist with completing these items will be considered academic dishonestly.

POLICY STATEMENT ON NON-DISCRIMINATION ON THE BASIS OF DISABILITY (ADA)

The University is an equal opportunity educational institution. Please read The University’s Policy Statement on Nondiscrimination on the Basis of Disability Americans with Disability Act Compliance. Students can find this policy along with other university policies listed by audience on the University Policy webpage (<http://www.utoledo.edu/policies/audience.html/#students>).

ACADEMIC ACCOMMODATIONS

The University of Toledo embraces the inclusion of students with disabilities. We are committed to ensuring equal opportunity and seamless access for full participation in all courses. For students who have an Accommodations Memo from the Office of Accessibility and Disability Resources, I invite you to correspond with me as soon as possible so that we can communicate confidentially about implementing accommodations in this course.

For students who have not established accommodations with the Office of Accessibility and Disability Resources and are experiencing disability access barriers or are interested in a referral to health care resources for a potential disability, please connect with the office by calling 419.530.4981 or sending an email to StudentDisability@utoledo.edu.

ACADEMIC AND SUPPORT SERVICES

Please follow this link to view a comprehensive list of Student Academic and Support Services (<http://www.utoledo.edu/studentaffairs/departments.html>) available to you as a student.

SAFETY AND HEALTH SERVICES FOR UT STUDENTS

Please use the following link to view a comprehensive list Campus Health and Safety Services (<http://www.utoledo.edu/offices/provost/utc/docs/CampusHealthSafetyContacts.pdf>) available to you as a student.

STUDENT PRIVACY

Federal law and university policy prohibits instructors from discussing a student’s grades or class performance with anyone outside of university faculty/staff without the student’s written and signed consent. This includes parents and spouses. For details, see the “Confidentiality of student records (FERPA)” section of the University Policy Page at <http://www.utoledo.edu/policies/academic/undergraduate/index.html>

OTHER UNIVERSITY POLICIES

Refer to the student handbook at <http://www.utoledo.edu/studentaffairs/pdfs/handbook.pdf>

RESOURCES

Free math tutoring on a walk-in basis is available in the Math Learning and Resources Center located in Rm B0200 in the lower level of Carlson Library (phone ext 2176). The Center operates on a walk-in basis. MLRC hours can be found at <http://www.math.utoledo.edu/mlrc/MLRC.pdf>

SPECIAL COURSE EXPECTATIONS DURING COVID-19 AND FLU SEASON

Maintaining a safe campus during the ongoing COVID-19 pandemic and flu season remains a top priority. UToledo continues to follow the guidance of the U.S. Centers for Disease Control and Prevention and Ohio Department of Health to keep our campus safe.

ATTENDANCE

The University of Toledo has a missed class policy. It is important that students and instructors discuss attendance requirements for the course. Anyone with a temperature at or above 100.0 degrees Fahrenheit or who is experiencing symptoms consistent with COVID-19 or the flu should not come to campus until symptoms abate. It is recommended that the student do a self-administered COVID test or contact their primary care physician or the Main Campus Health Center at 419.530.3451 or Health Science Campus Student Health and Wellness Center at 419.383.5000 to be treated. Free Over the Counter self-administered COVID tests are available at various locations across both campuses including, many residence halls at the main desk, both Rec. Centers, and the Student Affairs Office in the Student Union. For more information on the symptoms of COVID-19, along with the differences of flu vs. COVID-19 please go to <https://www.cdc.gov/coronavirus/2019-ncov/your-health/isolation.html> for the latest CDC guidelines on symptoms and testing.

Testing is available for students experiencing symptoms of COVID-19 on both Main Campus and Health Science Campus. On Main Campus, no appointment is needed. Symptomatic students should go to the University Health Center, door 2 at the front of the building and call 419.530.3451 to notify the staff. You will be immediately let into the sick area for COVID testing. On the Health Science Campus, symptomatic COVID testing is done at UTMC by appointment only, call 419.383.4545 for an appointment.

Absences due to testing positive for COVID-19 are considered excused absences. Students should notify their instructors and follow the protocols summarized in this document on Navigating COVID-Related Course Concerns (<https://www.utoledo.edu/offices/provost/docs/covid-19/COVID%20student%20flow%20chart.pdf>). If a student has been exposed to someone with COVID-19, they should wear a mask for 10 days and test at day 5, but they DO NOT have to quarantine. Go to <https://www.cdc.gov/coronavirus/2019-ncov/community/health-equity/racial-ethnic-disparities/increased-risk-exposure.html> for the most up to date CDC Exposure Guidelines.

In the event that you have tested positive for COVID-19 please review the CDC guidance (<https://www.cdc.gov/coronavirus/2019-ncov/your-health/isolation.html>) on self-isolation and precautions for people with COVID-19, and report the disclosure to the Division of Student Affairs by emailing StudentAffairs@utoledo.edu or by connecting with their on-call representative at 419.343.9946. Disclosure is voluntary and will only be shared on a need-to-know basis with staff such as in the Office of Student Advocacy and Support, The Office of Residence Life, and/or the Office of Accessibility and Disability Resources to coordinate supportive measures or to assist the student as needed.

FACE COVERING

Face coverings are currently not required while on campus, but students should feel free to wear them as risk of exposure to individuals with COVID, the flu, or other respiratory illnesses is ongoing. To maintain campus safety the health experts on campus will continue to monitor the situation as infection rates fluctuate, and changes to this policy may be made after consulting CDC and County Health Department guidelines.

Face masks ARE required at UTMC (including the cafeteria) and in all University clinics including the Main Campus Health Clinic Building. Health science students must also follow all COVID and other health requirements of the particular clinical settings in which they have clinical experiences.

VACCINATION

To promote and protect the health and safety of our campus, the University requires all students and employees to be fully vaccinated against COVID-19 or have an approved exemption. Students new to UToledo are required to be fully vaccinated or have an approved exemption within eight weeks of the first day of classes in their first semester.

Full vaccination is defined as having received all recommended doses in the primary COVID-19 vaccination series. Proof of vaccination should be shared through the University's secure vaccine registry portal at <https://utvaccinereg.utoledo.edu/>. Exemption request forms also can be downloaded and submitted through the portal. The University is strongly encouraging all members of the campus community to receive a COVID-19 booster shot when eligible.

Students can receive a COVID-19 vaccine on Main Campus at the Main Campus Pharmacy and on Health Science Campus at the outpatient pharmacy in the UTM Medical Pavilion. For more information, call the Main Campus pharmacy at 419.530.3471 or the UTM outpatient pharmacy at 419.383.3750.

SPECIAL NOTES

It's important to note, that based on the unpredictability of the COVID-19 virus, things can change at any time. So please be patient and understanding as we move through the semester. Please refer to <https://www.utoledo.edu/coronavirus/> on a regular basis for updates to current requirements or mandates. I also ask that you keep me informed of concerns you may have about class, completing course work/assignments timely and/or health concerns related to COVID.

SUGGESTED SCHEDULE

Chapter	1	Introduction	(total 3 hrs)
	1.1	Some Basic Mathematical Models; Direction Fields; Slope Fields	1.5
	1.2	Solutions to Some Differential Equations; Standard equations	1
	1.3	Classification of Differential Equations	0.5
	1.4	(Op.) Historical Remarks	
Chapter	2	First Order Differential Equations	(total 9 hrs)
	2.1	Linear Equations; Method of Integrating Factors; Standard equations	1.5
	2.2	Separable Equations; Standard equations	1.5
		Problems 30, 31, 32 Other equations	1
	2.3	Modeling with First Order Equations; Applications	2
	2.4	Differences Between Linear and Nonlinear Equations	0.5
		Problems 27, 28, 29 Other equations	1
	2.5	(Op.) Autonomous Equations and Population Dynamics;	
	2.6	Exact Equations and Integrating Factors; Standard equations	1.5
	2.7	(Op.) Numerical Approximations: Euler's Method	
	2.8	(Op.) The Existence and Uniqueness Theorem	
	2.9	(Op.) First Order Difference Equations	
Chapter	3	Second Order Linear Equations	(total 11 hrs)
	3.1	Homogeneous Equations with Constant Coefficients; Homogeneous equations	1
	3.2	Solutions of Linear Homogeneous Equations; Homogeneous equations	2
	3.3	Complex Roots of the Characteristic Equation; Homogeneous equations	1
		Problem 34 on Euler Equations	0.5
	3.4	Repeated Roots; Reduction of Order; Homogeneous equations	1.5
	3.5	Nonhomogeneous Equations; Undetermined Coefficients	2
	3.6	Variation of Parameters; Variation	1.5
	3.7	Mechanical and Electrical Vibrations; Applications	1.5
	3.8	(Op.) Forced Vibrations;	
Chapter	4	Higher Order Linear Equations	(total 5 hrs)
	4.1	General Theory of n th Order Linear Equations; Homogeneous equations	1
	4.2	Homogeneous Equations with Constant Coefficients; Homogeneous equations	1.5
	4.3	The Method of Undetermined Coefficients; Undetermined Coefficients	1.5
	4.4	The Method of Variation of Parameters; Variation	1
Chapter	5	Series Solutions of Second Order Linear Equations	(Optional)
	5.1	Review of Power Series	
	5.2	Series Solutions Near an Ordinary Point, Part I	
	5.3	Series Solutions Near an Ordinary Point, Part II	
	5.4	Euler Equations; Regular Singular Points	
	5.5	Series Solutions Near a Regular Singular Point, Part I	
	5.6	Series Solutions Near a Regular Singular Point, Part II	
	5.7	Bessel's Equation	
Chapter	6	The Laplace Transform	(total 10 hrs)
	6.1	Definition of the Laplace Transform; Laplace transform	1.5
	6.2	Solution of Initial Value Problems; Laplace transform	2
	6.3	Step Functions; Laplace transform	1.5
	6.4	Differential Equations with Discontinuous Forcing Functions; Laplace transform	2
	6.5	Impulse Functions; Laplace transform	2
	6.6	The Convolution Integral; Laplace transform	1
Chapter	7	Systems of First Order Linear Equations	(Optional)
		Total Hours	38

LEARNING OBJECTIVES

Below is the list of learning objectives. At least 70% of the course time will be devoted to these essential outcomes. These objectives are listed again in the chronological list of topics at the end of this syllabus.

- **Slope fields:** Understand the relationship between slope fields and solution curves for differential equations. Use a slope field and an initial condition to estimate a solution curve to a differential equation.
- **Standard equations:** Solve first-order differential equations that are separable, linear or exact.
- **Other equations:** Solve first-order differential equations by making the appropriate substitutions, including homogeneous and Bernoulli equations.
- **Applications:** Use linear or non-linear first-order differential equations to solve application problems such as exponential growth and decay, falling objects and solution mixtures.
- **Homogeneous equations:** Solve higher-order homogeneous linear equations with constant coefficients.
- **Undetermined Coefficients:** Solve higher-order nonhomogeneous linear equations with constant coefficients by the method of undetermined coefficients.
- **Variation of parameters:** Solve higher-order nonhomogeneous linear equations by the method of variation of parameters.
- **Applications:** Use linear second-order differential equations to solve application problems such as spring/mass system motion problems and three component series circuits.
- **Laplace transform:** Perform operations with Laplace and inverse Laplace transforms to solve higher-order differential equations.