PHY 384 Theoretical Physics

Summer 2024

Course Credits: 4
Contact Hours: 56 hours
Instructor: TBA
Email: TBA

COURSE OBJECTIVES

This course explores the fundamental concepts of theoretical physics, including classical mechanics, quantum theory, thermodynamics, and electromagnetic. Through rigorous investigation, students obtain a thorough comprehension of the fundamental rules that govern the universe. The emphasis is on problem solving and critical thinking, which prepares students to examine complicated physical processes and pursue higher studies in theoretical physics.

Upon Completion of this Course, students will be able to:

1. Understand finite and infinite-dimensional vector spaces, essential for mathematical modeling in physics.

2. Apply concepts like linear mappings and eigenvalue problems to solve diverse physics problems.

3. Explore Fourier series and transforms, crucial for studying periodic phenomena and signal processing in physics.

4. Understand how to solve wave and diffusion equations, which are necessary for modeling many physical systems and boundary value issues.

5. Learn techniques to solve boundary value problems, a fundamental aspect of mathematical physics.

PREREQUISITES

N/A

GRADING

Grades will be determined by accumulating points, with 100 points being the maximum, as follows:

ITEM	POINTS
Quizzes	15 Points
Assignments	30 Points
Midterm	15 Points
Project	20 Points
Final Exam	20 Points
Total	100 Points

Late submissions will be graded at the end of the course. Grades will be assigned according to the following rule:

$A \geq 90 > B \geq 80 > C \geq 70 > D \geq 60 > F$.

We reserve the right to make adjustments to the overall grading policy.

COURSE MATERIALS

Required Texts:

Albrecht Lindner , Dieter Strauch, ***A Complete Course on Theoretical Physics***, 1st Edition, Springer, 2019.

Recommended (Optional) Texts or Other Materials:

None

COURSE TOPICS

MODULE	TASKS
Module 1	**Topics:** Topic 1: Vector Analysis Topic 2: Delta Function Topic 3: Fourier Transform Topic 4: Orthogonal Transformations and Euler Angles **Assessments:** Quiz#1 Assignment#1

Module 2	**Topics:** Topic 5: Reformulation of Partial Differential Quotients Topic 6: Finite Measurement Series and Their Average Error Topic 7: Classical Mechanics Topic 8: Infinitesimal Canonical Transformations. Liouville Equation **Assessments:** Quiz#2 Assignment#2
Module 3	**Topics:** Topic 9: Lorentz Invariance Topic 10: Solutions of the Inhomogeneous Wave Equations Topic 11: Wave–Particle Duality Topic 12: Linear and Anti-linear Operators **Assessments:** Midterm Project
Module 4	**Topics:** Topic 13: Matrix Elements and Representation of Linear Operators Topic 14: Eigenvalues and Eigenvectors Topic 15: Expansion in Terms of a Basis of Orthogonal Operators Topic 16: Eigenvalue Equation for the Energy **Assessments:** Quiz#3 Assignment#3 Project
Module 5	**Topics:** Topic 17: Damped Linear Harmonic Oscillations Topic 18: Adjoint Spinors and Bilinear Covariants Topic 19: Thermodynamics and Statistics Topic 20: Molecular Motion and Diffusion **Assessments:** Final Exam Project due

ATTENDANCE

1) Class attendance is required. Missing classes without permission will lead to decrease in overall grade.

Missing less than two classes: no penalty.

Missing more than two classes: 7% will be taken off from the overall grade.

If the instructor reports a student's frequent missing of class to the Soochow

University Academic Administration Office, the student might get a written warning and might be prohibited from attending final exam.

2) Participants in this course are expected to arrive in class promptly and adequately prepared. The primary objective of this course is to critically engage with the readings and the subject matter. Therefore, course participants are expected to have completed the reading prior to class and prepare thoughtful reflections/commentaries to share with fellow colleagues.

LEARNING REQUIREMENTS

1) Late assignments are not acceptable and are subjected to grade deductions.
2) Assignments submitted in the wrong format will be counted as not submitted.
3) Failure to submit or fulfill any required course component results in failure of the class.
4) Make-up for midterm and final exams only with valid excuses, as defined by the University.
5) In order to earn a Certificate of Completion, participants must thoughtfully complete all assignments by stated deadlines and earn an average quiz score of 50% or greater.

TECHNOLOGY POLICY

The use of electronic devices in class is distracting, both for the user and for the rest of the class. Only non-programmable calculators can be used in the tests and exam. Any attempts to use cell phones and other electronic communication devices will be seemed as cheating. Laptops are discouraged, unless you use them for activities DIRECTLY related to the course (eg., note taking, reading course documents).

ACEDEMIC INTEGRITY POLICY

Soochow University highly values the academic integrity and aims to promote the academic fairness, honesty and responsibility. Any academic dishonesty behaviors and any attempts to cheats and plagiarism will be reported to the university administration office. A written warning and the relevant penalties will be imposed. The record might be shown on the official university transcript.

DISABILITY ACCOMMODATION

Soochow University is committed to maintaining a barrier-free environment so that students with disabilities can fully access programs, courses, services, and activities at Soochow University. Students with disabilities who require accommodations for access to and/or participation in this course are welcome.

Note:

Please contact the University Administrative Office immediately if you have a learning disability, a medical issue, or any other type of problem that prevents professors from seeing you have learned the course material.