

**Physics 385/685 (3 credits): Numerical Methods for Classical Physics,  
Spring 2025  
Friday 8:30AM - 11:20PM  
Room: Zoom**

**Instructor:** Dr. Tan-na Lee

**Email:** tl2286@hunter.cuny.edu (best way to reach me, no attachment accepted)

**Prerequisites:** PHYS121 or 120 and two semesters of calculus. MATH 254 (ordinary differential equations) is NOT a pre-req. MATH 254 is not necessary for the student since the numerical techniques for solving differential equations taught in PHYS 385/685 are quite different from the techniques taught in MATH 254.

**Course Material:**

**Lecture slides/notes**, along with other material, such as homework assignments and program examples, will be made available on the website of the course.

**Supplement material:**

Computational Methods for Physics, ISBN: 978-1-107-03430-3  
Joel Franklin, Cambridge © 2013 (It is not required)

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

**Required Resources:** Mathematica Student License

<https://www.wolfram.com/siteinfo>

**Learning Goals:**

- Distinguish problems in Physics that can be solved analytically and those cannot be solved analytically
- Learn mathematical tools for solving Physics problems expressed as differential equations numerically
- Learn how to use computer technology (e.g. *Mathematica*) to implement numerical methods
- Learn how to use AI capabilities within Mathematica
- Calculate and compare various numerical methods in terms of number of calculations and error limits

**Tentative Topics and Exams:**

Week	Topics	Reading
1	Introduction of Mathematica Mathematica with ChatGPT	Lecture 1 - Introduction to Mathematica.pdf Wolfram Support Quick Answers_ How can I start using chat notebooks in Wolfram products.pdf
2	The Cooling Problem	Lecture 2 - Taylor and Maclaurin Series.pdf

	Euler's method Taylor series	Lecture 3 – CoolingProblem.pdf
3	Falling Mass Numerical integration Verlet method	Lecture 4 – FallingMass.pdf
4	Projectile motion with air resistance Euler's method Shooting method Newton method (Root finding)	Lecture 5 – Projectile motion with air resistance.pdf
5	Exam 1 (2/28)	
6	Mass Spring Euler-Cromer method RK2 method RK4 method	Lecture 6 – MassSpring.pdf Lecture 7 – Simple Harmonica Motion.pdf
7	The Pendulum and Planetary motion	Lecture 8 – The Pendulum.pdf Lecture 9 – PlanetaryMotion.pdf
8	Equations and Ordinary Differential Equations for Physics Problems with Mathematica	Lecture 10 – Equations and Ordinary differential equations for Physics Problems.pdf
9	Exam 2 (3/28)	
10	Partial Differential Equations for Physics Heat Diffusion	Lecture 11 – Partial differential equations in Classical Physics.pdf Lecture 12 – DiffusionEq.pdf
11	Gauss' Law, Electric Potential and Electric Field with Boundary and Initial Conditions	Lecture 13 – LaplaceEq.pdf Lecture 14 – PoissonEq.pdf
12	No Class	
13	String and EM Wave	Lecture 15 – WaveEq.pdf
14	Numerical Integration	Lecture 16 – NumericalIntegral.pdf
15	Final Exam (5/9)	

**Grading:**

Attendance (5%), In Class and Homework Assignment (20%), Take-Home Exams 1 and 2, (25% each), and a Take-Home Final Exam (25%); no make-up exam and no retake, in case of missing exam your other exam will be overweighed at my discretion if it is due to excusable reason with documentation.

**No Classes**

04/18/2025(Spring Recess)

**Last Class Meeting/Final Exam**

05/9/2024

**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-academic-integrity.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 schedules 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.p](http://www.hunter.cuny.edu/publicsafety/repository/files/Sexual_Assault_PolicyBOTAUGUST20103.p)

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