

Identification	Subject	PHSC 225– Applied Physics, 4 ECTS credits
	Department	Physics and Electronics
	Program (Undergraduate, Graduate)	Undergraduate
	Term	Fall Semester, 2026/2027
	Instructor	Associate Professor Shahla Aliyeva, PhD (Physics)
	Email:	aliyeva.shahla2020@gmail.com
	Classroom/hours	408 Elshan Mehdiyev str. (Bakikhanov campus), Saturday, 11:50-18:30
Prerequisites	None	
Language	English	
Compulsory/Elective	Compulsory	
Textbooks and course materials	1. Halliday, D., Resnick, R., & Walker, J. (2011). <i>Fundamentals of Physics</i> (9th ed.). Wiley. 2. Serway, R. A., & Jewett, J. W. (2014). <i>Physics for Scientists and Engineers</i> (9th ed.). Cengage Learning. 3. Cutnell, J. D., Johnson, K. W., Young, D., & Stadler, S. (2015). <i>Physics</i> (10th ed.). Wiley.	
Course description	The course “Applied Physics” introduces students to the practical applications of physical phenomena and laws studied in the “Fundamentals of Physics” course and stimulates their interest in the subject. The course is based on the integration of theoretical knowledge and experimental approaches in the study of physical phenomena and regularities. It focuses on the analysis of results obtained under laboratory conditions, the selection of appropriate physical models for solving practical problems, and the development of individual skills that provide future engineers with new opportunities for professional growth. Based on the knowledge and skills acquired, the course establishes a foundation for the application of physical laws, phenomena, and experimental methods to various fields of engineering. In this regard, the teaching of this course is highly relevant and important for modern engineering education.	
Course objectives	The main objective of the Applied Physics course is to provide students with an understanding of the practical applications of fundamental physical laws and principles in engineering and technology. The course aims to develop students’ ability to analyze physical phenomena, apply theoretical knowledge to real-world problems, interpret experimental results, and select appropriate physical models for solving practical tasks. Furthermore, the course seeks to enhance analytical thinking, problem-solving skills, and the ability to use physical methods in scientific and engineering applications.	

Learning Outcomes	Students will be able to explain the basic principles and laws of applied physics, their application in the fields of engineering and technology. They will acquire the ability to analyze physical phenomena based on theoretical and experimental approaches, apply physical concepts and mathematical methods to solve practical problems, interpret and evaluate experimental results obtained in laboratory conditions. Students will also be able to select appropriate physical models for the investigation and solution of real engineering problems, and use modern scientific and computer tools in the study of physical processes. The subject will develop analytical thinking and problem-solving skills in them, and will form the competence to apply the laws of physics and experimental methods in the analysis and design of engineering systems.		
Teaching methods	Case analysis		+
	Group discussion		x
	Lecture		+
	Simulation		+
Evaluation Criteria	Methods	Date/deadlines	Percentage (%)
	Midterm Exam	TBA	30
	Quizzes	Quizzes are conducted twice during the semester, and each quiz is assessed with a maximum of 5 points.	10
	Practical Assignments	Assignments are given twice during the semester, and each assignment is assessed with a maximum of 5 points.	10
	Activity	Each Class	5
	Attendance	End of the Semester	5
	Final Exam	TBA	40
	Total		100
Class Policy	Preparation for Class The structure of this course places significant emphasis on students' independent study and preparation outside the classroom. Lecture sessions will focus on the key concepts and topics presented in the course materials. Reading the assigned chapters before class and becoming familiar with the content will greatly enhance your understanding of the lectures. At the end of each lecture or chapter, students are expected to review typical exam questions, lecture notes, solved problems, and case studies. Passing Requirements (Pass/Fail)		

This course strictly follows the assessment policy of the Faculty of Engineering. To successfully complete the course, students must achieve a minimum overall score of 60%. Students who fail to meet this requirement will be required to retake the course in the following semester or academic year.

Academic Integrity and Plagiarism

Any form of cheating, plagiarism, or other academic misconduct during quizzes, midterm examinations, or final examinations will result in disciplinary action. In such cases, the student will automatically receive a grade of zero (0) without further discussion.

Professional Conduct Guidelines

Students are expected to behave professionally and contribute to a positive academic environment during class hours. Discussions unrelated to the course and any form of unethical behavior are strictly prohibited.

Quizzes

Two quizzes will be conducted during the semester, prior to the midterm and final examinations. The quizzes will cover topics discussed during lectures. Each quiz will be worth 5 points.

Presentations

Students will deliver two presentations during the semester, each worth 5 points. Presentation topics will be selected from the course syllabus.

Class Participation

Students who actively participate in discussions, particularly during the review of previously covered material, will be awarded participation points. Class participation is worth a maximum of 5 points.

Attendance

Students who attend all classes throughout the semester will receive 5 points for attendance.

Artificial Intelligence (AI)

Artificial intelligence tools may be used in this course to support learning, generate ideas, organize information, and improve language and writing quality. However, the main content of assignments, scientific analysis, and conclusions must be prepared independently by the student. The use of AI tools during midterm and final examinations is strictly prohibited. Students who use AI tools in their coursework must appropriately acknowledge such use in accordance with academic standards.

Tentative Schedule			
Week	Date/Day (tentative)	Topics	Textbook/Assignments
1	18.09.26- 20.09.26	Applications of the Law of Conservation of Momentum. Reactive Motion. Meshchersky Equation. Motion Under the Influence of Gravity.	1. Halliday, Resnick & Walker - Fundamentals of Physics, p.225-233, 372-405 2. Serway & Jewett - Physics for Scientists and Engineers, 210-245
2	25.09.26- 27.09.26	Damped Oscillations. Forced Oscillations. Resonance. Elastic Waves. Propagation Velocity of Transverse and Longitudinal Waves. Traveling Wave and Its Equation.	1. Halliday, Resnick & Walker - Fundamentals of Physics, p.398-405 2. Serway & Jewett - Physics for Scientists and Engineers, p.449-532
3	02.10.26- 04.10.26	Wave Energy and Energy Density. Standing Waves. Sound Waves and Their Properties. The Doppler Effect for Sound Waves.	1. Halliday, Resnick & Walker - Fundamentals of Physics, p.445-464 2. Serway & Jewett - Physics for Scientists and Engineers, p.533-565
4	09.10.26- 11.10.26	Internal Friction in Liquids. Motion of Viscous Fluids. Laminar and Turbulent Flow. Reynolds Number. Poiseuille's and Stokes' Laws. Non-Newtonian Fluids. Deformation of Elastic Bodies. Relationship Between Mechanical Stress and Strain – Hooke's Law. Young's Modulus. Poisson's Ratio.	1. Halliday, Resnick & Walker - Fundamentals of Physics, p.390-398 2. Serway & Jewett - Physics for Scientists and Engineers, p.417-448
5	16.10.26- 18.10.26	Dielectrics in an Electric Field. Polarization of Dielectrics. Electric Displacement Vector. Gauss's Theorem for the Electrostatic Field in Dielectrics. Ferroelectrics. Piezoelectric Effect. Hall Effect.	1. Halliday, Resnick & Walker - Fundamentals of Physics, 890-903 2. Serway & Jewett - Physics for Scientists and Engineers, p.793-806
6	23.10.26- 25.10.26	Magnetization of Materials. Classification and Properties of Magnetic Materials. Magnetic Hysteresis and Hysteresis Loops. Magnetostriction and Its Applications.	1. Serway & Jewett - Physics for Scientists and Engineers, p.919-932

			2. Cutnell, J.D., Johnson, K.W. <i>Physics</i> . Wiley, p.580-590
7	30.10.26-01.11.26	Generation of Alternating Current (AC). Resistance, Capacitive Reactance, and Inductive Reactance in AC Circuits. Total Impedance of the Circuit. Power in AC Circuits.	1. Serway & Jewett - Physics for Scientists and Engineers, 998-1015 2. Cutnell, J.D., Johnson, K.W. <i>Physics</i> . Wiley, p.525-530
		Midterm exam	
8	06.11.26-08.11.26	Oscillatory Circuit (LC Circuit). Free Oscillations in an Oscillatory Circuit. Differential Equation of Electromagnetic Waves. Properties of Electromagnetic Waves. Experimental Generation of Electromagnetic Waves.	1. Halliday, Resnick & Walker - Fundamentals of Physics, p.651-660 2. Serway & Jewett - Physics for Scientists and Engineers, p.1034-1045
9	13.11.26-15.11.26	Displacement Current. Maxwell's Equations. Fundamentals of Photometry. Applications of Light Interference. Interferometers. Diffraction Gratings.	1. Halliday, Resnick & Walker - Fundamentals of Physics. 2. Serway & Jewett - Physics for Scientists and Engineers, p.1030-1034
10	20.11.26-22.11.26	Heisenberg's Uncertainty Principle. Wave Function and Its Properties. Schrödinger Equation.	1. Halliday, Resnick & Walker - Fundamentals of Physics, p.1069-1074 2. Cutnell, J.D., Johnson, K.W. <i>Physics</i> . Wiley, p.790-794
11	27.11.26-29.11.26	Linear Harmonic Oscillator. Hydrogen-Like Atom. X-ray Spectra. Moseley's Law. Diffraction of X-rays. Bragg's Law.	1. Halliday, Resnick & Walker - Fundamentals of Physics, p.1136-1138 2. Cutnell, J.D., Johnson, K.W. <i>Physics</i> . Wiley, p.800-806
12	04.12.2026-06.12.2026	Elements of the Quantum Theory of Radiation. Absorption, Spontaneous Emission, and Stimulated Emission. Lasers and Their Operating Principles. Main Characteristics of Laser Radiation.	1. Serway & Jewett - Physics for Scientists

			and Engineers, p. 1326-1340 2. Cutnell, J.D., Johnson, K.W. <i>Physics</i> . Wiley, p.816-820
13	11.12.26-13.12.26	Band Theory of Solids. Formation of Energy Bands. Metals, Semiconductors, and Dielectrics According to Band Theory. Intrinsic and Extrinsic Conductivity of Semiconductors. p–n Junction. Semiconductor Diode.	1. Halliday, Resnick & Walker - Fundamentals of Physics, p.1150-1158 2. Cutnell, J.D., Johnson, K.W. <i>Physics</i> . Wiley, p.754-757
14	20.12.26-22.12.26	Contact Phenomena in Metals. Work Function of an Electron in a Metal. Contact Potential Difference. Volta's Laws. Thermoelectric Phenomena. Seebeck and Peltier Effects. Thomson Effect.	1. Halliday, Resnick & Walker - Fundamentals of Physics, p.728-750 2. Cutnell, J.D., Johnson, K.W. <i>Physics</i> . Wiley, p.595–615
15	27.12.26-29.12.26	Composition and Characteristics of the Atomic Nucleus. Nuclear Forces. Binding Energy. Specific Binding Energy. Nuclear Reactions. Radioactivity. Law of Radioactive Decay. Nanotechnology and Its Applications. Electron Microscope. Scanning Tunneling Microscope (STM). Atomic Force Microscope (AFM).	1. Halliday, Resnick & Walker - Fundamentals of Physics, p.1181-1187 2. Cutnell, J.D., Johnson, K.W. <i>Physics</i> . Wiley, p.797-805,p.824-829
		Final exam	

