EIN 4522: Systems Modeling and Optimization

Instructor: Daniel Lopes da Silva, Ph.D.

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Class : MWF, 3-3:50 PM, TBD
Office Hours: MTW, 1:30-2:30 PM
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1 Course Description

This course enriches the modeling of systems operations in manufacturing and service industries, and solving the models using optimization algorithms to prescribe the best course of action for decision-making.

- **Delivery mode:** In-person instructional format. Three lectures (2 hours and 30 minutes) a week. Complementary autonomous work done outside the classroom.
- **Course webpage:** Canvas management system.
- **Gordon Rule (6A-10.030):** No.

Course Objectives

After successfully completing this course, the student should be able:

1. to model the operations of manufacturing and service systems in terms of advanced optimization problems;
2. to solve advanced optimization problems and evaluate the solutions obtained;
3. to develop and apply specialized algorithms to solve optimization problems.

1.1 Required Materials

- **Equipment and Material:** Florida Poly email, Canvas, Excel Solver, mathematical/scientific programming language (Python) and Gurobi Optimization Solver.

- **Reference Textbook:** Taha, H., Operations Research: An Introduction, 10th Edition, Pearson, 2016. Identifiers: ISBN-10: 0134444019, ISBN-13: 978-0134444017.

  This is an excellent reference book, but it is not required. Class slides and supplemental notes will be provided.

  Complementary Textbook:

- Hillier, F. S., Lieberman, G. J. (2014). Introduction to Operations Research. 10th ed. McGraw Hill.

1.2 Prerequisites

- EGN 3448 Operations Research.

1.3 Course Schedule (by topic)

Week	Topic	Assessment
1 - 3	Review of mathematical programming and optimization	Homework
4 - 7	Transportation and Assignment Models	Homework, Exam
8 - 12	Network Models	Homework, Exam, Project
13 - 15	The Traveling Salesperson Problem	Homework
16	Final Exam	

Table 1: Tentative course schedule by topic.

1.4 Assessment and Grading Policy

There will be 5 to 8 homework assignments throughout the semester. The homework assignments are worth 10% of the final grade. The lowest assignment grade will be dropped.

There will be 3 exams throughout the semester, one of which will be a **cumulative final exam given during the finals week**. The final exam is worth 30% of the total grade. The other two exams will be given during regular class hours and each one exams is 20% of the total grade.

A breakdown of the contribution of each assessment item to the final grade is presented in Table 2.

Assessment method	Percentage of final grade	Total
Homework Assignments	10%	10%
Exam 1	15%	25%
Exam 2	15%	40%
Course project	30%	70%
Final Exam	30%	100%

Table 2: Percentage of each assessment method.

- **Grade appeals:** Appeals on assignment and exam grades should be sent to the instructor **in written format** (Canvas message or email) within **one week** from the date the grade is posted. In other words, you have to prepare a short argument (1 to 2 paragraphs) explaining why you think your grade is incorrect and send it to the instructor within 7 days from the date you receive your grade.
- **Homework submissions:** All assignments should be submitted through Canvas (no other submission format will be accepted). Students are responsible for ensuring that their assignments were **submitted correctly**. Students are also responsible for ensuring that the assignments are organized and legible. Penalties may be applied to incomprehensible assignments and extra points will be given to organized submissions.
- **Late submission 1:** You have **2 free late submission days** (no penalty for late submission) to use throughout the semester. You can use the 2 days for a single homework or you can use one day for one assignment and the other for another assignment.
- **Late submission 2:** Once the free late submission days are gone, each day of late submission will result in a 20% penalty (up to three late days; see the next item).
- **Late submission 3:** No submission will be accepted **after the third day past the deadline** (regardless of free late days). The submission page on Canvas will close three days after the deadline and you won't be able to submit the assignment after that, even if you choose to use all of your free late submission days.
- **Make-up exams:** Make-up exams will be allowed only in unique situations with appropriate documentation sent to the instructor by the appropriate University unit.

1.5 Grading Scale

The grading scale for this course is shown in Table 3.

Grade	**A**	**B+**	**B**	**B-**	**C+**	**C**	**D**	**F**
Percent (%)	90%	87%	83%	80%	77%	70%	60%	$< 60\%$
GPA	4.0	3.33	3.0	2.67	2.33	2.0	1.0	0.0

Table 3: Grade distribution according to grade letter, percentage, and GPA.

2 Course Policies

- **Communication:** General questions regarding assignment, schedule, lectures and everything related to the course should be sent through Canvas. The instructor will then share the question (anonymized) and the answer with all the students through Canvas.
- Questions regarding **special individual circumstances** should be sent to the instructor email address.
- **Communication responses:** I try to be very responsive **during week days**. Most of the times, I will be able to respond within a day. If I haven't replied in more than two days,

please feel free to reach out again. You should **not expect** me to reply immediately or during weekends and holidays.

- **Accessibility:** If you need any type of accommodation, please request accommodations through the appropriate channels (see Section 3.1) as soon as possible, so we can remove any unnecessary barriers to your learning right from the beginning of the semester.
- **In-class activity:** Student engagement is fundamental to effective learning. We will have a series of in-class and online (Canvas) activities.
- **Academic Integrity 1:** Discussions about assignment questions are allowed and encouraged, but each student **must submit their individual work**. Here are examples of **acceptable behavior**:

  1. Student A and Student B discuss potential methods to solve a question from a current assignment (high level discussion);
  2. Student A and Student B solve an example (not a Homework question) together.

  Here are examples of **unacceptable behavior**:

  1. Student B copies the solutions from Student A (both students are in violation of academic integrity policies);
  2. Student A and Student B solve a homework together.

  If you are not sure whether an action is in violation of academic integrity, **ask the instructor**. Any violations of academic integrity regulation will be reported to the Director of Student Affairs and the issue will be resolved between the student and the University representatives.
- **Academic Integrity 2:** The use of Large Language Models (LLMs) and Generative AI (ChatGPT and others) tools to solve assignments is a direct **violation of academic integrity**. These tools can be used to help students summarize concepts, but extra care should be observed when using these tools. The use of **Chegg** or any similar service is **prohibited**. The instructor will create all the assignment questions and will check whether these questions end up on Chegg and similar websites after the respective assignment is posted.

2.1 Expectations:

You can expect the **instructor**:

1. to be at the classroom on time for each lecture unless special circumstances prevents regular operations;
2. to announce any course updates in class;
3. to lead lectures, class discussions and activities as to guarantee that everybody can participate in a respectful and appropriate manner;
4. to respectfully answer students questions and to work with students to find information;

5. to clearly and fairly evaluate students learning;
6. to provide grades and return assignments in a timely manner.

Students are expected:

1. to attend class on time unless special circumstances occur;
2. to participate and ask questions during classes in a respectful manner;
3. to review posted materials before each class;
4. to allocate an appropriate amount of time each week to review lecture notes and work on assignments;
5. to ask questions regarding the lecture concepts or assignments problems that are not completely understood by the student;
6. to follow the academic integrity policies.

3 University Policies

3.1 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.edu/disability`.

3.2 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.)

3.3 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.

3.4 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.

3.5 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****.*

4 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/writingcenter.

5 Course and Program Learning Outcomes

5.1 Program Learning Outcomes (ABET PLOs):

At the time they graduate, Bachelor of Science in Industrial Engineering graduates should have the following program outcomes:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
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.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
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.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

5.2 Course Learning Outcomes (CLOs)

After successfully completing this course, students should be able

1. to model the operations of manufacturing and service systems in terms of advanced optimization problems (ABET PLOs: 1, 2, 4, 7);

2. to solve advanced optimization problems such as the generalized assignment problem, the transportation problem and network flow problems, and evaluate the solutions obtained (ABET PLOs: 1, 2, 6);

3. to develop specialized algorithms to solve advanced optimization problems (ABET PLOs: 1, 2, 6, 7).