FLORIDA POLYTECHNIC UNIVERSITY

Course Information

- **Course Number and Title**: MAP 2302 Differential Equations
- **Credit Hours:** 3
- **Academic Term: Spring 2026**

Instructor Information

- **Instructor: Dr. Luka Mernik**
- **Office Location: IST 2025**
- **Office Hours**: MWF 10:00 AM – 10:50 AM or BY APPOINTMENT
- **Email address**: lmernik@floridapoly.edu

Course Delivery and Course Description

- **Delivery Mode**: Face-to-face; MWF 9:00 AM - 9:50 AM
- **Course Website**: Canvas course site
- **Official Catalog Course Description**: The relationship between differential equations and initial conditions to physical problems in engineering, physics, technology and other applied areas is discussed. Students will be able to formulate, solve, and analyze the results of mathematical models of elementary physical problems and apply them. Topics include: first-order ordinary differential equations, theory of linear ordinary differential equations, solution of linear ordinary differential equations with constant coefficients, the Laplace transform and its application to solving linear ordinary differential equations.
    - **Course Pre and/or Co-Requisites**: C or higher in MAC2312 Analytic Geometry and Calculus 2
    - **Communication/Computation Skills Requirement (6A-10.030)**: N
- **Required Texts and Materials:**
    - Differential Equations: A Toolbox for Modeling the World, by Kurt Bryan
      ISBN: 978-1-63877-937-7 or ISBN: 979-8-89372-019-8
      (The text is available here)
    - MATLAB.

Course Objectives and Outcomes

- **Course Objectives**: At the end of this course, you should:
    - Set up and solve models involving first order ordinary differential equations using appropriate methods and learn their applications
    - Set up and solve models involving second order ODEs with constant coefficients
    - Learn the theory of linear ODE with constant coefficients
    - Understand the use of the Laplace Transform and its applications.

- **Course Learning Outcomes**: The following topic will be used to measure the student learning outcome "Demonstrate fluency in mathematics concepts," which corresponds to the Mathematics Reasoning Competency:
    - Solve 1st order ODE's (Separation of variables and /or Integrating Factor).
    - Model an application problem using 1^{st} order ODEs.
    - Interpret differential equations by analyzing their solution to explain the underlying physical processes.
    - Demonstrate the ability to integrate knowledge and ideas of differential equations in a coherent and meaningful manner for solving real world problems.
    - Model an impulse reaction and use Laplace transforms to solve the resulting ODE.

Student Learning Outcomes:

1. Write effectively mathematical solutions in a clear and concise manner.
2. Locate and use information to solve first and second order ordinary differential equations.
3. Demonstrate ability to think critically by determining and using appropriate techniques for solving a variety of differential equations.
4. Demonstrate an intuitive and computational understanding of differential equations by solving a variety of application problems arising from biology, chemistry, physics, engineering, and mathematics.
5. Solve a nonhomogeneous higher order linear ODE with constant coefficients.

Additional, Student learning outcomes:

6. Interpret differential equations by analyzing their solution to explain the underlying physical processes.
7. Develop appropriate mathematical models of physical systems.

- **Alignment with Program Outcomes**:

Course Learning Outcome	**Learning Level (Anderson/ Krathwohl)**	**Program Learning Outcome (ABET/GenEd)**
Solve 1st order ODE's (Separation of variables and /or Integrating Factor)	Application	**ABET:** 7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies. **GenEd:** Apply appropriate mathematical techniques and problem-solving strategies to produce valid results.
Model an application problem using ODEs.	Analysis	**ABET:** 7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies. **GenEd:** Apply appropriate mathematical techniques and problem-solving strategies to produce valid results.
Demonstrate the ability to integrate knowledge and ideas of differential equations in a coherent and meaningful manner for solving real-world problems.	Analysis	**ABET:** 7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies. **GenEd:** Apply appropriate mathematical techniques and problem-solving strategies to produce valid results.
	Analysis	**ABET:** 7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies. **GenEd:** Apply appropriate mathematical techniques and problem-solving strategies to produce valid results.
Interpret differential equations by analyzing their solution to explain the underlying physical processes	Application	**ABET:** 7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies. **GenEd:** Apply appropriate mathematical techniques and problem-solving strategies to produce valid results.

Course Policies

Attendance

Students are expected "to attend all of their scheduled University classes and to satisfy all academic objectives as defined by the instructor" (University Policy, FPU-5.0010AP). Attending class regularly is important for success in this course. Attendance will be taken daily through A+ Attendance. Absences will be considered "excused" due to illness or family emergency. Falsifying attendance for yourself or for another student is an act of academic dishonesty and subject to academic discipline.

Participation

Students are expected to participate in the classroom experience. The use of earbuds/headphones during class is specifically not allowed and students who engage in this behavior may be asked to leave the class for the day (noting exceptions for authorized accommodations). Persistent problems with participation may result in a code of conduct referral.

Late Work/Make-up work

Make-up exams will not be permitted except for sickness, family emergency, or University related activity. A written note from an appropriate person (doctor, family member, etc.) is required. If possible, notification SHOULD be made BEFORE the missed event.
Homework submitted up to 24 hours late will be accepted with a 20% penalty. No submissions will be accepted more than 24 hours late.
Extensions without penalty may be granted on a case-by-case basis. Please communicate with your instructor.
The final exam will replace your lowest exam score; however, an unexcused missed exam will NOT be replaced.

Grading Scale

The following gives the lowest number required to guarantee the corresponding grade:

A	B+	B	B-	C+	C	D	F
90%	87%	83%	80%	77%	70%	60%	0%

Assignment/Evaluation Methods

Quizzes: 10%
Homework: 7%
Labs: 10%
Midterm Exams (3 at 16% each): 48%
Final exam: 25%

Homework: Homework will be assigned through Canvas on a regular basis and will be covering some important topics to get well-prepared for exams. You should submit it in a pdf form through Canvas. Multiple submissions are allowed but only the last one will be graded. The use of word processors is strongly recommended.
*****All HW assignments will be DUE on the specified dates BY 11:59 PM.
Late Submission Penalty:

× 0.8 for <24 hours late
× 0 for >24 hours late

At the end of the semester, your lowest homework score will be dropped.

Quizzes: Quizzes are scheduled throughout the semester (see tentative schedule). Quizzes will be timed and given in class or as take-home assignments.

Labs: Six labs will be done during the semester. The labs will be conducted partly during class on the dates listed on the tentative schedule. Labs are intended to emphasize applications and concepts, often in a coding environment. Follow up questions over the labs are likely to occur on quizzes and exams. So studying the labs is essential.

Midterm Exams: There will be three common midterm exams during the semester, tentatively on the dates specified in the schedule below.

Final Exam: The final exam will be comprehensive, taken by all students, and administered during the final exam period. It will replace the lowest Midterm Exam grade, up to 80%, if greater.

Topic List

1 Why Study Differential Equations?
1.1 The 2008 Olympic 100-Meter Dash
1.2 Intracochlear Drug Delivery
1.3 Population Growth and Fishery Management
1.4 Where Do We Go from Here?
1.5 The Blessing of Dimensionality
2 First-Order Equations
2.1 First-Order Linear Equations
2.2 Separable Equations
2.3 Qualitative and Graphical Insights
2.4 The Existence and Uniqueness of Solutions

4 Second-Order Equations
4.1 Vibration and the Harmonic Oscillator
4.2 The Harmonic Oscillator
4.3 The Forced Harmonic Oscillator
4.4 Resonance
4.6 Modeling Projects
5 The Laplace Transform
5.1 Discontinuous Forcing Functions
5.2 The Laplace Transform
5.3 Nonhomogeneous Problems and Discontinuous Forcing Functions
5.4 The Dirac Delta Function
5.5 Input-Output, Transfer Functions, and Convolution

- Important Dates: https://floridapoly.edu/academics/academic-calendar/index.php

Tentative Schedule (subject to change)

	Monday	Wednesday	Friday
Week 1 Jan 12-16	Introduction: Modelling - Section 1.1	Modelling - Section 1.1, 1.2 Reading Assignment Section 1.3	Section 1.4
Week 2 Jan 19-23	**MLK Day – No class**	Section 1.5	LAB 1
Week 3 Jan 26-30	Section 2.1-**Quiz 1**	Section 2.1, 1.3	Section 2.2
Week 4 Feb 2-6	Section 2.2	LAB 2	Section 2.3-**Quiz 2**
Week 5 Feb 9-13	Section 2.3	Section 2.4	Section 2.4
Week 6 Feb 16-20	**Review**	**Celebration 1**	Section 4.1
Week 7 Feb 23-27	Sections 4.1	Section 4.2	Section 4.2
Week 8 Mar 2-6	Sections 4.2	LAB 3	Section 4.3-**Quiz 3**
Week 9 Mar 9-13	Section 4.3	Section 4.4 - LAB 4 take home	Section 4.4-**Quiz 4**
Week 10 Mar 16-20	**Spring Break**	**Spring Break**	**Spring Break**
Week 11 Mar 23-27	**Review**	**Celebration 2**	Boundary Value Problem
Week 12 Mar 30 - Apr 3	Boundary Value Problems	Sections 5.1, 5.2	Sections 5.2
Week 13 Apr 3 – 10	Section 5.3	Section 5.3	Section 5.4
Week 14 Apr 13-17	Section 5.4	Section 5.5	Section 5.5
Week 15 Apr 20-24	LAB 5	**Quiz 5-Review**	**Celebration 3**
Week 16 Apr 27 - May 1	Review – Assign Lab 6	**Reading Days**	**Reading Days**
May 4-8	Final Exams		

Academic Support Resources

- **Library**: Students can access the Florida Polytechnic University Library through the University website and Canvas, on and off campus. Students may direct questions to library@floridapoly.edu.
- **Tutoring and Learning Center (TLC)**: Sharpen your skills and gain confidence through peer tutoring and guided learning sessions offered in the Innovation, Science, and Technology Building (IST) Commons (south side). https://floridapoly.edu/academics/resources/student-success/#tutoring
- **Academic Success Coaches**: All students at Florida Poly are assigned an Academic Success Coach. Your Academic Success Coach can assist you with academic success strategies. Please visit the Student Success Center on the second floor of the IST building to meet with an Academic Success Coach.
- **Writing Center:** Located on the second floor of the IST (2059/2061), the Writing Center helps students to develop their writing and presentation skills. Consultations are available in person and virtually. For more detail, visit https://floridapolytechnic.libguides.com/writingservices.

Civility and Collegiality

Faculty and students come to the university for the same reason, which is to participate in a highly professional educational environment. To that end, both students and faculty are expected to treat each other with mutual regard and civility. In more general terms, collegiality means respecting the right of both faculty and students to participate fully and fairly in the educational enterprise.

University Policies

Reasonable Accommodations

The University is committed to ensuring equal access to all educational opportunities. The University, through the Office of Disability Services (ODS), facilitates reasonable accommodations for students with disabilities and documented eligibility. It is the student's responsibility to self-identify as a student with disabilities and register with ODS to request accommodations.

If you have already registered with ODS, please ensure that you have requested an accommodation letter for this course through the ODS student portal and communicate with your instructor about your approved accommodations as soon as possible. Arrangements for testing accommodations must be made in advance. Accommodations are not retroactive.
If you are not registered with ODS but believe you have a temporary health condition or permanent disability requiring an accommodation, please contact ODS as soon as possible.

The Office of Disability Services (ODS):
DisabilityServices@floridapoly.edu
(863) 874-8770
The Access Point
https://floridapoly.edu/studentlife/disability-services/

Accommodations for Religious Observances, Practices and Beliefs

The University will reasonably accommodate the religious observances, practices, and beliefs of individuals in regard to admissions, class attendance, and the scheduling of examinations and work assignments. (See university policy: https://floridapoly.edu/university-policies-regulations-rules/.)

Title IX

Florida Polytechnic University is committed to ensuring a safe, productive learning environment on our campus that prohibits sex discrimination and sexual misconduct, including sexual harassment, sexual assault, dating violence, domestic violence and stalking. Resources are available if you or someone you know needs assistance. You may

speak to your professor, but your professors have an obligation to report the incident to the Title IX Coordinator. Please know, however, that your information will be kept private to the greatest extent possible. You will not be required to share your experience. If you want to speak to someone who is permitted to keep your disclosure confidential, please seek assistance from the Florida Polytechnic University Ombuds office https://floridapoly.edu/about/departments/ombuds/, BayCare's Student Assistance Program, 1-800-878-5470 and locally within the community at Peace River Center, 863-413-2707 (24-hour hotline) or 863-413-2708 to schedule an appointment. The Title IX Coordinator is available for any questions to discussion resources and options available.

Communication

Students with a concern or issue should feel free to email their instructor at lmernik@floridapoly.edu. Instructors will make every reasonable effort to respond by the end of the next class day. If, after sending the instructor a follow-up email, the issue is not resolved, the student may email the department chair, Dr. Mike Brilleslyper at mbrilleslyper@floridapoly.edu. Students may request an appointment with the department chair for further discussion, if needed.

Academic Integrity

The faculty and administration take academic integrity very seriously. Violations of academic integrity https://floridapoly.edu/wp-content/uploads/2025/09/fpu_5.005_academic_integrity_5.3.21.pdf include actions such as cheating, plagiarism, use of unauthorized resources (including but not limited to use of Artificial Intelligence tools), illegal use of intellectual property, and inappropriately aiding other students. Such actions undermine the central mission of the university and negatively impact the value of your Florida Poly degree. Suspected violations will be fully investigated, possibly resulting in an academic integrity hearing and sanctions against the accused student if found in violation. Sanctions range from receiving a zero on the exam or assignment, to expulsion from the university. Repeat offenders are subject to more severe sanctions and penalties.

Recording Lectures

Students may, without prior notice, record video or audio of a class lecture for a class in which the student is enrolled for their own personal educational use. Recordings may not be used as a substitute for class participation or class attendance. Recordings may not be published or shared in any way, either intentionally or accidentally, without the written consent of the faculty member. Failure to adhere to these requirements is a violation of state law (subject to civil penalty) and the student code of conduct (subject to disciplinary action).

Recording class activities other than class lectures, including but not limited to lab sessions, student presentations (whether individually or part of a group), class discussion (except when incidental to and incorporated within a class lecture), and invited guest speakers is ***prohibited****.*