EML5930 Guidance, Navigation and Control – Course Syllabus

Spring 2026

Course Information

- **Course Number and Title: EML5930 Introduction to Guidance, Navigation and Control**
- **Credit Hours:** 3
- **Academic Term: Spring 2026**

Instructor Information

- **Instructor: Guilherme Dufflis Fernandes**
- **Office Location: BARC 1105**
- **Office Hours**: **By appointment (online)**
- **Other Ways to Contact You**: **by email, gdufflisfernandes@floridapoly.edu**

Course Details

- **Delivery Mode**: This course is conducted entirely online, which means you do not have to be on campus to complete any portion of it. You will participate in the course using our Canvas learning management system (https://floridapolytechnic.instructure.com)
- **Required Texts:**
  - Kabamba, Pierre T., and Anouck R. Girard. **Fundamentals of Aerospace Navigation and Guidance**. Cambridge University Press, 2014 (the textbook is not strictly necessary, however it is a great reference).
- **Technology Requirement:**
  - **Access:** You will need to have access to a computer off campus and a reliable internet connection.
  - MATLAB/Simulink (student license available with your .edu email)
  - **Computer Requirements: your computer must meet the minimum requirements to run MATLAB/Simulink.**
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  - **Web camera and a microphone (internal or extremal)**
  - Alternatively, you may use Python or any other language. Most languages have free options. However, MATLAB scripts will be provided to you.
- **Course Objectives**:
  - Provide a foundation in the principles and applications of guidance, navigation, and control systems in aerospace contexts.
  - Introduce students to classical dynamic systems theory and its relevance to aerospace systems.
  - Explore the role of navigation technologies in flight and target tracking.
  - Develop analytical and simulation skills for modeling and evaluating GNC systems.
- **Course Learning Outcomes**:
  Upon successful completion of this course, students will be able to:
  - Describe the functions and interactions of guidance, navigation, and control subsystems.
  - Model simplified dynamic systems using 2D motion and 3DOF principles.
  - Analyze system stability and performance using time-domain methods.
  - Explain the operation and application of radar systems in aerospace guidance and navigation.
  - Compare legacy and modern navigation technologies and their integration into missile systems.
  - Apply guidance laws to simulate and evaluate missile-target interception scenarios.
- **Alignment with Program Outcomes**:
  - This course supports the **Master of Science in Mechanical Engineering** program by reinforcing core engineering principles and applying them to aerospace systems, particularly missile and rocket technologies. Through modeling, analysis, and design of GNC systems, students engage in project-based learning that aligns with the program's emphasis on applied research and multidisciplinary collaboration.

Academic Support Resources

(Copy and paste the following)

- **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**: The Tutoring and Learning Center (The TLC) provides tutoring to all Florida Poly students who may need additional academic support. The TLC is staffed by students who have excelled in the courses they tutor. They offer support by reviewing concepts and materials from class, clarifying points of confusion and providing assistance with learning strategies. While the focus of TLC is to provide support to students in freshman-level courses, upper-level courses are also tutored at the Center. The TLC is located in IST 1019 (on the first floor in the center hallway of the IST building).
- **Knack Tutoring**: Students looking for additional assistance outside of the classroom are advised to consider working with a peer tutor through Knack. Florida Polytechnic University has partnered with Knack to provide students with access to verified peer tutors who have previously aced this course. To view available tutors, visit http://floridapoly.joinknack.com and sign in with your student account.
- **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 www.floridapoly.edu/writingcenter.

Course Schedule (tentative)

Week Number	Module Number	Module Title	Topics Covered	Assignments
1	1	Foundations of Guidance, Navigation, and Control	Video lectures: Introduction to GNC; Definitions and Roles; Historical Context	Post-class quiz
2	1	Foundations of Guidance, Navigation, and Control	Video lectures: 2D Motion; Newton's Laws; 3DOF Models	Post-class quiz; Module homework
3	2	Control Systems Basics	Video lectures: System Modeling; Transfer Functions; Laplace Transforms	Post-class quiz
4	2	Control Systems Basics	Video lectures: Block Diagrams; Time-Domain Analysis	Post-class quiz
5	2	Control Systems Basics	Video lectures: PID Controller Design and Tuning	Post-class quiz; Module homework
6	3	Frequency Domain and Classical Control	Video lectures: Frequency Response; Bode Plots	Post-class quiz
7	3	Frequency Domain and Classical Control	Video lectures: Nyquist Criterion; Root Locus Analysis	Post-class quiz; Module homework; Midterm exam covering modules 1,2 and 3
8	4	Radar Systems for GNC	Video lectures: Radar Fundamentals; Radar Equation; Frequencies	Post-class quiz
9	4	Radar Systems for GNC	Video lectures: CW and FM Radar; Doppler Effect	Post-class quiz
10	4	Radar Systems for GNC	Video lectures: Pulse Doppler Radar; Tracking Applications	Post-class quiz; Module homework
11	5	Navigation Technologies	Video lectures: Legacy Systems: LORAN, Decca, Omega, VOR	Post-class quiz

12	5	Navigation Technologies	Video lectures: GPS and INS; Sensor Fusion; Error Mitigation	Post-class quiz; Module homework
13	6	Guidance Laws and Target Interception	Video lectures: LOS and Pursuit Guidance; PN Basics	Post-class quiz
14	6	Guidance Laws and Target Interception	Video lectures: Advanced PN; Optimal Guidance; Intercept Scenarios	Post-class quiz; Module homework
15	7	Integrated GNC Systems and Applications	Video lectures: GNC Architecture; Real-World Examples; Simulation Tools	Post-class quiz
16	7	Integrated GNC Systems and Applications	Final Project Presentations; Course Review	Post-class quiz; Module homework

Course Policies

Attendance

Because this is an online course, your attendance is based on your online activity and participation. The following is a summary of everyone's expected participation:

- Class participation: most lectures contain certain prompts that you should interact with. Your attendance will be measured by these prompts.
- **Excused absences/non-participation**: Excuses for missing an entire week of participation are similar to excused absence excuses in an in-person class. A death in your immediate family, illness, or a major mental health emergency would count because these understandably affect more than 1-3 days of work. All excused non-participation must be documented in writing (doctor's note or similar).

Late Work/Make-up work

You will be provided with ample time to complete assignments; since our online course is fully flexible, no late work will be accepted, unless in exceptional circumstances. Assignments will be consistently due on certain dates (e.g. quizzes due always on Friday by 11:59pm) to help students maintain a solid learning rhythm.

Assignment/Evaluation Methods

You are expected to complete a quiz after each "lecture" (each lecture consists of a number of short videos). There will be one homework assignment for each module, as well as a midterm exam covering modules 1, 2 and 3. There is no final exam, which is substituted by a final project where you will have the opportunity to apply the entirety of the course content. Your full grade will be calculated as follows:

- Attendance: 10% (measured by your interactions with the lectures)
- Post-class quizzes: 15%
- Homework assignments: 25%
- Midterm exam: 20%
- Final project: 30%

Pace of Online Activities

This course is an asynchronous course – meaning that you will be working on it at different times than your colleagues. This course is not a self-passed class or an independent study. You will have assignment deadlines, and work must be submitted on time. Each assignment sequence must be completed on schedule – you can't work ahead or get behind and be successful.

Course Communication and Feedback

The best way to contact me is via email. I will try to respond within two business days. I will make every effort to reply on the same business day to emails, and normally I will be able to. Expect that responses will likely be slower over the weekend. For larger assignments, you can generally expect feedback within 7 days.

Grading Scale

The standard university grading policy will be used.

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 accommodation 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 accommodation.

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 accommodation must be made in advance. Accommodation is 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
The Access Point
ODS website: www.floridapoly.edu > Student Affairs > Health Wellness > 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. It is important for you to know that there are resources 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. It is an educational goal that you feel able to share information related to your life experiences in classroom discussions and in one-on-one meetings. However, it is requirement for university employees to share information with the Title IX Coordinator regarding disclosure. However, please know 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.

Academic Integrity

All students are expected to adhere to the highest standards of academic integrity. Violations of academic integrity include actions such as cheating, plagiarism, use of unauthorized resources, 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. It is critical that students take a professional approach to their academic work. The faculty and administration take academic integrity very seriously. 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. More information about Florida Poly's academic integrity policies and procedures can be found here: https://floridapoly.edu/wp-content/uploads/2017/07/FPU-5.005-Academic-Integrity-7.29.14.pdf#search=academic%20integrity

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.

Students who participate in this class with their camera on or use a profile image are agreeing to have their video or image recorded solely for the purpose of creating a record for students enrolled in the class to refer to, including those enrolled students who are unable to attend live. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally agree to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep

your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live.

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****.*