APPLIED MATHEMATICS
FLORIDA POLYTECHNIC UNIVERSITY

MAP 4341
Applied Partial Differential Equations

Course Information

- Course Number and Title: MAP 4341.01 Applied Partial Differential Equations
- Credit Hours: 3
- Academic Term: Spring 2026

Instructor Information

- Instructor: Dr. Satyajith (SJ) B Boyana
- Office Location: IST 2024
- Office Hours: MWF 13:00 - 13:50
- Email: sbommanaboyana@floridapoly.edu

Course Delivery and Course Description

- Delivery Mode: Face-to-face; **MWF 14:00 – 14:50, BARC-1142**
- Course Website: Canvas course site
- Official Catalog Course Description: This course introduces three main types of partial differential equations: diffusion, elliptic, and hyperbolic. It includes mathematical tools, real-world examples, and applications.
  - Course Pre and/or Co-Requisites:
    - MAP 2302 – Differential Equations
    - MAC 2313 – Analytic Geometry and Calculus III
  - Communication/Computation Skills Requirement (6A-10.030): No
- Required Texts and Materials:

  - An Introduction to Partial Differential Equations with MATLAB
    ISBN: 978-1-032-63938-3 (hbk); 978-1-032-65086-9 (pbk); 978-1-032-65085-2 (ebk)
    Edition: Third edition. Publisher: CRC Press.
  - MATLAB (free through school)
  - free account on overleaf.com

Course Objectives and Outcomes

- Course Objectives: At the end of this course, students should have a basic understanding of:
  - How to derive and analyze a variety of PDEs, given a standard setup situation.
  - Classification and properties of PDEs (elliptic, parabolic, hyperbolic)
  - Analytical and numerical solution techniques
  - Applications to diffusion, wave, and transport phenomena
  - Introduction to modern computational methods and tools for PDEs
- Course Learning Outcomes:
  - Classify partial differential equations.
  - Solve Sturm-Liouville eigenvalue problems.
  - Classify PDEs into parabolic, elliptic, or hyperbolic based on the standard form. Apply separation of variables to solve second-order linear PDEs.
  - Use finite differences, finite element methods, and MATLAB DE solvers to find numerical solutions to PDEs.
  - Alignment with Program Outcomes: This course supports General Education competency for demonstrating fluency in mathematical concepts.

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).
- We will use A+ Attendance to monitor students' presence in class.

Participation

Students are expected to actively engage in the classroom experience. The use of earbuds or headphones during class is strictly prohibited unless authorized accommodations have been approved. Students who disregard this policy may be asked to leave the class for the day. Repeated issues with participation may lead to a referral under the Student Code of Conduct.

Late Work/Make-up Work

Late submissions will be accepted up to 24 hours after the deadline, with a 20% deduction. Extensions without penalty may be granted at the instructor's discretion on a case-by-case basis. Please ensure timely communication with the instructor regarding any requests for extensions.

Grading Scale

A	A-	B+	B	B-	C+	C	D	F
90%	87%	84%	80%	77%	74%	70%	60%	$< 60\%$

Assignment/Evaluation Methods

In this course we will have:

Homework	20%
3 Midterm Exams	$3 \times 20\%$
Final Project	20%
Total	100%

- **Homework:** Homework assignments will include problems from the textbook or small MATLAB tasks and will be posted on Canvas. All submissions must be uploaded electronically as a single PDF file through Canvas. If multiple files are submitted, only one will be graded. Homework must be clear, legible, and well-organized; otherwise, no credit will be given. Each homework set will be graded on a 20-point scale. You may use Overleaf to type your homework submissions, and any typed submission that is readable will earn an additional 10% bonus.

  The two lowest homework grades will be dropped. Assignments submitted up to 24 hours late will incur a 20% penalty, and no submissions will be accepted beyond this timeframe. Failure to meet the deadline due to technical issues will still be treated as a late submission. Once the due date has passed, you will not be allowed to submit a corrected file, regardless of the reason for the original incorrect submission.

- **Midterm Exams:** Two in-class midterms and one take-home exam will assess your understanding of the course material and your ability to solve problems. All exams will be free-response, meaning you must show your work rather than provide only final answers. Completing homework assignments will give you practice in clearly presenting your work, which will be beneficial during exams. Each midterm exam will contribute 20% to your final grade, with a total of three midterm exams scheduled. The take-home exam will be due 48 hours after it is assigned, and all submissions related to the take-home exam must be uploaded electronically as a single PDF file through Canvas. Specific exam dates will be announced well in advance during class, and the tentative schedule is provided in Table 1.

- **Final Project:** A final project will be assigned during Week 12 or Week 13 of the semester and will be completed in instructor-assigned teams. The project will include a coding component, and you may use any programming language of your choice. However, you will receive training to complete the project using MATLAB. You must document all results and observations and submit a well-structured scientific report prepared in Overleaf; introductory training materials for Overleaf will be provided. You will submit your code, but only the final report will be graded. The report is worth 70 points.

  During Final Exam Week (Week 17), on the date scheduled for our final exam (to be announced later in the semester), each team will give a project presentation worth 30 points. The complete final project, including the report and the presentation, is due on the day of the final exam (date announced later in the semester). Failure to submit by the due date will result in a deduction of 20% from your final grade.

Course Schedule (Subject to Change)

- See Table 1 below.
- Important dates can be found on the Florida Polytechnic University Academic Calendar. **It is your responsibility to keep track of and adhere to the important dates listed on the website.**

Academic Support Resources

- **Library:** Students can access the Florida Polytechnic University Library through the university website, on and off campus. Students may direct questions to library@floridapoly.edu.
- **Tutoring and Learning Center (TLC):** There are specially trained student leaders who help their peers strategize approaches to course content and work through solution methods at TLC. TLC works in collaboration with the courses they support so the content and methods are aligned with your instructors' expectations. Students can meet with a tutor in the TLC at IST Commons, which is located on the second floor of the Innovation, Science, and Technology (IST) building.
- **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 Writing Center.

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 accommodation, please contact ODS as soon as possible.
The Office of Disability Services (ODS): DisabilityServices@floridapoly.edu
(863) 874-8770
ODS website: 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.)

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 must 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 discuss resources and options available.

Communication

Students with a concern or issue should feel free to email their instructor at sbommanaboyana@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 regulation include actions such as cheating, plagiarism, use of unauthorized resources (including but not limited to the 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.

Week #	Monday	Wednesday	Friday
Week 1: Jan 12 – Jan 16	Introduction, 1.1 – What are PDEs?	1.2 – PDEs we can already solve	1.3, 1.4 – Initial and boundary conditions, Linear PDEs
Week 2: Jan 19 – Jan 23	MLK Day – NO CLASS	1.5 – The Principle of Superposition	1.6 – Separation of variables
Week 3: Jan 26 – Jan 30	1.7 – Eigenvalue Problems	1.7 – Eigenvalue Problems (continued)	2.1 – 2nd order, linear homogeneous PDEs
Week 4: Feb 02 – Feb 06	2.2 – The heat equation and diffusion	2.3 – The wave equation and the vibrating string	2.4 – ICs and BCs for the heat and wave equations
Week 5: Feb 09 – Feb 13	2.5 – Laplace's equation, the potential equation	2.6 – Using separation of variables	3.1, 3.2 – Properties of sine and cosine
Week 6: Feb 16 – Feb 20	Review	**Exam 1 (In-Class)**	3.3 – The Fourier Series
Week 7: Feb 23 – Feb 27	3.4 – Fourier Series, Continued	3.6 – Fourier sine and cosine series	4.1 – Homogeneous heat equation on finite rod
Week 8: Mar 02 – Mar 06	4.2 – Homogeneous wave equation for finite string	4.3 – Homogeneous Laplace's equation on a rectangular domain	4.4 – Nonhomogeneous problems
Week 9: Mar 09 – Mar 13	4.4 – Non-homogeneity due to BCs	4.4 – Non-homogeneity due to PDE	5.1 – 1st order PDEs with constant coefficients
Week 10: Mar 16 – Mar 20	**Spring Break - No Class**		
Week 11: Mar 23 – Mar 27	5.2 – 1st order PDEs with variable coefficients	5.3 – The infinite string	Quasilinear PDEs and Shock Waves – 1
Week 12: Mar 30 – Apr 03	Quasilinear PDEs and Shock Waves – 2	Review	**Exam 2 (In-Class)**
Week 13: Apr 06 – Apr 10	Discussion on Projects; Projects assigned	FEM – Weak Formulation	FEM – Poisson's equation with homogeneous Dirichlet BCs
Week 14: Apr 13 – Apr 17	FEM – Poisson's equation with nonhomogeneous Dirichlet BCs	FEM – Heat equation with nonhomogeneous Dirichlet BCs	8.1 – Sturm–Liouville problems
Week 15: Apr 20 – Apr 24	8.2 – Regular Sturm–Liouville problems	9.1 – PDEs in higher dimensions	9.2 – Wave and heat equation on a rectangle; **Exam 3 (Take Home)**
Week 16: Apr 27 – May 01	9.2 – Wave and heat equation on a rectangle	Optional last minute help session; Work on final project	Optional last minute help session; Work on final project
Week 17: May 04 – May 08	**Final Project Presentation**		

Table 1