PHY 4003/5013
MATHEMATICAL PHYSICS II
Spring Semester 2006
MW 5:45-7:00, Howell Hall 100

INSTRUCTOR: Dr. Weldon Wilson
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COURSE SYNOPSIS: This course is designed to introduce upper-level undergraduates and first-year graduate students to the advanced mathematical methods and tools needed for research and more advanced courses in physics, engineering, and other applied areas. The subject exposes the students to the level of mathematical sophistication required for graduate work. The main objective is to learn how to use some of the applied mathematics techniques that are useful to practicing physicists, engineers, and applied mathematicians. The course will present topics selected from vectors and tensor analysis, orthogonal functions, complex variables theory, Fourier series, integral transforms, boundary-value problems of partial differential equations, Green's function methods, and the calculus of variations. This course also introduces the students to the symbolic computing software Maple 10.

PREREQUISITES: PHY 3884 (Mathematical Physics I) or mathematics through MATH 3103 (Differential Equations) and consent of instructor is required. Students must have some familiarity with partial differentiation, multiple integrals, differential vector calculus (grad, div, curl, Laplacian), integral vector calculus (divergence and Stokes theorems), matrices and determinants, simultaneous linear equations, and complex numbers.

OFFICE HOURS: MWF 1:00-1:50; TR 10:30-11:20; Other times by mutual arrangement.

Official hours are as listed above, but I am usually around from 9-4 each day during the week whenever I am not teaching class. Please feel free to come by any time especially if you want to talk about physics or school. I would ask you, however, to avoid the hour just before I teach a class if at all possible.

TEXTBOOK: Mathematical Methods for Physicists, 6th Ed., by George B. Afrken and Hans J. Weber, (ISBN 0120598760, Academic Press, 2005).

SOFTWARE: The use of the symbolic computing software Maple 10 will be required in this course. Maple 10 will be used throughout the course and the homework exercises will require its use. This software is available on a number of machines in the mathematics and physics computer lab areas. You will probably find it more convenient to obtain your own copy of this software. I have made special arrangements with Maplesoft who has agreed to allow students enrolled in this course to obtain a license of Maple 10 for $75 which is substantially below the regular price. Details of how to obtain the software at this substantial discount will be provided in class.

HOMEWORK: Weekly homework assignments will be made and will generally consist of 5 to 10 problems designed to take approximately 10 hours of concentrated effort to complete.

WORKING TOGETHER: You are strongly encouraged to work together on your homework assignments. You will find that you learn the material more quickly while developing a deeper understanding by working with two or three classmates. This does not mean that you copy someone else's work, however. Since you will ultimately have to demonstrate how well you can independently set up and solve similar problems on your exams, you should work toward being able to do the problems on your own. Do not consult solution sets or another student?s work from any previous class. Always show your arguments, realizing that clarity and neatness count. Homework will be collected for grading at the **beginning** of class on the dates designated and should be placed in a stack at the front of the room as you enter class. Late homework will not be accepted.

Homework solutions should be neatly written on standard notebook-size (8.5 x 11) paper using **one side only**. Each problem should be started on a new page and the pages should be stapled together. For full credit, homework solutions should clearly state the basics principles used and fully explain all reasoning.

EXAMS: There will be a midterm and a final exam on the dates listed in the attached schedule. All exams will be comprehensive. Students who miss an exam should contact their instructor as soon as possible to schedule a makeup. Exams will consist of questions and problems similar to those assigned for homework. All exams will be open book and open note.

FINAL EXAM: A comprehensive final exam will be given on the scheduled date for this course — **Wednesday, May 3 @ 5:30-7:20 PM**. The final exam cannot be given early or late to accommodate individual schedules. By university policy, if a university emergency occurs that prevents the administration of a final examination, the students final course grade will be calculated based on the work in the course completed to that point in time and the faculty members considered judgment. In this event final exams will not be rescheduled, and a grade of I will not be given as a result of the missed exam.

GRADING: Homework (30%), Mid-term Exam (35%), Final Exam (35%).

$$A > 85\% \geq B > 70\% \geq C > 55\% \geq D \geq 40\% > F \ .$$

Students enrolled in PHY 5013 will have different tests and homework assignments and be graded on a separate scale from those enrolled in PHY 4003.

ATTENDANCE POLICY: My attendance policy is that I have none. I believe that my lectures will be informative and useful to you. However, if you choose not to attend that is your business. I strongly recommend that you find a way to attend class regularly and to be there on time. If you happen to miss a day, you are responsible for getting the notes, assignments, and announcements from someone else in the class.

COURSE WEB PAGE: Time permitting, I will be placing some lecture notes and other materials on our course web page at **www.physics.ucok.edu/wwilson/courses/mp2/** . You should check it often for announcements and other course related information.

ADA STATEMENT: The University of Central Oklahoma complies with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990. Students with disabilities who need special accommodations must contact the assistant director of Disability Support Services, Kim Fields, in room 309 of the Nigh University Center, (405) 974-2549. It is the student?s responsibility to contact the instructor as soon as possible after the DSS has verified the need for accommodations to ensure that such accommodations are implemented in a timely fashion.

STUDENT INFO SHEET: The UCO administration is now requiring the following attachment to all course syllabi. It can also be obtained online at
http://www.busn.ucok.edu/academicaffairs/FORMS/Student%20Information%20SheetSPR06rev.pdf

APPROXIMATE CLASS SCHEDULE

DATE	LECTURE TOPIC
M – Jan 9	Curvilinear Coordinates
W – Jan 11	Vector Operators in Curvilinear Coordinates
M – Jan 16	**NO CLASS – MLK HOLIDAY**
W – Jan 18	Gamma Function and Beta Function
M – Jan 23	Error Function and Ei Function
W – Jan 25	The Dirac Delta Function
M – Jan 30	Elliptic Integrals and Functions
W – Feb 1	"Review" of ODE Solution Methods
M – Feb 6	PDEs of Physics
W – Feb 8	PDE's/Separation of Variables
M – Feb 13	Series Solutions of ODEs; Legendre Functions
W – Feb 15	Properties of Legendre Functions
M – Feb 20	Legendre Functions Expansions
W – Feb 22	Associated Legendre Functions and Spherical Harmonics
M – Feb 27	Orthogonal Functions
W – Mar 1	**MIDTERM EXAM**
M – Mar 6	Sturm-Liouville Theory
W – Mar 9	Eigenfunction Expansions
T – Mar 13	**NO CLASS – SPRING BREAK**
R – Mar 15	**NO CLASS – SPRING BREAK**
M – Mar 13	Series Solutions of ODEs; Bessel Functions
W – Mar 15	Properties of Bessel Functions
M – Mar 20	Functions Related to Bessel Functions
W – Mar 22	Orthogonality of Bessel Functions
M – Mar 27	The Heat Equation
W – Mar 29	Solving the Heat Equation in Cartesian Coordinates
M – Apr 3	Solving the Heat Equation in Cylindrical Coordinates
W – Apr 5	Solving the Heat Equation in Spherical Coordinates
M – Apr 10	Tensors
W – Apr 12	Tensor Notation and Operations
M – Apr 17	Kronecker Delta and Levi-Civita Symbol
W – Apr 19	Applications of Tensors
M – Apr 24	Pseudo-vectors and Pseudo-tensors
W – Apr 26	Applications of Pseudo-tensors
W – May 3	**FINAL EXAM 5:30–7:20 PM**