

Syllabus: Differential Equations

Fall semester 2024.

Course Information

- **Course Number and Title:** MAP2302 Differential Equations
- **Credit Hours:** 3
- **Current Academic Term:** Fall 2024

Instructor Information

- **Instructor:**
- **Office:**
- **Office Hours:**
- **E-mail:**

Course Delivery and Course Description

- **Class Meeting Day, Time & Location:**
- **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 Prerequisites:** MAC 2312 - Analytic Geometry and Calculus 2 (with a minimum grade of C)
 - **Communication/Computation Skills Requirement (6A-10.030):** No
- **Required Texts:** Differential Equations: A Toolbox for Modeling the World, by Kurt Bryan
ISBN: 978- 1-63877-937-7
(The Text is available [here](#))
 - **Equipment and Materials:** MATLAB

Course Objectives and Outcomes

- **Course Objectives:** 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 ODE 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:
 1. Solve 1st order ODE’s (Separation of variables and /or Integrating Factor)
 2. Model an application problem using 1st order ODEs.

3. Interpret differential equations by analyzing their solution to explain the underlying physical processes
4. Demonstrate the ability to integrate knowledge and ideas of differential equations in a coherent and meaningful manner for solving real-world problems.
5. 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 (Bloom's Taxonomy)	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.
Interpret differential equations by analyzing their solution to explain the underlying physical processes	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.
Model an impulse reaction and use Laplace transforms to solve the resulting ODE	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 in face-to-face courses 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) (see also [University Policy](#)).

[Falsifying attendance for yourself or for another student is an act of academic dishonesty and subject to academic discipline.]

A+ Attendance will be used to track attendance.

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). In addition, students who routinely do not bring materials to class that are required for participation, will not be given credit for class attendance, and if this becomes a pattern of behavior, may be asked to leave the class for the day. Persistent problems with participation may result in a code of conduct referral.

Late Work/Make-up work:

The final exam will replace your lowest exam score, however, an unexcused missed exam will NOT be replaced. The instructor will only allow make-up exams in extreme circumstances provided you have sufficient documentation for your absence. If you miss an exam because you are participating in a university-sponsored activity, the instructor must be informed in writing before the exam and be provided with documentation.

Grading Scale:

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

Assignment/Evaluation Methods:

Quizzes	Homework	Labs	Three Midterm Exams	Comprehensive Final
8%	8%	14%	15%+15%+15%	25%

The Midterm exams and the Final Exam will be common, and the date will be fixed at the beginning of the semester.

Homework and Quizzes policy

1. Homework and Quizzes submission should be legible and well organized. Illegible and ill-organized homework will get no credit. The usage of word processors (e.g. MS word, LaTeX, Page, etc.) are strongly recommended.
2. **Homework and Quizzes** will be collected in PDF format through the Canvas course webpage. Multiple submission is allowed but only the latest one will be graded.
3. **Quizzes:** Quizzes will be timed and will be given in class or as take-home assignments
4. **Labs Six** labs will be done during the semester. The labs will be conducted during class on the dates listed on the tentative schedule. Most labs will consist of a segment which will be collected in class and a follow segment that will be submitted via canvas.
5. All Homework 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

Classroom Rules: It is important for us to work together to create a learning environment in which every student get the most out of every class. Therefore, **Laptops/tablets should only be used for class purpose** cell phones **MUST** be on silent/mute mode and should not be used to the extent that they disturb other students or distract from class participation.

Tentative Course Topics

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

Tentative Schedule

<i>Week</i>	<i>Mon</i>	<i>Wed</i>	<i>Fri</i>
1		21-Aug	23-Aug
		Introduction: Modelling - Section 1.1	Modelling - Section 1.1, 1.2 Reading Assignment Section 1.3
2	26-Aug	28-Aug	30-Aug
	Section 1.4	Section 1.5	LAB 1
3	2-Sep	4-Sep	6-Sep
	Labor Day – No Classes	Section 2.1	Section 2.1, 1.3
4	9-Sep	11-Sep	13-Sep
	Section 2.2	Section 2.2	LAB 2
5	16-Sep	18-Sep	20-Sep
	Section 2.3	Section 2.3	Section 2.4
6	23-Sep	25-Sep	27-Sep
	Section 2.4	Review	Celebration 1
7	30-Sep	2-Oct	4-Oct
	Section 4.1	Sections 4.1, 4.2	Section 4.2

8	7-Oct	9-Oct	11-Oct
	Section 4.2	Sections 4.2, 4.3	LAB 3
9	14-Oct	16-Oct	18-Oct
	Section 4.3	Section 4.4	Section 4.4
10	21-Oct	23-Oct	25-Oct
	LAB 4	Review	Celebration 2
11	28-Oct	30-Oct	1-Nov
	Sections 5.1, 5.2	Sections 5.2	Sections 5.2
12	4-Nov	6-Nov	8-Nov
	Section 5.3	Section 5.3	Section 5.4
13	11-Nov	13-Nov	15-Nov
	Veterans' Day – No Classes	Section 5.4	Section 5.5
14	18-Nov	20-Nov	22-Nov
	Section 5.5	Review	Celebration 3
15	25-Nov	27-Nov	29-Nov
	LAB 5	Thanks Giving Break – No Classes	Thanks Giving Break – No Classes
16	2-Dec	4-Dec	6-Dec
	LAB 6	Review – Last day of regular class meeting time	Reading Days
17	December 7, 9-12 Final Exam Days		
	Final Fiesta - TBA		

* Tuesday November 19th : Last day for Withdrawal Without Academic Penalty Deadline

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.
- **Peer Learning Strategists (PLS):** Are specially trained student leaders who help their peers strategize approaches to course content and work through solution methods. PLS work in collaboration with the courses they support so the content and methods are aligned with your instructors' expectations. Students can meet with a PLS in The Learning Center, which is located on the first floor of the Innovation, Science and Technology (IST) building in room 1019.
- **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://floridapoly.edu/writingcenter>.

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
[ODS website: www.floridapoly.edu/disability](http://www.floridapoly.edu/disability)

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](#).)

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. Any faculty or staff member you speak to is required 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, 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.

Academic Integrity

The faculty and administration take academic integrity very seriously. Violations of [academic integrity regulation](#) 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. Do not compromise your integrity for a perceived short-term gain.

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.