FLORIDA POLYTECHNIC UNIVERSITY

Syllabus: Mechanical Lab Design 2

Spring semester 2026

Course Information

- **Course Number and Title**: EGN 3016C Mechanical Lab Design 2
- **Credit Hours:** 3 (2 lecture, 1 lab)
- **Academic Term:** Spring 2026

Instructor Information

- **Instructor:** Guilherme Dufflis Fernandes
- **Office Location:** BARC 1105
- **Office Hours**: MTF 3:15 - 4:15 PM, or by Appointment
- **Email address**: gdufflisfernandes@floridapoly.edu

Course Delivery and Course Description

- **Class Schedule and Location:** TR, 3:50-5:20 PM, WEB-1002 (2 – 110 min. sessions)
- **Official Catalog Course Description**: This course aims to build on skills learned in proceeding courses and put them to use towards designing and executing mechanical engineering laboratories. Student teams will investigate and then develop demonstrable laboratory apparatuses of mechanical engineering principles and phenomena including heat transfer, fluids, vibrations, and control systems. Students will be guided through the process with educational primers on principles that will be investigated while being taught general design practices and processes. The course will include functional representations, concept evaluation, planning, and require extensive written communication and documentation. Teams will utilize LabVIEW and data acquisition (DAQ) cards for the development of the mechanical systems laboratories. This course will enhance students' knowledge of design processes as well as core mechanical engineering topics and prepare them to tackle future open ended problems in their capstone design course.
    - **Course Prerequisites:** EGN 3321 Dynamics, EGN 3331 Strength of Materials, EGN 2002C Skills and Design 2, **Co-Requisite:** none
    - **Communication/Computation Skills Requirement (6A-10.030)**: No

- **Required Texts**: Theory and Design for Mechanical Measurements, by Figliola & Beasley, ISBN: 978-1119723455, Publisher: Wiley.
    - **Equipment and Materials**: Canvas, computer or tablet, Microsoft Office, LabVIEW, MATLAB, Arduino IDE, calculator, FL Poly email.
    - **Note:** Only use of the following calculator models as used on the Fundamentals of Engineering (FE) Exam will be allowed:
        - **Casio**: All fx-115 and fx-991 models (Any Casio calculator must have "fx-115" or "fx-991" in its model name.)
        - **Hewlett Packard:** The HP 33s and HP 35s models, but no others
        - **Texas Instruments:** All TI-30X and TI-36X models (Any Texas Instruments calculator must have "TI-30X" or "TI-36X" in its model name.)

Course Objectives and Outcomes

- **Course Objectives**:
    - The objective of this course is to design mechanical engineering laboratory systems. For this purpose, the course covers a variety of mechanical engineering principles and phenomena including heat transfer, fluids, vibrations, and control systems, as well as instrumentation with computer-based data acquisition. Engineering design principles and project management techniques are added as well to help design processes and manage multiple systems.

    - Bloom's taxonomy points to three domains of educational activities of learning that laboratories cover: Cognitive (knowledge related), psychomotor (physical skills), and affective (behavior and attitudes). The first domain includes: Creating, evaluating, analyzing, applying, understanding, and remembering which are discussed while using instrumentation, developing and evaluating models, learning about experiments, data analysis and designing experiments. The second domain is mostly related to ability to manipulate apparatus and sensory or perception awareness. The last domain, mostly behavior and attitudes, include components such as creativity, learning from failure, lab safety, teamwork and communication. An effective engineer is a person who has been exposed to these three domains.

    - Highlights are as follows:
        - The engineering design process
        - Project management (including planning and scheduling)
        - Functional decomposition and concept variant analysis
        - Design of Experiments
        - Simulation and prototyping
        - Computer-based data acquisition
        - Verification and validation
        - Mechanical measurements and instrumentation
        - Topics in mechanical engineering (heat transfer, fluids, vibration, and controls)
        - Professional communication skills, e.g., written report, oral presentation, poster, and/or multimedia.
        - Professional skills in teaming, leadership, and team management

- **Course Learning Outcomes**:
    - Students will be able to demonstrate the ability to do the following:
        a) Explain: static and dynamic measurements; analog and digital signals; root-mean-square, frequency analysis; zero, first and 2nd order systems; transfer functions; probability density functions; standard deviation of the mean; hypothesis testing; regression analysis; uncertainty analysis; flow measurement devices
        b) Implement circuitry for data acquisition using temperature, pressure, and vibration measurement.
        c) Analyze the calibration of differential pressure sensors.
        d) Evaluate and document a plan for a two-semester team project developing a laboratory apparatus that involves mechanical, thermal, fluids, vibrations, or control systems with existing equipment.
        e) Create and document a design for a two-semester team project developing a laboratory apparatus that involves mechanical, thermal, fluids, vibrations, or control systems with existing equipment.

- **Alignment with Program Outcomes**:

Course Learning Outcome	Learning Level (Bloom's / ABET Assessment Example)	Program Learning Outcome (ABET, GenEd, Other)
(a) Explain: static and dynamic measurements; analog and digital signals; root-mean-square, frequency analysis; zero, first and 2nd order systems; transfer functions; probability density functions; standard deviation of the mean; hypothesis testing; regression analysis; uncertainty analysis; flow measurement devices	**Knowledge**- Ability to recall previously learned material **Application**- Ability to use learned material in new situations **ABET Assessment** – homework, exams	ABET 1 – an ability to identify formulate, and solve complex engineering problems by applying principles of engineering, science, and math.
(b) Implement circuitry for data acquisition using temperature, pressure, and vibration measurement. (c) Analyze the calibration of differential pressure sensors	**Analysis**- Ability to separate material into component parts and show relationships between parts **ABET Assessment** – lab reports	ABET 6 – An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
(e) Create and document a design for a two-semester team project developing a laboratory apparatus that involves mechanical, thermal, fluids, vibrations, or control systems with existing equipment.	**Knowledge**- Ability to recall previously learned material **Application**- Ability to use learned material in new situations **Comprehension**- Ability to grasp meaning, explain, and restate ideas **Evaluation** - Ability to judge the worth of material against stated criteria **ABET Assessment** – project	ABET 2 - An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
(d) Evaluate a plan for a two-semester team project developing a laboratory apparatus that involves mechanical, thermal, fluids, vibrations, or control systems with existing equipment.	**Knowledge**- Ability to recall previously learned material **Application** – Ability to use learned material in new situations. **ABET Assessment** – Peer evaluation	ABET 5 - An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
(d) Evaluate and document a plan for a two-semester team project developing a laboratory apparatus that involves mechanical, thermal, fluids, vibrations, or control systems with existing equipment. (e) Create and document a design for a two-semester team project developing a laboratory apparatus that involves mechanical, thermal, fluids, vibrations, or control systems with existing equipment.	**Application** – Ability to use learned material in new situations. **ABET Assessment-** presentations, project report, lab reports	ABET 3- an ability to communicate effectively with a range of audiences
(e) Create and document a design for a two-semester team project developing a laboratory apparatus that involves mechanical, thermal, fluids, vibrations, or control systems with existing equipment.	**Knowledge**- Ability to recall previously learned material **ABET Assessment-** project report	ABET 7 - an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Course Policies

Attendance

- Students in **face-to-face (this includes labs and C-courses)** 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).
- Attendance is mandatory.

Late Work/Make-up work

- Make-up opportunities will be granted exclusively for exams in exceptional circumstances and at the discretion of the professor. Please note that no make-up options will be provided for in-class activities. Students are expected to reach out to the instructor well in advance of an exam or provide a valid justification if doing so ahead of time is not possible.
- All deliverables must be turned in and posted in canvas assignments to earn credit (no email or Canvas messages) by the due date. If an assignment is not posted on Canvas, a zero will be recorded for that assignment. Students are granted a 2-day grace period following the homework due date to submit their work; beyond this period, no submissions will be accepted. In-class activities are due by the due date with no extension or grace period.
- All deliverables, other than work group, presentations, videos, or as indicated, will be 'individual' where everyone must submit their own work.

Grading Policy

- Only neatly written problems will be graded (points might be deducted).
- A correct answer without a correct outline of the work will not receive credit.
- When multiple solutions are presented for a problem, the solution with the most errors will be graded.
- All deliverables must be turned in in Canvas to earn credit and receive a grade.

Lab Policy

Students are expected to observe the policies for lab safety, lab preparation, meetings, and writing guidelines. Policies will be revised accordingly and discussed with all students prior to any lab activity.

Grading Scale

The grading scale that will be used in the course. (See also University Grading Policy).

Grading Scale (%)	
93-100	A
90-92	A-
86-89	B+
83-85	B
80-82	B-
76-79	C+
70-75	C
60-69	D
0-59	F

Grade Breakdown	
Presentations (group work)	15%
Project Reports (group work)	25%
Lab Reports (group work)	20%
Assignments (individual work)	5%
Attendance and Class Participation	5%
Peer Evaluation	5%
Midterm Exam	25%
Total	100%

Note: *Grades for will be posted to Canvas for reference only, and students should make sure they are recorded correctly. However, there is no guarantee that the percentages or projected grades provided there are correct. The instructor will calculate final percentages and will determine final grades regardless of Canvas calculations. Also, Percentages that fall between grades will be rounded up.*

Attendance & Class participation

- **ATTENDANCE**: All class meetings are mandatory. Attendance is recorded at the start of class.
  - **LATE:** If you arrive late, check in with the instructor at the end of class to be marked late instead of absent. Extenuating circumstances will be considered individually.
  - **ABSENCE:** Notify the instructor via Canvas before your absence, except in extreme cases. Documentation may be required. Failure to notify results in an absence.
- **Participation:** In-class activities count toward participation grades.

Assignments

- Complete all Canvas-posted assignments and problem sets. They are designed to reinforce learning and allow students to demonstrate understanding.

Lab Reports

- This is a group assignment to be submitted on Canvas based on the individual portions of the lab activities developed through the semester.

Project Reports

- Teams will investigate and develop a laboratory apparatus. A progress and a final report along with a laboratory manual will be submitted.

Presentation

- Teams will deliver a four presentations showcasing the progress of their project. All members must participate for full credit.

Peer Evaluation

- Teams will provide feedback on each member's contribution and professionalism. A paper or Canvas form will be distributed near the end of the semester for this assessment.

Midterm Exam

- Exam will be held during regular class time.
- **Exam Policy**: Make-up exams are allowed only with satisfactory evidence of an unavoidable absence. Students must notify the instructor before the exam or within 24 hours of the absence to arrange a make-up.

NOTE: Changes in syllabus and assignment sheets may be modified as deemed appropriate. All changes will be announced in class.

University Policies

Reasonable Accommodations

The University is committed to ensuring equal access to all educational opportunities. 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: DisabilityServices@floridapoly.edu; (863) 874-8770; www.floridapoly.edy/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 discuss resources and options available.

Academic Integrity

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 sanctions up to and including expulsion from the university.

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 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****.*

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**: 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 the IST Commons (second floor).
    - **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 floridapoly.joinknack.com and sign in with your student account.
- **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 floridapoly.edu/writing center.

Course Schedule - *Subject to change per course policies.*
Tentative Schedule (Subject to Change)

Week	Date	Topics(s)	Deliverable(s)/Note(s)/Action(s)
1	Jan 12/14	Course Introduction, Establish Teams, and Projects **Chapter 2:** Static and Dynamic Characteristics of Signals	Group Selection
2	Jan ~~19~~/21	**Design Project**	Presentation 1 (Project Selection)
3	Jan 26/28	**Design Project**	HW
4	Feb 2/4	**Chapter 3:** Measurement System Behavior - 1st order systems	Presentation 2 (Design Specs & BOM)
5	Feb 9/11	**Chapter 3:** Measurement System Behavior - 1st order systems	HW & Lab Report, Finalized BOM
6	Feb 16/18	**Design Project**	Lab Report
7	Feb 23/25	**Midterm Exam – During Class**	
8	Mar 2/4	**Design Project**	Alpha Prototype & Progress Report
9	Mar 9/11	**Design Project**	Presentation 3 (Progress Update)
10	Mar 16/18	******** Spring Break ********	
11	Mar 23/25	Design Project	Beta Prototype
12	Mar 30, Apr 1	Design Project	Manual & Presentation 4 (Final Design)
13	Apr 6/8	Conduct laboratory experiments	Lab report
14	Apr 13/15	Conduct laboratory experiments	Lab report
15	Apr 20/22	Conduct laboratory experiments	Lab report
16	Apr 27	Finalize/revise lab documentation	Final Report Revised Lab Manuals

Holidays:

- January 19: Martin Luther King Day - No Classes