PHYS 3343
Mathematical Methods in Physics
Spring 2004
Class Location: LSC 110
Class Time: 8:00 - 8:50 MWF
Dr. Stephen R. Addison
Office: LSC 169
Telephone: 450-5900
E-mail: saddison@mail.uca.edu
Web Page: http://faculty.uca.edu/ saddison/

TEXT: *Essential Mathematical Methods for Physicists,* Hans J. Weber and George B. Arfken, Elsevier ACADEMIC PRESS, Boston 2004.

Over the years, I have used many different textbooks for this course, you can find out which ones by consulting the course home page. While this is the main book that I will use, I will use many others. A list of books that I will refer to is on the course home page. This list contains other general books on mathematical methods in physics and specialized references for particular sections.

While our text is a good one, you will find it useful to become familiar with books at higher and lower levels. Remember —your goal is to master mathematical methods that will be used in subsequent courses, not the contents of any particular book.

CATALOG DESCRIPTION: A study of vector calculus, matrices, complex variables, series solutions to differential equations, special functions, and other areas of mathematics that are important for physics. Emphasis in all areas is placed on problems encountered in physics and their solutions. Lecture. Prerequisites: PHYS 1442 or 1420 and MATH 2371, 3320. Spring.

COURSE GOALS: This course is designed to develop students' mathematical skills and understanding in areas appropriate for advanced study in physics. Students will also learn to formulate physical phenomena in mathematical terms. Where appropriate students will also be introduced to appropriate numerical and symbolic tools to deepen their understanding and to enable them to investigate complex phenomena. The underlying idea is that mathematics is a tool — a tool that can be mastered with practice.

This philosophy of mathematics as a tool can be thought of as "plumbing with functions" — we will begin with basic ideas and concepts and then lay out the tools. We will emphasize visualization and geometric insight, and we will often find that there are many ways to solve our problems. Topics covered will include vectors and an introduction to tensors, linear algebra, series, functions of a complex variable, and differential equations. We will emphasize mathematics that is physically useful throughout.

WEB PAGE: I have established a web page for the course. You should check it frequently. It will contain information that will aid your studies in this course. In addition all assignments and their solutions will be posted on the web page. Assignments will also be announced in class. Solutions will ordinarily be distributed only through the web site.

EXPECTATIONS: Students are expected to

- Attend all classes
- Complete all assignments
- Take exams and turn in assignments as scheduled
- Ask about material they dont understand
- Actively participate in the class

ATTENDANCE POLICY: I expect you to attend all classes. If you know that you will be missing a class, you should discuss it with me before a class is missed. If you miss a class without prior arrangement you are required to provide me with a written explanation. Students who are excessively absent will be dropped for non-attendance. A written warning will be provided to any student who is in danger of being dropped for non-attendance.

PUNCTUALITY: I will be on time for class, and will be ready to start at 8:00 and I will finish promptly at 8:50 every day. Lateness and/or early departures will not be tolerated.

OFFICE HOURS: I am usually in my office from 7:30 to 4:30. You can see me if I am available. If I am not available, my secretary will make an appointment for you. You can also call my secretary at 450-5900 to schedule an appointment. As our class is at 8:00 am on MWF, I will not usually be available for consultations before class. In particular, I will not address questions about assignments on the day they are due — I expect you to budget your time, and consult me when you have enough time to benefit from the consultation.

GRADING SYSTEM: Grades will be determined using the following:

- Three or four 100-point tests
- A 200-point, comprehensive final
- Approximately 100 homework problems worth 1 to 10 points each
- A project worth 100 points (see below)

Tests will include problems, derivations of key equations, numerical computations and short essays. Homework problems will be numbered sequentially throughout the course. Assignments will explicitly state the point value of each problem. Problems will be taken from our text, and from a variety of other sources. Assignments will involve analytical and numerical solutions, and written assignments. Assignments that involve computers can be performed using any common language. I will make arrangements for you to have access to computers containing MATLAB and other numerical and computer algebra systems. I will use MATLAB and occasionally MAPLE in class. Some assignments requiring computation could be performed on a TI-92 calculator. However, if you have relied on a TI-92 to do calculus, you are going to find that it will frequently fail on the functional manipulations that we will be learning. Be warned that an incorrect answer copied

from a calculator will not earn much in the way of partial credit — you must learn to think about physical situations in mathematical terms.

Points earned throughout the course will be converted to a percentage. Grades earned will be determined by the following scale:

A	90 +
B	80-89
C	70-79
D	60-69
F	0-59

PROJECT: You will each develop a project that will expand on the material of the course. This project can be theoretical or computational. All students will work on different projects. Your choice of project must be approved. I will be posting suggestions on the course web page; however, your project can be on any subject where mathematical methods introduced in the course are used to solve physical problems. Point values, and due dates are provided below. The Physics Teacher and the American Journal of Physics are good sources of suitable projects. Your final goal is to produce a report of approximately 5 pages in length. The report must be produced on a computer and be in the style of the American Journal of Physics.

Prospectus (one page) with references (at least 3 required, copies of the first page of each reference must be attached to the prospectus). (15 points – Due February 16)

Progress Report : (30 points – Due March 19) This will be a rough draft of your complete project, detailing what you have done but not necessarily containing all your conclusions.

Oral Presentation: (15 points – May be given any time after the Progress Report)

Written Report: (40 points – Due by April 12)

Additional details about the nature of these assignments and some options will be discussed throughout January.

COMPUTER ACCESS: Account will be provided on the departmental LINUX laboratory, we will also remotely access some systems in the Department of Computer Science. Most tasks can be accomplished using your own computers or using those computers to access servers on campus. Some support for installing appropriate packages on your own machines will be provided. Orientation sessions will be held for students unfamiliar with particular packages. There will be an orientation for all students on the UNIX/LINUX family of operating systems.

ACADEMIC INTEGRITY: Plagiarism, copying from others on tests, the use of unauthorized materials on tests (cheat sheets, programmed calculators, text messaging, etc.), or any other form of academic misconduct will not be tolerated. Penalties for academic misconduct are described in the UCA Student Handbook. Penalties can include grade reduction on an assignment, or in a course, and can extend be expulsion from UCA. Further details about penalties and procedures are described in the UCA Student Handbook.

All that having been said, science is an essentially collaborative endeavor so you are encouraged to collaborate and to seek help from other students to complete your assignments, but the final

write-up should be your own. If you do obtain help, you should acknowledge it. Such an acknowledgement will not lower your grade. Tests, either in class, or take home, **MUST** be entirely your own work.

AMERICANS WITH DISABILITIES: The University of Central Arkansas adheres to the requirements of the Americans with Disabilities Act. If you need an accommodation under this Act due to a disability, contact the UCA Office of Disability Services at 450-3135. In addition, I ask that you confer with me so that we can make appropriate arrangements for any required accommodation.

GENERAL POLICIES IN THE STUDENT HANDBOOK: Students are expected to be familiar with the general policies of the university. I encourage you to read the UCA Student Handbook where these policies are described. For your convenience, I provide some page references.

Academic Policies (beginning on page 36 of the 2003-2004 Student Handbook) Sexual Harassment Policy (page 107 of the 2003-2004 Student Handbook)