

# PHYS 467: Methods of Theoretical Physics II

## Spring 2016

### Time and Location:

T R 12:30-13:45, Physics and Astronomy Room 5

### Instructor:

Rouzbeh Allahverdi

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### Teaching Assistant:

Stephen Sanders

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### Course Webpage:

<http://physics.unm.edu/Courses/Allahverdi/Phys467Sp16/index.php>

### Description:

This class is a full 3 credit course primarily aimed at graduate students, but can serve as an elective for undergraduates.

I plan to discuss topics with extended practical applications in physics that are not systematically taught in other, non-specialized, courses (including PHYC 466).

### Requisites:

There are not really many prerequisites for this material other than the maturity that one has by being a graduate student or an advanced senior student in physics.

### Book(s):

There are many good books on the subject. I have decided to use the following book, which is new and very nice, regularly throughout this class:

#### **Mathematical Methods for Physics and Engineering**

K. F. Riley, M. P. Hobson, S. J. Bence, *3<sup>rd</sup> Edition, Cambridge University Press 2006*

Here is a short list of other books that cover the subject thoroughly:

#### **Physical Mathematics**

K. Cahill, *Cambridge University Press 2013*

#### **Mathematical Methods for Physicists A Comprehensive Guide**

G. B. Arfken, H. J. Webber, F. E. Harris, *Elsevier 2013*

## **Mathematics of Classical and Quantum Physics**

F. W. Byron, R. W. Fuller, *Dover Edition 1992*

I will use these (and other) books from time to time to supplement my lectures. Also, if and when necessary, I may distribute handouts on specific topics.

I will put as many useful books as possible on reserve at the Centennial Library and, if available at the Physics and Astronomy Library, in the Physics and Astronomy main office.

### **Grading Policy:**

The final grade will consist of equal contributions from the following three things:

- a) Homework assignments (approximately 10 sets)
- b) A midterm exam almost halfway through
- c) A final cumulative exam

### **Preliminary Outline:**

Here is the list of main topics that will be covered in this course:

#### **Tensors**

Cartesian tensors, covariant and contravariant tensors, physical applications of tensors, the metric tensor, general coordinate transformations, covariant differentiation, geodesics.

#### **Group Theory**

Transformations and symmetries, groups, finite groups, continuous groups, three-dimensional rotation group  $SO(3)$ , angular momentum operators and  $SU(2)$ , Lorentz group.

#### **Calculus of Variations**

The Euler-Lagrange equation, special cases, some extensions, constrained variation, applications to classical mechanics, invariance principles and Noether's theorem.

#### **Probability & Statistics**

*Probability:* Axioms and theorems, conditional probability & Baye's theorem, important discrete and continuous distributions, the central limit theorem, joint distributions.

*Statistics:* Samples and populations, sample statistics, estimators and sampling distributions, some basic estimators, maximum-likelihood method, hypothesis testing.