Physics 485/695

Numerical Methods II - Fall 2018 (3 credits)

Dates 8/27/18 - 12/23/18, Friday 2:45PM - 5:10PM
Room: North Building 1001G

Instructor: Dr. Yao Chu
Email: yc904@hunter.cuny.edu (best way to reach me, no assignment accepted)

Textbook: Computational Physics, Second Edition, ISBN: 0-13-146990-8
Nicholas J. Giordano, and Hisao Nakanishi, Pearson Education © 2006

Prerequisites: PHYS121 or 120 and two semesters of calculus.

Description:

The course will focus on the numerical solution of some representative partial differential equations occurring in physics (e.g. the wave equation, the diffusion equation, Poisson equation, and the Schrödinger equation). The numerical solution of partial differential equations uses methods that are different from the methods used to solve ordinary differential equations so Numerical Methods I, PHYS 385/685 is NOT a pre-requisite. Also, the techniques for the numerical solution of partial differential equations are easier, more direct, and different from the analytical or formula solution methods so PHYS 301/605 or MATH 301 Mathematical Methods for the Physical Sciences is NOT a prerequisite. Implicit and explicit numerical methods will be examined as well as relaxation methods. Also the conditions for the stability of the numerical solution will be derived and discussed. Curve fitting techniques and the numerical form of the Fourier series and especially the so-called Fast Fourier Transform will be learned.

Learning Goals:

- Review of representative classical and modern Physics problems in partial differential equations
- Learn numerical tools for solving Physics problems expressed in partial differential equations
- Learn how to use computer technology (e.g. Mathematica) to implement numerical methods in coding
- Calculate and compare various numerical methods in terms of number of calculations and error limits

Grading:

Attendance (10%), In Class Assignment (20%), Exams 1* and 2**, (20% each), Final Exam (30%)
There is no make-up exam. Your other exam will be overweighed if you miss an exam for excusable reason with documentation

A+ 97.5 - 100
A 92.5 - 97.4
A- 90.0 - 92.4
B+ 87.5 - 89.9
B 82.5 - 87.4
B- 80.0 - 82.4
C+ 77.5 - 79.9
C 70.0 - 77.4
D 60.0 - 69.9
F 0.0 - 59.9

Class Meetings:

Unit 1: Introduction to Mathematica, 08/31/2018 (First Day)
Unit 2: Numerical Solution to Laplace Equation, 09/07/2018
Unit 3: Numerical Solution to Poisson Equation, 09/14/2018

Unit 4: Fourier Series, 09/21/2018*
Unit 5: Discrete Fourier Series, 09/28/2018
Unit 6: Fourier Solution to Laplace Equation, 10/05/2018
Unit 7: Diffusion Equation, 10/12/2018
Unit 8: Numerical Solution to Diffusion Equation, 10/19/2018**
Unit 9: Stability Analysis of Numerical Solution of the Heat Diffusion Equation, 10/26/2018
Unit 10: Fourier Series Solution of the Heat Diffusion Equation, 11/02/2018
Unit 11: Reaction Diffusion Equation, 11/09/2018
Unit 12: Quantum Mechanics, 11/16/2018
Unit 13: Wave Packets, 11/30/2018
Unit 14: Solution of the Schrödinger equation, 12/07/2018 (Last Day)

No Classes

No classes: September 3, October 6-8 and November 22-25 in observance of Labor Day, Columbus Day and the Thanksgiving holiday. Only November 23, 2018 falls on Friday.

Disability Accommodation

In compliance with the American Disability Act of 1990 (ADA) and with Section 504 of the Rehabilitation Act of 1973, Hunter College is committed to ensuring educational parity and accommodations for all students with documented disabilities and/or medical conditions. It is recommended that all students with documented disabilities (Emotional, Medical, Physical and/ or Learning) consult the Office of AccessABILITY located in Room E1124 to secure necessary academic accommodations. For further information and assistance please call (212- 772- 4857)/TTY (212- 650- 3230).

Academic Honesty

Hunter College regards acts of academic dishonesty (e.g., plagiarism, cheating on examinations, obtaining unfair advantage, and falsification of records and official documents) as serious offenses against the values of intellectual honesty.
The college is committed to enforcing the CUNY Policy on Academic Integrity and will pursue cases of academic dishonesty according to the Hunter College Academic Integrity Procedures.
http://www.hunter.cuny.edu/studentaffairs/repository/files/student-guide-academicintegrity.pdf

Sexual Harassment

It is the policy of The City University of New York and Hunter College to prohibit sexual harassment of employees and students. It is a violation of policy for any member of the college community to take action against any individual for reporting sexual harassment.

Hunter College has a sexual harassment panel, appointed by the President, which consists of faculty, staff, and students. The panel is charged with ensuring that the college community is familiar with the sexual harassment policies of Hunter College and the City University. Other responsibilities include investigating reports of sexual harassment and forwarding findings and recommendations to the college President. A member of the faculty, staff, or a student should report sexual harassment occurrences to a member of the Sexual Harassment Panel or to the Dean of Students, and, if required, to the local city police precinct. Reporting information can also be found in college catalogs and schedule of classes.

The entire Hunter College Sexual Harassment Policy can be found on the Human Resources website.
http://www.hunter.cuny.edu/publicsafety/repository/files/Sexual_Assault_PolicyBOTAugust20103.pdf