PHY 7110 – Methods of Theoretical Physics II – Syllabus

Semester: Fall 2011

Lecturer:

Prof. ***Alexey A. Petrov***, Room 358 Physics Building,
Phone: 313-577-2739, or 313-577-2720 (for messages)
e-mail: apetrov@wayne.edu, Web: http://www.physics.wayne.edu/~apetrov/

Lecture Time/Room:

Lecture **Monday, Wednesday, Friday 9.35-10.30 am**, 177 Physics Building

Required Text: G.B. Arfken and H.J. Weber, Mathematical Methods for Physicists, (6^{th} edition, Elsevier/Academic Press).

Other Texts: P.M. Morse and H. Feshbach, Methods of Theoretical Physics I/II, J. Matthews and R.L. Walker, Mathematical Methods of Physics, etc.

Office Hours: Monday 10:30 – 11:30 pm or by appointment.

Grading: Your course grade will be determined by your performance in homework assignments, two Midterm Exams and a Final Exam on the basis of the following distribution.

Homework Projects (typically every week)	30%
First Midterm Exam	20%
Second Midterm Exam	20%
Final Exam	30%

The completed homework assignments are due at 5 pm on the date specified; typically one week after the assignment is given. **Late submissions will not be accepted.** Homework must include **explanatory text** and be **neatly written** or it will be given zero credit. The final exam will cover all the material of this course; however, there will be slight emphasis on material not covered by the first and the second midterm exams.

Course description and objectives:

This course provides an introduction to mathematical methods for theoretical physics. It includes topics in functions of complex variables, differential equations, Sturm-Liouville's theory, special functions, Fourier series and integral transformations.

Website: http://www.physics.wayne.edu/~apetrov/PHY7110/

Topics to be covered (approximate):

1. **Functions of a Complex Variable.** Complex algebra. Cauchy-Riemann conditions. Cauchy's Integral Theorem. Laurent expansion. Mapping. Calculus of residues. Dispersion relations. Method of steepest descents.
2. **Special Functions I. The Gamma function.** Definitions. Digamma and Polygamma functions. Stirling's series. The Beta function.
3. **Ordinary Differential Equations.** Separation of variables. Other topics.
4. **Sturm-Liouville Theory.** Self-adjoint ODEs. Hermitian operators. Gram-Schmidt orthogonalization. Completeness of eigenfunctions.
5. **Special Functions II.** Bessel functions. Neumann functions. Hankel functions. Spherical Bessel functions. Legendre functions. Hermite functions, etc.
6. **Fourier Series.** Applications and properties. Gibbs phenomenon, etc.
7. **Integral transformations.** Fourier integral. Momentum representation. Laplace transform. Inverse transforms.

The material discussed in class will approximately correspond to chapters 6-15 of Arfken & Weber's book. PHY 5100 or equivalent is a prerequisite for this course.

Final Grade:

The overall course grade will be determined on the basis of the following grading curve:

Grade	Cumulated Score	Grade	Cumulated Score
A	85-100	C	60-64
A-	80-84	C-	55-59
B	75-79	D	45-49
B-	70-74	D-	40-44
C+	65-69	F	0-39

Student Disability Services:

If you have a documented disability that requires accommodations, you will need to register with Student Disability Services (SDS) for coordination of your academic accommodations. The Student Disability Services (SDS) office is located at 1600 David Adamany Undergraduate Library in the Student Academic Success Services department. SDS telephone number is 313-577-1851 or 313-577-3365 (TDD only). Once you have your accommodations in place, I will be glad to meet with you privately during my office hours to discuss your special needs. Student Disability Services' mission is to assist the university in creating an accessible community where students with disabilities have an equal opportunity to fully participate in their educational experience at Wayne State University.

Please be aware that a delay in getting SDS accommodation letters for the current semester may hinder the availability or facilitation of those accommodations in a timely manner. Therefore, it is in your best interest to get your accommodation letters as early in the semester as possible.