Physics 410/510: Math Bootcamp

Fall 2021

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- Course Website: https://d2l.pdx.edu/

Course Description

PH 410/510 is a special topics course designed to cover specific mathematical techniques needed for studies advanced physics and engineering: quantum mechanics, electricity and magnetism, statistical mechanics, and solid state physics. It has no overlap with PH434 (Math Methods) but is designed to complement it. The course is designed for those transitioning into physics from other majors, those who have taken mathematics courses a while ago and need a refresher, and for those who intend to go to graduate school in physics or related fields or who are enrolled in graduate programs and need to catch up. The goal is to obtain a better understanding of physics problems by first approaching the underlying mathematics techniques and realizing why these techniques were used in physics, then applying the math to physical problems.

Prerequisite: Mth 251-253 (Calculus I-III); PHY211-213 series

Class times:

Dates:

Book: The required textbook for this course is ***Physical Mathematics*** by Kevin Cahill. I will be working from the first edition, which can be found inexpensively used or as an e-book. It is highly recommended that you buy a copy. We will cover material from Chapters 6, 8, 9, 10, and 13.

Homework: There is biweekly assigned homework. Homework questions will be taken from the book and other sources. All homework will be assigned at the beginning, so if you wish to turn them in early, you're free to do so.

Exams: One midterm and a final, taken in class. The idea behind the exams will be learning to work some types of problems quickly without reference to outside material. Exam questions will be easier than homework problems.

Lectures and Zoom meetings: I really hope we'll be meeting in person in Fall 2021.

Grading

The grade of each exam and the course will follow this scale

A: 89-110%
A-: 85-88%
B+: 82-84%
B: 75-81%
B-: 70-74%
C+: 67-69%
C: 60-66%
C-: 55-59%;

D: 40-54%
F <40%

Calculating grades
Grade is calculated as Homework (50%)+ midterm (20%)+final (30%).

POLICY STATEMENTS
Academic Honesty: "Academic honesty is a cornerstone of any meaningful education and a reflection of each student's maturity and integrity. The Code of Student Conduct and Responsibility, which applies to all students, prohibits all forms of academic cheating, fraud, and dishonesty. These acts include, but are not limited to: plagiarism, buying and selling of course assignments and research papers, performing academic assignments (including tests and examinations) for other persons, unauthorized disclosure and receipt of academic information, and other practices commonly understood to be academically dishonest" – Portland State University Bulletin, General Catalog Issue, Vol. 50, 2016-2017.
Title IX – Portland State is committed to providing an environment free of all forms of prohibited discrimination and sexual harassment (sexual assault, domestic and dating violence, and gender or sex-based harassment and stalking). If you have experienced any form of gender or sex-based discrimination or harassment, know that help and support are available. PSU has staff members trained to support survivors in navigating campus life, accessing health and counseling services, providing academic and on-housing accommodations, helping with legal protective orders, and more. Information about PSU's support services on campus, including confidential services and reporting options, can be found on PSU's Sexual Misconduct Prevention and Response website at: http://www.pdx.edu/sexual-assault/get-help or you may call a confidential IPV Advocate at 503-725-5672. Please be aware that all PSU faculty members and instructors are required to report information of an incident that may constitute prohibited discrimination, including sexual harassment and sexual violence. This means that if you tell me about a situation of sexual harassment or sexual violence that may have violated university policy or student code of conduct, I have to share the information with my supervisor or the University's Title IX Coordinator or the Office of Affirmative Action. For more information about Title IX please complete the required student module Creating a Safe Campus in your D2L.

Disability Accommodations at PSU – PSU values diversity and inclusion; we are committed to fostering mutual respect and full participation for all students. My goal is to create a learning environment that is equitable, useable, inclusive, and welcoming. If any aspects of instruction or course design result in barriers to your inclusion or learning, please notify me. The Disability Resource Center (DRC) provides reasonable accommodations for students who encounter barriers in the learning environment. If you have, or think you may have, a disability that may affect your work in this class and feel you need accommodations, contact the Disability Resource Center to schedule an appointment and initiate a conversation about reasonable accommodations. The DRC is located in 116 Smith Memorial Student Union, 503-725-4150, drc@pdx.edu,

https://www.pdx.edu/drc.

Course Schedule (subject to change as announced in class and on d2l)

Week	Dates	Topics, Readings, Assignments, Deadlines
1		**Day 1**: Probability, Bayes Theorem, Distributions (13.1-13.5) (Instructor) **Day 2:** Review of calculus and linear algebra (Chapter 1) **(Student 1)**
2		**Day 3**: Fluid mechanics, separable PDEs, wave equations, KG, Dirac equation first-order ODEs (6.5-6.10) **(Student 1)** **Day 4**: Error function, Maxwell-Boltzmann, diffusion, Brownian motion (13.6-13.10) **(Student 2)** **Homework 1 due: Chapter 13**
3		**Day 5**: Homogenous and linear ODEs, systems of ODEs (6.15-6.17) **(Student 3)** **Day 6**: finite barrier, tunneling
4	**Oct 19, 21**	**Day 7**: Singular points and method of Frobenius, Fuch's theorem (6.18-6.20) **(Student 3)** **Day 8**: Introduction to group theories. Definitions and examples (10.1-10.4) **(Student 4)**
5	**Oct 26, 28**	**Day 9**: Representations, cosets, finite groups, continuous groups (10.5-10.10) **(Student 4)** **Day 10**: Dirac notation (Chapter 1) and Lie algebra, structure constants, rotation group, angular momentum (10.11-10.16) **(Instructor)**
6	**Nov 2, 4**	**Day 11**: SU(2). Pauli matrices, Casimir operators, adjoint representation (10.17-10.23) **Instructor** **Day 12**: Global and local symmetries, the standard model, gauge invariance, quarks (10.24-10.28) **Student 3**
7	**Nov 9, 11**	**Day 13**: Midterm (Chapters 1, 6) **Day 14: school is closed**
8	**Nov 16, 18**	**Day 15:** Legendre functions (8.1-8.6) **(Student 2)** **Day 16:** Legendre functions (8.7-8.13) **(Student 5)**
9		**Day 17**: Bessel functions of the first kind (9.1-9.2) **(Student 5)** **Day 18:** Bessel functions of the second kind (9.3-9.4) or start with relativity **(Student 3)**
10		**Day 19**: A review of special relativity **(Instructor)** **Day 20**: Review and recap
Final Exam		[date time] Comprehensive but mostly Chapters 8-10