

## Syllabus for PHYS 481 (Section 1) Physics Problem Solving – Fall 2021

**Class Location / Times:** M, 6:00-8:00 PM, RITA 363

**Instructor Information:** Dr. Mike Larsen

**Phone:** 843-327-2372

**Instructor Email Address:** LarsenML@cofc.edu

**Office Location:** RITA 317

**Pre- or Co-requisite:** PHYS 370 or ASTR 377

**Course Webpage:** [http://larsenml.people.cofc.edu/phys481\\_fall121.html](http://larsenml.people.cofc.edu/phys481_fall121.html)

(Please see course page for full description of course, rationale, and supplementary information).

**Course Texts:** None

**Office Hours:** Mondays 2-3 PM, Tuesdays 8:30-9:30 AM, and Thursdays 9:30-10:30 AM or by appointment. Office hours will be predominantly handled through zoom unless scheduled otherwise. You can schedule a one-on-one zoom meeting time during the specified office hours by going to <http://www.calendly.com/mikelarsen> If you desire an in-person meeting or would like to schedule a zoom meeting at a different time, please contact me through the course Slack or through email and I will try to come up with a mutually agreeable time and a place to meet.

### Course Description

Physicists are problem solvers. Often, a full solution to a system is unnecessary to grasp the central elements of a problem. This course utilizes the basic tools of symmetry, limiting cases, scaling, and dimensional analysis to engage in problem solving exercises where speed is more important than a closed-form solution. In particular, we will be focusing on approaches that are helpful for success on the Physics Subject GRE examination.

**Attendance Policy** It is expected that you will attend class if you are healthy. I will. You are responsible for any material missed in classes you are unable to attend. Since this course doesn't have a unifying text, missing class could be more detrimental for this class than most. Given that we only plan to meet 10-11 times throughout the semester, missing more than 2 class meetings may negatively impact your grade.

**Plan for Course** As I write this syllabus, there are only 4 people signed up for this course and the hope is that – with such a low enrollment – we will all be able to stay safe and healthy throughout the semester. That being said, if multiple people in the class (and/or the instructor) has to quarantine or self-isolate for some time, we may have no choice but to pivot to an on-line (likely synchronous) format. Please contact me through email or the course slack if you will be unable to attend class and we will work through accommodations and adjustments on a case-by-case basis.

**Grading** Grades for this course will be based on the following components:

1. Participation (20%)

Developing a dialogue to understand and progress on your weaker areas is central to improvement. The skills to be developed in this course rely on practice which will include carefully designed dialogue between students and the instructor. The instructor uses counter-examples to demonstrate how the central tools used in this course (symmetry, limiting cases, scaling, and dimensional analysis) apply to each problem. Since each problem applies these ideas in slightly different ways, students need to be present for and actively engage in these discussions to develop an understanding of the course content.

2. Completion and Self-Evaluation of 6 Sample GRE Exams (60% total)

Each of the 6 Sample GRE exams is 100 questions, which the student has 2 hours and 50 minutes to answer. The completion of these tests will, thus, take a total of about 17 hours (outside of class). Students will be expected to also write a brief (1-2 paragraph) reflection on each sample testing experience.

3. Preparation and Presentation of Fermi Problem (20%) Each student will be tasked with preparing and presenting a professional solution to a so-called “Fermi Problem”. The presentations will include the prepared Fermi Problem (70%) and a solution of an extemporaneously posed problem (30%). Presentations will be graded for clarity, accuracy, and appropriate use of skills developed in the class. The prepared presentation will be expected to be approximately 5-10 minutes in duration, and include pre-prepared audio-visual aids.

**Grading Scale** The grading scale applied to this class will be:

A	91-100	B-	80-81	D+	69-70
A-	90-91	C+	79-80	D	61-69
B+	89-90	C	71-79	D-	60-61
B	81-89	C-	70-71	F	<60

## Required Objectives and Outcomes Statements

In order to meet assessment requirements, it is necessary to include course objectives and learning outcomes for every course. Here they are for this course.

### Course Objectives

1. Broadly review basic content from introductory and intermediate-level Physics courses.
2. Discuss the nature of the Physics Subject GRE test including the purpose of the exam, deadlines (including how they relate to graduate school application timetables), test-taking strategies, and the exam format (including topics covered).
3. Discuss and practice applying the basic tools of symmetry, limiting cases, scaling, and dimensional analysis to a variety of standard undergraduate-level Physics problems, including problems in areas where students have had little or no previous formal instruction.
4. Collaboratively work through problems on retired GRE examinations by combining previous Physics knowledge with skills developed in this course.
5. Solve so-called “Fermi Problems” collaboratively and individually.

### Learning Outcomes

1. Successful students will demonstrate substantial improvement in sample Physics subject GRE test performance.
2. Successful students will be able to professionally present solutions to both pre-prepared and extemporaneous “Fermi Problems”
3. Successful students will be able to identify their own personal areas of weakness on GRE-type tests to help target their studying patterns for subject GRE and Major Field Test assessments.
4. Successful students will be able to discard incorrect proposed solutions to complex physics problems by using symmetry, limiting cases, scaling, and dimensional analysis.

## Required Syllabus Statements

The university requires us to include some standard (so-called “boilerplate”) text into all syllabi. Since you presumably see the same text in all of your classes, I have grouped these statements together.

### **Honor Code and Academic Integrity**

Lying, cheating, attempted cheating, and plagiarism are violations of our Honor Code that, when suspected, are investigated. Each incident will be examined to determine the degree of deception involved.

Incidents where the instructor determines the student’s actions are related more to misunderstanding and confusion will be handled by the instructor. The instructor designs an intervention or assigns a grade reduction to help prevent the student from repeating the error. The response is recorded on a form and signed both by the instructor and the student. It is forwarded to the Office of the Dean of Students and placed in the student’s file.

Cases of suspected academic dishonesty will be reported directly by the instructor and/or others having knowledge of the incident to the Dean of Students. A student found responsible by the Honor Board for academic dishonesty will receive a XXF in the course, indicating failure of the course due to academic dishonesty. This status indicator will appear on the student’s transcript for two years after which the student may petition for the XX to be expunged. The F is permanent.

Students can find the complete Honor Code and all related processes in the *Student Handbook* at <http://studentaffairs.cofc.edu/honor-system/studenthandbook/index.php>

### **Students with Disabilities**

The College will make reasonable accommodations for persons with documented disabilities. Students should apply at the Center for Disability Services/SNAP located on the first floor of the Lightsey Center, Suite 104. Students approved for accommodations are responsible for notifying your professor as soon as possible and subsequently contacting your professor again at least one week before any specific accommodation is needed.

### **Oaks**

OAKS, including Gradebook, will be used for this course throughout the semester to provide the syllabus and class materials and grades for each assignment, which will be regularly posted.

### **Continuity of Learning**

Due to social distancing requirements, this class will include a variety of online and technology enhanced components to reinforce continuity of learning for all enrolled students. Before the drop/add deadline, students should decide whether the course plan on the syllabus matches their own circumstances.

### **Recording of Classes**

Class sessions will be recorded via both voice and video recording. By attending and remaining in this class, the student consents to being recorded. Recorded class sessions are for instructional use only and may not be shared with anyone who is not enrolled in the class.

### **Inclement Weather, Pandemic, or Substantial Interruption of Instruction**

If in-person classes are suspended, faculty will announce to their students a detailed plan for a change in modality to ensure the continuity of learning. All students must have access to a computer equipped with a web camera, microphone, and internet access. Resources are available to provide students with these essential tools.

### **Mental and Physical Wellbeing**

At the college, we take every students' mental and physical wellbeing seriously. If you find yourself experiencing physical illnesses, please reach out to student health services (843-953-5520). And if you find yourself experiencing any mental health challenges (for example, anxiety, depression, stressful life events, sleep deprivation, and/or loneliness/homesickness) please consider contacting either the Counseling Center (professional counselors at <http://counseling.cofc.edu> or 843-953-5640 3rd Robert Scott Small Building) or the Students 4 Support (certified volunteers through texting "4support" to 839863, visit <http://counseling.cofc.edu/cct/index.php>, or meet with them in person 3rd Floor Stern Center). These services are there for you to help you cope with difficulties you may be experiencing and to maintain optimal physical and mental health.

### **Food and Housing Resources**

Many CofC students report experiencing food and housing insecurity. If you are facing challenges in securing food (such as not being able to afford groceries or get sufficient food to eat every day) and housing (such as lacking a safe and stable place to live), please contact the Dean of Students for support (<http://studentaffairs.cofc.edu/about/salt.php>). Also, you can go to <http://studentaffairs.cofc.edu/student-food-housing-insecurity/index.php> to learn about food and housing assistance that is available to you. In addition, there are several resources on and off campus to help. You can visit the Cougar Pantry in the Stern Center (2nd floor), a student-run food pantry that provides dry-goods and hygiene products at no charge to any student in need. Please also consider reaching out to Professor Larsen if you are comfortable in doing so.