EML 6364 – Optimal Control
Spring 2026

COURSE INSTRUCTOR

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YouTube Channel: https://www.youtube.com/user/anilvrao2

Teaching Assistant: Emily Palmer
Contact: Via Canvas

All contact methods are acceptable! Note for fastest response it is best to reach me on my mobile phone.

COURSE LOCATIONS AND CLASS PERIODS

Class Period: Tuesday 3:00 PM to 4.55 PM (Periods 8 and 9), Thursday 4.05 PM to 4.55 PM (Period 9). Attendance is expected.
Lecture Room: NEB 100
Online Videos: Class will be recorded via UF EDGE
Office Hours: MWF 2:00 PM to 3:00 PM (As Needed — In Person). Evenings MWF 7:00 PM to 8:00 PM/As Needed — Remote Students)
Office Hours Zoom Link:
- Meeting ID: 998 1802 4382
- Click here for Zoom link or copy and paste the following URL into your browser: https://ufl.zoom.us/j/99818024382.

CATALOG DESCRIPTION

Calculus of variations, calculus of variations applied to optimal control, nonlinear optimization, numerical Methods for optimal control

PREREQUISITES

Differential and integral calculus, ordinary and partial differential equations

COURSE OBJECTIVES

- Develop the fundamentals of calculus of variations
- Develop fundamentals of optimal control theory using calculus of variations
- Introduce major numerical methods for solving constrained optimal control problems

IMPORTANT NOTE

I consider it an honor and a privilege to be able to teach all of you, and I intend to provide the best instruction possible in order to enable you to learn the material well. If you cannot make office hours, please contact me and we will set up a time for you to get help. Regardless of how busy I am with other things, I will do what I am able to make myself available.

APPROXIMATE SCHEDULE FOR MATERIAL

Topic	Material Covered	Schedule
Review of Minima and Maxima of Functions	Optimization of Function of One Variable	Week 1
Calculus of Variations	Develop Theory of Calculus of Variations	Weeks 2 and 3
Calculus of Variations Applied to Optimal Control Problems	Optimality Conditions, Linear Quadratic Control, Pontryagin's Minimum Principle, Bang – Bang Optimal Control, Singular Arcs	Weeks 4 through 8
Nonlinear Optimization	Unconstrained and Constrained Finite-Dimensional Optimization	Week 9
Numerical Methods for Optimal Control	Indirect Methods and Direct Methods	Week 10 through 13

OFFICE HOURS

Anil Rao (Instructor): Monday and Wednesday 3:00 PM to 5:00 PM
Location: Reitz Union Food Court

Emily Palmer (Teaching Assistant): TBD
Location: Zoom

Note: If for some reason you are unable to make my office hours, you can always schedule an appointment at a time that is mutually agreeable to both you and I.

OFFICE HOURS

Name	Times	Meeting Location and Contact
Anil V. Rao (Instructor)	MWF 3:00 PM to 4:00 PM	Zoom: https://ufl.zoom.us/j/92338141900 (Meeting ID: 923 3814 1900) anilvrao@ufl.edu

PERSONAL HOURS

I have found that often students want to talk with me about topics other than the course. Sometimes it is just to get career directions and advice, other times to find out about opportunities to work in my research group as an undergraduate or graduate student. Because students would like to have conversations on such topics (and other topics), each week I will hold what I call "personal hours". If you are interested in just having a conversation with me that is not specific to the course material, please join me for personal hours. I will try to make these hours actual in person hours because I feel it is the best way to have non-technical conversations. As a result, I will hold personal hours in the Reitz Union food court.

Personal Office Hours Times	Meeting Location
Friday 4:00 PM to 5:00 PM	Reitz Union Food Court (Next to Starbucks)

Note: I am happy to schedule other times for personal meetings about topics not related to the course. Please feel free to ask.

TEXTBOOK

Kirk, D. E., *Optimal Control Theory: An Introduction*, Dover Publications, 1970.

HOMEWORK ASSIGNMENTS

The assignments for this class are posted on the Canvas site for the course on E-Learning. Below is a list of these assignments.

Assignment
Assignment #1
Assignment #2
Assignment #3

COURSE PROJECT

One of the key assignments in this class is a course project. The project can be found by clicking here. The instructions are as follows. Choose two optimal control problems, one from the "elementary" optimal control problems list and one from the "advanced" optimal control problems list. For the problem you choose from "elementary" list you must formulate the complete set of first-order optimality conditions for your problem using the calculus of variations. You must then solve your problem using an indirect numerical method and a direct numerical method that we have studied in the course. Next, for the problem you choose from "advanced" list you must choose a single method (indirect or direct but not both). You must then analyze the quality of your solution. In your analysis, consider the following questions. Can you determine the proximity of your numerical solution to the "true" optimal solution. If you are unable to ascertain how close your solution is to the true optimal, how do you know you have obtained a reasonable approximation? What is the computational efficiency of the methods you applied to solve your problem? What are the limitations of the methods you have chosen on your problem. Given your analysis, what numerical method would you seek in order to overcome the deficiencies you found with the methods you chose? **It is highly recommended that you now wait until the last minute to think of a problem for your project! The course project is due on the last day of class. Click here to download a copy of the course project.**

ATTENDANCE RULES

Regular attendance is expected of all students.

CHEATING

Cheating of any kind in this course will be enforced in accordance with the university rules. Any violation of any kind (even something as simple as a single line of code that is identical in the homework of two students) will automatically result in an "E" in the course and will reported as appropriate to the Dean of Students Office.

MAKE-UP POLICY

Because all assignments in this course are not time limited (in the same manner as that a usual in-class exam), make-ups will be provided on a case-by-case basis. If you have an issue (illness, other urgent matter), please discuss it with me and we will work to find a fair and reasonable solution.

COURSE GRADING

Item	Point Value
Homework Assignments	30
Midterm Exam	30
Project	40
Total	**100 Points**

GRADING SCALE

Grades in this course are determined using the following scale:

Letter Grade	Score Range
A	95 and Above
A–	90 to less than 95
B+	85 to less than 90
B	80 to less than 85
B–	75 to less than 80
C+	70 to less than 75
C	65 to less than 70
C–	60 to less than 65
D+	55 to less than 60
D	50 to less than 55
D–	45 to less than 50
E	Less Than 45

NOTES ON ASSIGNMENT OF FINAL LETTER GRADES

- The grading scale posted above is not flexible.
- Any score on the boundary between two ranges will receive the higher grade (for example, a 94 receives a grade of "A-").
- Finally, it is noted that while your individual scores for assignments, exams, and quizzes will be posted on E-learning (Canvas), the Canvas portal may not accurately reflect a student's relative standing in the class. Regardless of the information that is seen in Canvas, computation of final grades will be based on the criteria set forth above and a student's grade will only be final when grades have been computed at the end of the semester.

IMPORTANT NOTE: Any assignment either not submitted or not completed with a good-faith effort (where the judgment of "good faith effort" rests wholly with me) will result in a full letter grade deduction in the course. For example, if the final score falls into the category of an "A–" and one homework or quiz is not submitted or is deemed to not have been performed with a good faith effort, the final grade will be a "B–". This policy is not flexible.

ACADEMIC POLICIES AND RESOURCES

To support consistent and accessible communication of university-wide student resources, instructors must include this link to academic policies and campus resources: https://go.ufl.edu/syllabuspolicies. Instructor-specific guidelines for courses must accommodate these policies.

COMMITMENT TO A POSITIVE LEARNING ENVIRONMENT

The Herbert Wertheim College of Engineering values varied perspectives and lived experiences within our community and is committed to supporting the University's core values.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:
- Your academic advisor or Graduate Coordinator
- HWCOE Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
- Pam Dickrell, Associate Dean of Student Affairs, 352-392-2177, pld@ufl.edu