PHYSICS 306
MATHEMATICAL METHODS IN PHYSICS

TUESDAYS AND FRIDAYS, 10AM IN SCP-121

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COURSE DESCRIPTION

3 Lecture Hours
Prerequisites: PHY 202, MAT 128

A study of the mathematical methods used by experimental and theoretical physicists to solve a variety of physical problems. Topics include complex numbers, multiple integrals, curvilinear coordinates, matrix algebra, vector and tensor calculus, Fourier analysis, ordinary and partial differential equations, boundary value problems, special functions and advanced numerical techniques. Mathematica and/or Fortran will be used for algebraic and numerical computations.

COURSE MATERIALS

Required Text:

***Mathematical Methods in the Physical Sciences**, Mary Boas, Wiley & Sons, 3rd Edition, 2006.*
ISBN 13 978-0-471-19826-0

Access to Mathematica and Matlab is available through the campus network of shared applications. If you anticipate working extensively on course assignments from off-campus, student liscences to these two software packages would be very useful.

Course assignments, solutions, and any schedule changes will be discussed in class and posted on SOCS.

COURSE REQUIREMENTS

Course readings will be assigned on a bi-weekly basis in conjunction with problem set assignments. Familiarity with these readings and sample problems therein will greatly aid in facilitating classroom discussion.

Classroom participation will be an essential portion of the course. Mathematics inherently lends itself to lectures, but the course will also make heavy use of interactive sample problem solving, utilizing both manual and computational techniques. Contributions to these exercises and questions of clarification are strongly encouraged and will contribute to course grades.

Over the course of the semester, 7 problem sets will be assigned at approximately 2 week intervals. These assignments will consist of problems requiring both longhand and computational solutions. The problems are an essential portion of the course and will help prepare students for the 3 examinations. Students can anticipate that these problem sets will require the most signficant investment of time for the course.

Three exams will be held during the semester and one final examination will be held.

COURSE PURPOSE & LEARNING GOALS

This Mathematical Physics course is meant to serve as a stepping stone toward advanced topics in physics. Mastery of the techniques developed in this course will be critical for success in upper-division core and elective courses. As you have undoubtedly noticed, many of the topics covered in this course (i.e. Linear Algebra, Multivariable Calculus, Differential Equations) are also to be found among the course offerings in the Math department. The distinction between those courses and PHY306 lies in both scope and perspective. Because PHY306 is a one-semester course, we will be unable to develop as much detail or theoretical context as is provided in Math department courses. For this reason, it is strongly advised that this course not be viewed as a replacement for the 3 math coures listed above, but rather as a supplement. This is most especially true for physics students considering graduate programs of any nature. While PHY306 provides sufficient mathematical backgroud for further study in physics, additional mathematics courses will provide tremendous benefit. We will approach study in this course from a practical perspective; where possible, we will focus on problems and applications that find repeated emphasis in physical problem solving. To this end, we will include computational analysis and problem solving that is driven by real data and includes applications that you are likely to encounter again in classical mechanics, thermodynamics, electricity and magnetism, and quantum mechanics.

TENTATIVE COURSE SCHEDULE: THIS IS ONLY AN INITIAL SCHEDULE AND IS SUBJECT TO CHANGE AS NEEDED. CHANGES WILL BE ANNOUNCED IN CLASS AND POSTED ON SOCS.

Week #	***Tuesday***	***Friday***
Week 1: Power Series	*8/31—introductions*	*9/3*
Week 2: Complex Numbers	*9/7 – no class, Mon. schedule*	*9/10*
Week 3: Linear Algebra	*9/14 PS 1 due*	*9/17*
Week 4: Linear Algebra	*9/21*	*9/24 PS 2 due*
Week 5: Partial derivatives	*9/28 Exam 1*	*10/1*
Week 6: Multivariable integration	*10/5*	*10/8 PS 3 due*
Week 7: Multivariable integration	*10/12*	*10/15*
Week 8: Vector Analysis: Grad, Div, and Curl	*10/19—(No Class, Fall Break)*	*10/22 PS 4 due*
Week 9: Vector Analysis: Grad, Div, and Curl	*10/26 Exam II*	*10/29*
Week10: Fourier Series and Transforms	*11/2*	*11/5 PS 5 due*
Week 11Fourier Series and Transforms	*11/9*	*11/12*
Week 12: Ordinary Differential Equations	*11/16*	*11/19 PS 6 due*
Week 13:Special functions	*11/23 Exam III*	*11/26—(no class,Thanksgiving)*
Week 14:Partial differential equations	*11/31*	*12/3*
Week 15:Partial differential equations	*12/7*	*12/10 PS 7 due*
Exam Week	*Date TBA (Dec. 14-17th)*	

GRADING

Three mid-semester exams:	15% per exam x 3exams
Problem sets:	5% per set x best 6 sets
Classroom participation:	5%
One final exam:	20%

Assignment and course grades will not be curved.

Final course grades are based on the following scale, with composite scores rounded to the nearest whole percent.

93-100	A
90-92	A-
88-89	B+
83-87	B
80-82	B-
78-79	C+
73-77	C
70-72	C-
60-69	D
00-59	F

SELECTED TCNJ POLICIES

TCNJ's final examination policy is available on the web:
http://www.tcnj.edu/~academic/policy/finalevaluations.htm

Attendance
Every student is expected to participate in each of his/her courses through regular attendance at lecture and laboratory sessions. It is further expected that every student will be present, on time, and prepared to participate when scheduled class sessions begin. At the first class meeting of a semester, instructors are expected to distribute in writing the attendance policies which apply to their courses. While attendance itself is not used as a criterion for academic evaluations, grading is frequently based on participation in class discussion, laboratory work, performance, studio practice, field experience, or other activities which may take place during class sessions. If these areas for evaluation make class attendance essential, the student may be penalized for failure to perform satisfactorily in the required activities. Students who must miss classes due to participation in a field trip, athletic event, or other official college function should arrange with their instructors for such class absences well in advance. The Office of Academic Affairs will verify, upon request, the dates of and participation in such college functions. In every instance, however, the student has the responsibility to initiate arrangements for make-up work.

TCNJ's full attendance policy is available on the web:
http://www.tcnj.edu/~recreg/policies/attendance.html

Academic Integrity Policy
Academic dishonesty is any attempt by the student to gain academic advantage through dishonest means, to submit, as his or her own, work which has not been done by him/her or to give improper aid to another student in the completion of an assignment. Such dishonesty would include, but is not limited to: submitting as his/her own a project, paper, report, test, or speech copied from, partially copied, or paraphrased from the work of another (whether the source is printed, under copyright, or in manuscript form). Credit must be given for words quoted or paraphrased. The rules apply to any academic dishonesty, whether the work is graded or ungraded, group or individual, written or oral.
TCNJ's academic integrity policy is available on the web:
http://www.tcnj.edu/~academic/policy/integrity.html.

Americans with Disabilities Act (ADA) Policy
Any student who has a documented disability and is in need of academic accommodations should notify the professor of this course and contact the Office of Differing Abilities Services (609-771-2571). Accommodations are individualized and in accordance with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1992.

TCNJ's Americans with Disabilities Act (ADA) policy is available on the web:
http://www.tcnj.edu/~affirm/ada.html .