Methods of Mathematical Physics (PHY 428)

Sera Cremonini

Instructor's Coordinates:

Office: Room 417, Physics Department
Phone: 8-3924
Email: cremonini@lehigh.edu
Office Hours: by appointment (email me to schedule a meeting time)

Course Information:

PHY 428, Fall 2016
Time: Tue, Thurs 10:45am-12 am
Location: Room 512, Lewis Lab (Physics)
Website: https://coursesite.lehigh.edu/

Course Description

This course covers a broad spectrum of analytical mathematical techniques essential to the solution of advanced problems in physics and engineering. Topics include: methods for solving ordinary and partial differential equations, Sturm-Liouville theory, complex analysis, Green's functions, Fourier series, integral transforms. Some more advanced mathematical topics may be included if time permits.

Required Textbook

"Mathematical Methods for Physicists – A Comprehensive Guide" by Arfken, Weber and Harris. 7th Edtn.

Additional references you might find useful (not required), of various levels

- "Mathematical methods of physics", by J. Mathews and R. L. Walker.
- "Methods of theoretical physics", by P.M. Morse and H. Feshback.
- "A course of modern analysis", by E.T. Whittaker and G.N. Watson.
- "Mathematics for Physics: A Guided Tour for Graduate Students", by P. Goldbart and M. Stone

Student Assessment Criteria:

- **Homework** will be assigned on a weekly or by-weekly basis, depending on difficulty level.
- **Exams:** we will have **two in-class midterm exams** and a **final exam**.

The grades will be determined as follows:

- Homework 30%
- Two Midterm Exams, 20% each
- Final Exam 30%
- Class participation will be taken into account for students on the border between two grades

Grading Scale

A = 88 – 100 B = 75 – 87 C = 60 – 74 D = 50 – 60

Feedback
Come and talk to me about anything you may be struggling with and give me your honest feedback! This can help me readjust the course throughout the semester, and address specific areas that might not be familiar to some of you.

Initial competences: Advanced calculus and working knowledge of vector analysis, differential equations and complex variables.

Final competences
The students will be expected to:

- develop intuition towards formulating physical phenomena in mathematical language
- gain an appreciation of the analytical methods that are most commonly used to solve problems in physics and engineering
- recognize and employ techniques for solving ordinary and partial differential equations and understand their relevance to a variety of physical systems
- be able to solve for Green's functions and compute integral transforms
- have an in-depth understanding of the basics of complex analysis, the residue theorem and its applications to integral solving techniques
- be able to use Maple and/or Mathematica to solve some of the problems discussed in class

Accommodations for Students with Disabilities:
If you have a disability for which you are or may be requesting accommodations, please contact both your instructor and the Office of Academic Support Services, University Center C212 (610-758-4152) as early as possible in the semester. You must have documentation from the Academic Support Services office before accommodations can be granted.

The Principles of Our Equitable Community:
Lehigh University endorses The Principles of Our Equitable Community [http://www.lehigh.edu/~inprv/initiatives/PrinciplesEquity_Sheet_v2_032212.pdf]. We expect each member of this class to acknowledge and practice these Principles. Respect for each other and for differing viewpoints is a vital component of the learning environment inside and outside the classroom.

Syllabus:

- **Ordinary differential equations**
- **Sturm-Liouville theory**
- **Partial differential equations**
- **Green's functions**
- **Complex analysis**
- **Special functions**
- **Fourier series and Integral transforms**
- **Group theory (if there is time)**
- **Calculus of variations (if there is time)**