**Courses:** General University Physics
PHYS 122MA
Spring 2003
MTuWF 10:00

Instructor: Greg Elliott
Office: Thompson 105
Phone: 879-2800
E-mail: gelliott@ups.edu

Multivariate Calculus
MATH 221PH
Spring 2003
MTuWF 11:00

Instructor: Martin Jackson
Office: Thompson 325
Phone: 879-3567
E-mail: martinj@ups.edu

**Course Web Page**

Web pages for this course are located at
`www.math.ups.edu/~martinj/courses/spring2003/m221ph122/m221ph122.html`
You can get to this page by following links at either `www.math.ups.edu/~martinj` or `www.ups.edu/physics/faculty/elliott`. Assignments will be listed and class handouts will be available to download as PDF files. Scores for assignments and exams will be posted by codeword for those who wish. If you want your scores to be posted, send us an e-mail to tell us the codeword you want to use.

**Course Overview and Text**

These sections of PHYS 122 and MATH 221 are team taught as a combined course. All students must be enrolled in both courses. The text for this course is Volume Two of *Integrated Physics and Calculus* by Andy Rex and Martin Jackson.

As a prerequisite for this course, students must have an understanding of the fundamental ideas taught in the first and second semesters of the calculus and the first semester of the physics sequences. On the mathematical side, the main theme in the course is extending the ideas of calculus to functions which have vector inputs and either scalar outputs or vector outputs. On the physics side, these types of function appear in the study of three important forces: gravitational, electric, and magnetic.

Students who take separate physics and calculus courses find many points of contact between the two fields. Physics relies on calculus as a tool or language for precise quantitative description of the natural world. Describing the natural world provided motivation for the developers of calculus, notably Newton. Our idea in this combined physics and calculus course is to enrich both subjects by emphasizing the many connections.

MATH 221 satisfies the Mathematical Reasoning category in the University Core Requirements. In successfully completing the calculus course, you should come to further appreciate the power of mathematics and formal methods in providing a way of understanding a problem unambiguously, describing its relation to other problems, and specifying clearly an approach to its solution. You should develop a variety of new mathematical skills and increase your understanding of formal reasoning. Specifically, in successfully completing this mathematics course, you should understand the differential and integral calculus of multivariate functions and the basics of vector analysis.

PHYS 122 satisfies one unit of the Natural World category in the University Core Requirements. In successfully completing this physics course, you should learn to observe the material world around us through the eyes of a physicist , define appropriate questions about the physical world, develop an approach to solving complex problems, apply the scientific method, and communicate orally and in writing about physics. In addition, you should be

prepared for advanced courses in physics and a better educated voter with technical and scientific knowledge. Specifically, in successfully completing this physics course you should be able to describe and define electric charges, electric fields, and electric potentials and electric currents, magnetic fields, and vector potentials and use them to describe and to explain observable electromagnetic phenomena; apply Maxwell's equations to determine capacitance, resistance, and inductance; and analyze electromagnetic behavior in DC circuits that include capacitors, resistors, and inductors.

**Office Hours**

Each of us will be available in our office on a drop-in basis at specific office hours each week. Consult our individual web pages for the office hours we have scheduled.

We are also happy to meet at any other time we can arrange. Feel free to stop us after class or call to find a mutually acceptable time. You are also welcome to contact us by e-mail.

**Grading, Coursework, and Policies**

We will assign one grade for the combined course. This grade will be recorded for both PHYS 122and MATH 221. Grades will be based on a percentage of the points you earn on coursework with points weighted according to the following:

| | |
|---|---|
| 1. Homework and projects | 40% |
| 2. Exams | 40% |
| 3. Laboratory work | 10% |
| 4. Final exam | 10% |

We assign a preliminary course grade based on this objective standard. We then look at each student's performance subjectively. Occasionally we will assign a course grade that is higher than the objective standard. For example, if a student has a grade of B according to the objective standard but has shown steady improvement, we might assign a course grade of B+.

We will assign homework problems from the textbook on which we expect you to spend considerable time and effort. We will discuss homework problems daily in class. You will benefit most from these discussions if you have worked on the assigned problems. A selection of homework problems will be regularly collected and evaluated.

You will be working on a take-home project periodically. We try to write project problems that are interesting and challenging. These problems can be open-ended in the sense that there is no one best solution. We will expect your results will be written up with complete sentences to guide a reader through the work (see below for more specific comments on writing style). We encourage you to work on the projects in small groups. If you do work on a project with others, you must do your own write-up of the results. The write-up should include the names of those with whom you worked.

Exams will be given approximately every three weeks. We will announce each exam date about one week in advance. We will give a make-up exam only if you make arrangements with us prior to the time of the exam. We write exams so that approximately half of each exam is "straightforward" and the remainder involves more challenging problems. By this, we intend that a well prepared student can do the "straightforward" problems without hesitation but will often or always have to struggle with the challenging problems.

Detailed information on labs will be given during the first lab session.

The final exam will be comprehensive. It is scheduled for 4:00-6:00 p.m. on Monday, May 12 *and* 8:00-10:00 a.m. on Tuesday, May 13.

**Attendance Policy**

We expect you will come to class every day. We do not take attendance, but in a class of this size we usually notice when someone is not here. Attending class helps enormously in learning physics and calculus. Class time is often used to (1) discuss new ideas, (2) work on example problems, (3) give hints on assignments, and (4) go over assigned problems. If you have to miss a class for any reason, professors generally appreciate it if you let them know why you will be missing, in advance if possible.

If you will be absent on an exam date, you must let us know well in advance. Students absent from campus on an exam date because they are representing the University in music, athletics, forensics, etc. can arrange to take the exam before leaving campus.

**Policy on Late Work**

Our policy is to accept no late work unless there are exceptional circumstances. Examples of exceptional circumstances are (1) a serious, extended illness and (2) a family emergency. Other circumstances can be considered on a case-by-case basis. Generally, permission to hand in late work should be *obtained in advance of the due date* from one or both professors. If you wake up and feel too sick to come to class the day an assignment is due, simply have someone else hand in your assignment for you.

**Reading and Writing Expectations**

Developing an ability to read and understand a technical piece of writing is one of our primary goals for students taking this course. This skill is fundamental not only for those of you who wish a career in science but also for those who wish to be a well-rounded member of society. Hence, careful reading of the texts is an integral part of this course. We recommend you make multiple readings of the material as practice toward the goal of quickly grasping technical material.

It is best to think of the weekly projects as officially assigned papers in which you completely explain your analyses of the problem(s). At the very least your project should be

- In ink or written on a word processor with the names of any collaborators cited on the first page.
- Written using complete, accurately punctuated sentences.
- Presented in the first person and with a clear, easy-to-follow expository style.
- Targeted at an audience consisting of students not in this class but with an equivalent mathematical background.

Since most of you are either science or mathematics majors, you might consider using a word processor to write your papers. Reasonable technical word processors that also have symbolic manipulation packages include: *Scientific Notebook*, *Mathematica*, *MathCad*, and *Matlab*.