Mathematical Methods in Physics III

PHYS-5319
Unique Number: 32294
Spring 2023

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Office/Lab/Help hours:	Online/in-person by appointment

Class start/end:	Jan 17, 2022 – May 2, 2022
Lecture meeting times:	MW 10:30AM – 11:45AM
Lecture meeting place:	SH 315 (and if needed, Teams Virtual Room)

COVID-19 NOTES:
All classes will be held in person (or other modalities if needed). Please avoid attending the lectures in person if you do not feel well for any reason. The instructor will ensure students have access to all materials, homework, and quizzes online if they cannot attend the lectures in person due to sickness or other reasons. PLEASE TAKE YOUR HEALTH AND OTHERS IN THIS CLASS SERIOUSLY BY PAYING ATTENTION TO COVID19 PROTOCOLS. FAILURE TO DO SO COULD COST YOUR FRIENDS, CLASSMATES, OR YOUR INSTRUCTOR'S LIVES. Wearing a mask and vaccinating is not mandated but strongly encouraged. Your instructor is fully vaccinated and will wear (K)N95 and/or double mask throughout in-person sessions.

COURSE OBJECTIVES / ACADEMIC LEARNING GOALS

This is the third course in the series of Mathematical Methods in Physics courses offered by the Physics program of the College of Science at the University of Texas Arlington. Upon successful completion of this course, students will be familiar with

- Principles of scientific project management,
- Fundamentals of Data Visualization
- Fundamentals of Integer Computing
- Fundamentals of Computer Programming
- Numerical Algebra methods

Also, students will be able to effectively understand and solve scientific problems in the category of:

- Numerical integration, differentiation, interpolation, fitting;
- Stochastic optimization, sampling, and integration
- Fourier Transformation (FFT) and its applications and computational methods.
- Modern Computing architectures
  - Neuromorphic Computing
  - Quantum Computing

COURSE TEXTBOOKS

No single textbook is mandatory for this course. Online and class lecture notes as well as excerpts from different books will be used as reference. We will primarily cover topics in the following book,

- William Press, Numerical Recipes (Fortran / C++)

Here are some book recommendations to get you started with your favorite language (*sorted alphabetically*):

- **C++**:
  - Boudreau and Swanson, Applied Computational Physics (in C++)
- **Fortran**:
  - Metcalf, Reid, Cohen, Modern Fortran Explained: Incorporating Fortran 2018
  - Computational Physics: Fortran Version
- **MATLAB:**
  - Chapman, MATLAB Programming for Engineers
  - Higham, MATLAB guide
- **Python:**
  - Langtangen, A Primer on Scientific Programming with Python
  - Johansson, Numerical Python: Scientific Computing and Data Science Applications with Numpy, SciPy and Matplotlib
- **R:**
  - Howard, Computational Methods for Numerical Analysis with R

If you are interested in learning principles of Data Visualization, I recommend,

- Wilke, Fundamentals of Data Visualization (available free of charge on the web)

If you are interested in learning more about the abstract foundations of computing, here is a resource,

- Primiero, On the Foundations of Computing

COURSE LOGISTICS

Grading:
Homework: 33% (Assignments might not be weighted equally)
Quizzes: 33%
Final Exam: 34%

Homework Policy:
There will be approximately one homework per week or biweekly. Assignments will be due every Monday before the lecture begins and should be added to an online repository determined by the instructor. No late assignments will be accepted. No exceptions to the homework policy will be made without prior instructor approval.

Examinations:
There will be no midterm exams but one final exam.

Quizzes:
There will be weekly or biweekly quizzes.

Attendance:
Regular attendance is expected. Any absence requires prior approval from the instructor, or compelling evidence of illness or an official letter from the university administration. Student attendance will be randomly checked.

Scholastic dishonesty: All students are responsible for upholding the University rules on scholastic dishonesty. Students who violate University rules on scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and/or dismissal from the University. Since such dishonesty harms the individual, all students, and the integrity of the University, policies on scholastic dishonesty will be strictly enforced.

Other matters: The University of Texas at Arlington provides, upon request, appropriate academic adjustments for qualified students with disabilities. Any student with a documented disability (physical or cognitive) who requires academic accommodations should contact the UTA's Office for Students with Disabilities as soon as possible to request an official letter outlining authorized accommodations. For visit https://www.uta.edu/disability/.