FLORIDA POLYTECHNIC UNIVERSITY

Course Information

- **Course Number and Title:** EGN 5445, Design of Experiments and Optimization
- **Credit Hours:** 3
- **Academic Term:** Spring 2026

Instructor Information

- **Instructor:** Dr. Matt Bohm
- **Office Location:** 1109 BARC
- **Office Hours:** MWF 12-1 PM, or by appointment
- **Email address:** mbohm@floridapoly.edu

Course Delivery and Course Description

- **Delivery Mode:** All class meetings are in person and on campus unless pre-announced otherwise for specific days. It is important for students to attend so they can participate in the discussion; lectures will be used to present new topics each week and to have a broad engineering design related discussion.
- **Course Website:** Design of Experiments and Optimization Course Website
- **Official Course Catalog Description:** This course will begin with a brief introduction of engineering design and engineering optimization processes. The first portion of the course will be devoted to Design of Experiment (DOE) techniques to enable identification and quantification of design variables and systems modeling. The remainder of the course will be dedicated to classical engineering optimization techniques such as quadratic forms, minimization, linear programming, dynamic programming, Newtonian methods, and multi-objective optimization. Overall, the course will focus greatly on identifying opportunities for optimization as well as determining which optimization method is appropriate for a given opportunity.
  - **Course Pre and/or Co-Requisites:** Graduate Standing or permission of the Department Chair.
  - **Communication/Computation Skills Requirement (6A-10.030):** N
- **Required Texts and Materials:**
  - Textbook: Optimization Concepts and Applications in Engineering, 2nd Edition, by Belegundu and Chandrupatla, 2011.
  - Additional Material: Statistical Design of Experiments with Engineering Applications by Rekab and Shaikh, 2005; and The Science of Decision Making: A Problem-Based Approach Using Excel by Denardo, 2002. There will be a fair amount of supplemental material and handouts.

Course Objectives and Outcomes

- **Course Objectives:** This course provides graduate students with a rigorous foundation in engineering optimization and decision-making methods for complex engineering

systems. Emphasis is placed on problem formulation, method selection, and the application of classical and numerical optimization techniques to realistic engineering problems. Students develop the ability to model systems, analyze trade-offs, and apply sound engineering judgment when interpreting optimization results and making design decisions.

- **Course Learning Outcomes:**
  1. **Formulate Engineering Optimization Problems:** Translate real-world engineering systems into well-posed optimization problems by defining design variables, objective functions, constraints, and performance measures.
  2. **Apply Design of Experiments and System Modeling Techniques:** Use design of experiments (DOE) and data-driven modeling approaches to identify significant factors, characterize system behavior, and support optimization efforts.
  3. **Select and Implement Appropriate Optimization Methods:** Evaluate, justify, and apply suitable optimization techniques (e.g., unconstrained, constrained, linear, nonlinear, and multi-objective methods) based on problem structure and assumptions.

Course Learning Outcome	Primary Bloom's Level	ABET EAC Alignment
Formulate Engineering Optimization Problems	Analyze	ABET 1
Apply Design of Experiments and System Modeling Techniques	Analyze / Evaluate	ABET 1, 6
Select and Implement Appropriate Optimization Methods	Evaluate	ABET 1, 7
Analyze and Interpret Optimization Results	Evaluate	ABET 2, 4
Use Modern Computational Tools for Optimization and Decision Making	Create	ABET 3, 5

  4. **Analyze and Interpret Optimization Results:** Assess solution quality, convergence behavior, sensitivity, trade-offs, and practical feasibility of optimization results using engineering judgment.
  5. **Use Modern Computational Tools for Optimization and Decision Making:** Employ appropriate computational tools to implement optimization algorithms, analyze results, and communicate findings effectively.
- **Alignment with Program Outcomes:**

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 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. Communication, written, oral and behavioral, between faculty and students must remain respectful. Within and outside of the classroom, students must refrain from derogatory comments toward the faculty member and their fellow students, and faculty as well must refrain from derogatory comments toward their students. Faculty and students should address each other with respect, in accordance with the wishes of the faculty and the students: for example, no one should be addressed by their last name alone.

Faculty from the outset of a course can and should specify what constitutes activities and behavior that take away from, that diminish, the educational environment. An individual student's distracting behavior impedes the education of fellow students, which itself is a form of disrespect. Civility and collegiality also include respecting each other's time: for example, neither students nor faculty should arrive late to class (unless unforeseen, pressing circumstances prevail); faculty should be present at the posted office hours; and students and faculty should be punctual when meeting times are scheduled. In more general terms, collegiality means respecting the right of both faculty and students to participate fully and fairly in the educational enterprise.

Course Attendance Policy

- 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 at all class meetings is expected. Absence does not excuse a student from material covered or any activity done on that day, nor does it extend a deadline.

- Students should inform the instructor as soon as possible if an absence is expected. The instructor should be contacted as soon as possible if an absence was due to an unforeseen emergency. Documentation is required in either case.

Course Email Policy

Emails must be sent from your Florida Poly email account to the Florida Poly email address of the instructor (name@floridapoly.edu). Please allow up to 36 hours on weekdays for a response, after which you may send a follow-up email. Emails must be composed in a professional manner with a greeting, signature, and in an organized fashion.

Course 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

As a graduate level course, late work or make-up work is not accepted. The only exceptions may be if a student has a verifiable excuse through CARE services or is gone because of a University sanctioned event. Leaving for Spring break early, or being out of town to visit family are not legitimate excuses.

Grading Scale

Grade	Percentage
A	100 - 93
A-	92 - 90
B+	89 - 86
B	85 - 83
B-	82 - 80
C	79 - 70
F	0 - 69

Assignment/Evaluation Methods

Activity	Weight
Homework	20%
In Class Activities	10%
Project	10%
Mid-Semester Exams	40%
Final Exam	20%

Course Schedule (Tentative)

	Date	Topic	Reading	HW Due
M	1/12/26	Review of the Design Process		
W	1/14/26	Introduction to Optimization	Sections 1 - 1.4	
F	1/16/26	Decision Theory		
M	1/19/26	No Class - MLK Jr. Holiday		
W	1/21/26	Introduction to Design of Experiments (DOE)		
F	1/23/26	DOE: Full Factorial and Resolution III Designs		
M	1/26/26	DOE: Single Factor Approach, Two-Level Factorials		DOE Trial
W	1/28/26	DOE: Plackett-Burman and Resolution IV Designs		
F	1/30/26	DOE: Review of Methods and Resolution V Designs		
M	2/2/26	Optimization of the Location Parameter		
W	2/4/26	Alternative to the Pareto Chart		
F	2/6/26	Project Presentations		DOE Project
M	2/9/26	Minimization of the Dispersion		
W	2/11/26	Optimization of the Location Parameter		
F	2/13/26	Minimization of the Dispersion Parameter, Three-Level Factorial Designs		

	Date	Topic	Reading	HW Due
M	2/16/26	Exam 1 Review		
W	2/18/26	Exam 1		
F	2/20/26	Minimum and Maximum, Quadratic Forms, Gradient	Sections 1.6 - 1.9	
M	2/23/26	Taylor's Theorem, Linear and Quadratic Approximations - Remote	Sections 1.10 - 1.11	
W	2/25/26	Single Variable Minimization - Remote	Sections 2 - 2.2	
F	2/27/26	Unimodality, Fibonacci, and Golden Section Methods	Sections 2.3 - 2.5	P1.1-10, P1.14,16,22
M	3/2/26	Polynomial and Shubert Methods; MatLAB	Sections 2.6 - 2.9	
W	3/4/26	Unconstrained Optimization, Sufficient Conditions, Convexity, Steepest Descent	Sections 3 - 3.5	P2.1-6, 2.8,9,18,20
F	3/6/26	Conjugate Gradient, Newton, and Quasi-Newton Methods	Sections 3.6 - 3.8	
M	3/9/26	Approximate Line Search; MatLab	Sections 3.9 - 3.10	
W	3/11/26	Introduction to Linear Programming	Sections 4 - 4.4	P3.1,4,8,11
F	3/13/26	Remixed Simplex, Duality, Dual Method, Sensitivity Analysis	Sections 4.9 - 4.12	
M	3/16/26	No Class - Spring Break		
W	3/18/26	No Class - Spring Break		
F	3/20/26	No Class - Spring Break		
M	3/23/26	Interior Approach, Quadratic Programming	Sections 4.13 - 4.14	
W	3/25/26	Exam 2 Review		P4.1-9, 4.14
F	3/27/26	Exam 2		
M	3/30/26	Introduction to Constrained Minimization	Sections 5 - 5.5	
W	4/1/26	Sufficient Conditions, Convexity, Sensitivity, Sequential Quadratic Programming	Sections 5.6 - 5.8 and 5.12 - 5.13	

	Date	Topic	Reading	HW Due
F	4/3/26	Direct Search Methods: Cyclic Coordinate, Hooke, Powell's, Genetic Algorithm	Sections 7 - 7.5 and 7.8	P5.1-5, 5.23
M	4/6/26	Applications of Direct Search Methods	Sections 7 - 7.5 and 7.8	
W	4/8/26	Multiobjective Optimization	Sections 8 - 8.2	P7.18-19
F	4/10/26	Pareto Curve, Compromise Solution	Sections 8.3 - 8.4	
M	4/13/26	Applications of Multiobjective Optimization	Sections 8 - 8.4	
W	4/15/26	Integer and Discrete Programming (1)	Sections 9 - 9.6	P8.5-8
F	4/17/26	Integer and Discrete Programming (2)	Sections 9 - 9.6	
M	4/20/26	Dynamic Programming (1)	Sections 10 - 10.3	P9.3.7, 9.14,15
W	4/22/26	Dynamic Programming (2)	Sections 10 - 10.3	
F	4/24/26	Catch up Day		
M	4/27/26	Final Exam Review		

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.

Revisions to the Syllabus

The instructor reserves the right to correct typos or other errors in the syllabus and make other reasonable adjustments to maintain the quality and integrity of the course in response to unanticipated circumstances.