Modern Physics/Experimental Physics 1
Physics 5610/4150
Spring 2026

Lectures or labs, TuTh 2:00 –3:20 p.m. The lectures are in the Language Building Room 313.
Lab schedules TBD during the first week of class. The lab sessions are mostly in the Physics Building Room 117

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Office Hours: Mo 3–5 p.m., or by appointment

Text: The course does not have a required textbook. However, class lecture slides and supporting educational materials will be available on Canvas. Additionally, we will make use of introductory material from "University Physics" by Young and Freedman, which is available in the 13th, 14th, or 15th edition.

Topics: The course will cover the principles of thermodynamics and heat engines, with a focus on technological applications. The course will emphasize the potential role of two-dimensional (2D) materials such as graphene, phosphorene, and transition metal dichalcogenides in advancing these technologies including hydrogen storage. It will introduce the band structure and electronic, optical, and catalytic properties of these materials. Topics will include the use of graphene-based materials for hydrogen storage, fuel cells, advanced batteries, and supercapacitors; and 2D solar energy production. The course will also include a laboratory section where students will conduct experiments to explore the properties of these materials using scanning electron microscopy, atomic force microscopy, Raman spectroscopy, photoluminescence, and current versus voltage device characterization.

Lecture and Lab Schedule and Attendance: Attendance at lectures and lab sessions is required. Please notify the professor and the instructional team in advance of any absences to reschedule labs. For the labs, students will be divided into groups, each consisting of two to four members. During the first week of class, the instructor, lab assistant, and students will decide on the days and times each group will meet to conduct the lab activities. Each group meets once or twice a week for a duration of 1 hour and 20 minutes for each meeting. If you need additional time to complete the lab, that can be accommodated.

Lab reports: For each lab, you are required to submit a lab report on Canvas. The lab report will consist of a quad chart describing the objectives, results, analysis, and conclusions of the lab. The grading of the lab reports will be based on the accuracy of the results, the clarity of the analysis and discussion, error analysis, and the overall completeness of the report.

Final Exam: The final exam will consist of a 3-to-4-page report, excluding figures and references, on a course topic that interests you. Please contact me concerning the topic before you start writing the term paper. I will suggest ideas and an outline for the paper.

Grade: The course grade will be determined by the total points earned from lab reports, final report, and attendance. The respective percentage values for each category are:

Lab reports	**50%**
Final report	**40%**
Attendance	**10%**
Total	**100%**

Disability Accommodation: The University of North Texas provides reasonable academic accommodation for students with disabilities. Students seeking accommodation must first register with the Office of Disability Accommodation (ODA) to verify their eligibility. If a disability is verified, the ODA will provide you with an accommodation letter to be delivered to faculty to begin a private discussion regarding your specific needs in a course. You may request accommodation at any time, however, ODA notices of accommodation should be provided as early as possible in the semester to avoid any delay in implementation. Note that students must obtain a new letter of accommodation for every semester and must meet with each faculty member prior to implementation in each class. For additional information see the Office of Disability Accommodation website at http://www.unt.edu/oda. You may also contact them by phone at 940.565.4323.

The University of North Texas is on record as being committed to both the spirit and letter of federal equal opportunity legislation; reference Public Law 92-112 – The Rehabilitation Act of 1973 as amended. With the passage of new federal legislation entitled Americans with Disabilities Act (ADA), pursuant to section 504 of the Rehabilitation Act, there is renewed focus on providing this population with the same opportunities enjoyed by all citizens.

UNT's policy on Academic Dishonesty is found at: https://vpaa.unt.edu/ss/integrity.

Tentative Lecture and Laboratory Schedule

Session	Date	Day	Topic
1	13 Jan.	Tu	Lecture: Course Overview and Introduction, Description of Advanced Student Laboratory
2	15 Jan.	Th	Lab Session: Tour of the Advanced Student Laboratory
3	20 Jan.	Tu	Lecture: Introduction, continued
4	22 Jan.	Th	Lab Session: Graphene Synthesis, Optical Microscopy, Raman Spectroscopy, and Atomic Force Microscopy
5	27 Jan.	Tu	Lecture: Thermodynamics, Temperature and Heat
6	29 Jan.	Th	Lab Session: Graphene Synthesis, Optical Microscopy, Raman Spectroscopy, and Atomic Force Microscopy, continued
7	3 Feb.	Tu	Lecture: Thermodynamics, Second Law
8	5 Feb.	Th	Lab Session: Graphene Synthesis, Optical Microscopy, Raman Spectroscopy, and Atomic Force Microscopy, continued
9	10 Feb.	Tu	Lecture: Thermodynamics, Heat Engines
10	12 Feb.	Th	Lab Session: MoS_2 and other 2D Materials
11	17 Feb.	Tu	Lecture: Heat Engines, continued
12	19 Feb.	Th	Lab Session: MoS_2 and other 2D Materials
13	24 Feb.	Tu	Lecture: Hydrogen Production, Storage, and Fuel Cells
14	26 Feb.	Th	Lab Session: Hydrogen Production and Fuel Cells
15	3 Mar.	Tu	Lecture: Hydrogen Production, Storage, and Fuel Cells, continued
16	5 Mar.	Th	Lab Session: Hydrogen Production and Fuel Cells, continued
17	10 Mar.	Tu	Spring Break – No classes
18	12 Mar.	Th	Spring Break – No classes
19	17 Mar.	Tu	Lecture: Properties and Characterization of 2D Materials
20	19 Mar.	Th	Lab Session: Scanning Electron Microscopy
21	24 Mar.	Tu	Lecture: Properties and Characterization of 2D Materials, continued
22	26 Mar.	Th	Lab Session: Scanning Electron Microscopy, continued
23	31 Mar.	Tu	Lecture: Modification, Lithography and *I-V* Characterization of 2D Materials
24	2 Apr.	Th	Lab Session: *I-V* Characterization and Lithography of 2D Materials for Devices and Solar Cells
25	7 Apr.	Tu	Lecture: Modification, Lithography and *I-V* Characterization of 2D Materials, continued
26	9 Apr.	Th	Lab Session: *I-V* Characterization and Lithography of 2D Materials for Devices and Solar Cells, Continued
27	14 Apr.	Tu	Lab Session: *I-V* Characterization and Lithography of 2D Materials for Devices and Solar Cells, continued
28	16 Apr.	Th	Lab Session: *I-V* Characterization and Lithography of 2D Materials for Devices and Solar Cells, continued

Note: This document is for informational purposes only and is subject to change upon notification.

29	21 Apr.	Tu	Lab Session: X-ray Diffraction and 3D Profilometry
30	23 Apr.	Th	Lab Session: X-ray Diffraction and 3D Profilometry, continued
31	28 Apr.	Mo	Review
32	30 Apr.	Tu	Make-up Labs

Final report Due Thursday, May 7

Ancillary Materials

On Canvas you will find a copy of all the lecture slides. You will find copies of the syllabus, lab modules describing the lab to be completed, and instruction manuals for the equipment.

Course Evaluation

The Student Perceptions of Teaching (SPOT) is a requirement for all organized classes at UNT. This short survey will be made available to you on-line at the end of the semester and will provide you with an opportunity to provide feedback to your course instructor. SPOT is an important part of your participation in this class.

After logging in to the my.unt.edu portal, students can access the SPOT survey site by clicking on the SPOT icon. A list of their currently enrolled courses will appear. Students complete each course evaluation independently. During the long terms, the SPOT is open for students to complete two weeks prior to final exams. During the summer terms, the SPOT is open for students to complete six days preceding their final exam.