Bachelor program,
Instrumentation Engineering (INEN) program, "Physics" department

Course Unit Title	Applied Physics
Course Unit Code	VTSS-B05
Type of Course Unit	Elective
Level of Course Unit	2 nd year INEN program
National Credits	7
Number of ECTS Credits Allocated	7
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	1
Year of Study	2
Semester when the course unit is delivered	3
Course Coordinator	Naziyev Jeyhun
Name of Lecturer (s)	Naziyev Jeyhun
Name of Assistant (s)	-
Mode of Delivery	Face to Face
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	-

Course description:

The course of "Applied physics" is the core of physical knowledge required to activities in the fields of physical laws. The physical laws underlying the operation of most technical devices. Rapid development of technology requires universal specialists who would have a wide range of knowledge for the design, construction and maintenance of modern machines, mechanisms and electronic devices. Course includes material on theory and applications of mechanics of rigid and fluid mechanics, alternating current, magnetism, electromagnetic waves, optics, atom, quantum and nuclear physics .

Objectives of the Course:

The main goal of the teaching of the subject is theoretical and practical teaching of students the content of physical phenomena and processes according to topics included in the course "Applied Physics" and in the curriculum. Providing theoretical knowledge, future engineers are invited to choose the right directions in the flow of technical information and to form a modern physical and scientific worldview, knowledge and skills of using fundamental laws, theories of classical and modern physics.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1.	The participants have a thorough knowledge and an in-depth understanding how to solve physical problems, make plausibility checks, evaluate relevant tolerances and measurement errors and estimate their influence on results.	1,2,3
2.	Understand and apply the main principles of rigid body and fluid mechanics.	2,3
3.	Calculate all sizes of undamped and damped vibrations, and analyze and calculate problems related to forced vibrations and resonance as well as transverse waves.	2,3
4.	Understand the process of alternating current production and AC calculations	2,3
5.	Understand the process of electromagnetic waves propagation and how these waves are used.	2,3
6.	Describe interference and diffraction and their applications.	1,3
7.	Understand the photoelectric effect, photon momentum and light as probability wave and perform calculations for it.	1,3
8.	Understand the meaning of the wave function and Schrodinger equation.	1,3
9.	Understand the theory of energy zones for metals, semiconductors and dielectrics.	1,3
10.	Understand the structures of atoms and nuclears and radioactive decay.	1,3

Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm exam

Course's Contribution to Program

		CL
1	Ability to develop as a specialist in the field of fundamental sciences and apply basic knowledge.	4
2	Ability to analyze and model functional and structural schemes of various purpose devices and systems.	3
3	Ability to use modern methods and tools, creation, selection, and application of engineering and information technology tools and modern devices and equipment.	4
4	The ability to use the strategy of team cooperation in the exchange of information,	4

	knowledge, and experience to achieve the set goal.	
5	As a result of training, the ability to use engineering knowledge, mathematical models, and basic concepts of physics and chemistry in production and technological processes, automation, measurement, and control systems.	4
6	The ability to use modern software to process technical documents of devices, design their structures, and algorithmize processes.	3
7	The ability to apply artificial intelligence to improve the quality characteristics of measurement and control systems.	1
8	The ability to process information acquisition, processing, and transmission processes based on schematic and programmable logical integrated circuits.	3
9	Ability to use knowledge to improve quality indicators and environmental safety of production processes.	4
10	Self-development ability to apply theoretical and experimental knowledge in solving modern engineering problems.	4

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)

Course Contents

Week	Chapter	Topics	Exam
1	[1], Ch. 9, 11	Lecture: Law of conservation of momentum and its application. Jet force. Variable mass equation. Seminar: Examples of solving problems on applied rigid body mechanics	
2	[1], Ch. 12	Lecture: Deformation of elastic bodies. Relation between mechanical voltage and deformation – Hooke's law. Young's modulus. Poisson's ratio. Laboratory: Introduction to labs	
3	[1], Ch. 14	Lecture: Viscosity. Laminar versus turbulent flow. Reynold's number. Poiseuille and Stoke's formulas. Non-Newtonian fluids. Seminar: Examples of solving problems on applied fluid mechanics	
4	[1], Ch. 15, 16	Lecture: Damped and forced oscillations. Resonance. Elastic waves. Longitudinal and transvers wave's velocity. Laboratory work #1: Determination of the damping coefficient, logarithmic decrement and the quality factor of the oscillating system	
5	[1], Ch. 17, 18	Lecture: Standing waves. Sound waves. Doppler's effects. Ultrasound. Receiving and application of ultrasound. Acoustic logging. Seminar: Examples of solving problems on Doppler's effects.	
6	[1], Ch. 24, 26	Lecture: Metals and dielectrics in electric field. Polarization of dielectric. Electric induction. Gauss' theorem for electrostatic field of dielectrics. Seminar: Examples of solving problems on applications of electromagnetic effects	
7	[1], Ch. 27, 29	Lecture: Ferroelectrics. Piezoelectric effects and its application. Superconductivity. Hall's effect and its applications. Laboratory work #2: Study of the Hall effect	Midterm
8	[1], Ch. 32, 33	Lecture: Receiving AC. Capacitive reactance, inductive reactance, active reactance in the AC circuit. Total reactance of circuit. Power of AC wire. RLC circuit. Oscillations in RLC circuit. Laboratory work #3: Study of the electrical circuit of the alternating current	
9	[1], Ch. 34	Lecture: The displacement current and Maxwell's equations. The differential equation of electromagnetic wave. Properties of electromagnetic wave. Electromagnetic spectrum. Application of electromagnetic waves. Doppler's effect. Seminar: Examples of solving problems on electromagnetic wave applications	
10	[1], Ch. 35-38	Lecture: Basic of photometry. Applications of interference. Interferometer. Diffraction grating. The Spectrometer and Spectroscopy. The characteristics of optic instruments. Laboratory work #4: Studying the operation of the solar cell	
11	[1], Ch. 41	Lecture: Heisenberg's uncertainty principle. Wave function and its properties. Schrodinger equation. A particle in potential well. Quantum energy. Quantum harmonic oscillator.	

		Seminar: Examples of solving problems on applied quantum optics	
12	[1], Ch. 42	Lecture: Hydrogen-like atom. Quantum theory of radiation. Absorption, spontaneous and stimulated emissions. Lasers. Working principle of laser. The characteristics of laser's radiation. Applications of lasers. Moseley's law. X-ray diffraction. Bragg's formula	
13	[1], Ch. 43	Lecture: Electronic band structure of solid. Formed of energy zone. Metals, semiconductors, dielectrics from the band theory view. Energy bands and electrical conduction. Charge carries (electrons and holes). Seminar: Examples of solving problems on applications of semiconductors and dielectrics	
14	[1], Ch. 43	Lecture: Semiconductor diode. Valve photoelectric effect. Solar panels. Photoelements. Light diode. Transistor. Integral circuits. Volta potential. Work function to remove an electron from a solid. Thermoelectric effects: Seebeck effect, Peltier effect, Thomson effect	
15	[1], Ch. 44	Lecture: Atomic structure. Atomic characteristics. Nuclear forces. Binding energy. Radioactivity. Radioactive decay law. $\alpha-$, $\beta-$, $\gamma-$ radiation. Application of radioactivity. $\gamma-$logging. Nanotechnologies and its applications. Seminar: Examples of solving problems on applications of radioactivity	
16			Final exam

Recommended Sources

TEXTBOOK(S)

1.Serway Jewett. Physics for Scientists and Engineers with Modern Physics. 9th Edition. Brooks/Cole. Boston, USA - 2014.
2. Giancoli. Physics. Principles with Applications. 7-th edition. Pearson Education, Inc., USA. 2014.
3. Laboratories on physics. ASOIU. Baku, Azerbaijan. – 2015.

Assessment

Attendance	0%	Less than 75% class attendance results in NA grade
Presentation	10%	
Lab. works	10%	
Course work	0%	
Quiz	10%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of Azerbaijan State Oil and İndustry University for undergraduate studies

Course Policies

1. Attendance of the course is mandatory.
2. Material presented in the lecture as well as assigned readings will be included in testing.
3. Late assignments will not be accepted unless an agreement is reached with the lecturer.
4. Cheating and plagiarism will not be tolerated.
5. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload (hour)
Course duration in class (including midterm)	15	4	60
Presentation	1	10	10
Self-study	14	3	52
Tutorials	14	3	52
Midterm Examination	1	3	3
Preparation for midterm exam	1	8	8
Final Examination	1	3	3
Preparation for final exam	1	20	16
Total Workload			210
Total Workload/30(h)			7
ECTS Credit of the Course			7