Name of subject	Physics (ECTS 10)
Subject/module code	FIZ11210
Science taught semester (s).	1st and 2nd semester
Responsible teacher	Mustafakulov Asror Akhmedovich, professor
Education language	Uzbek
Connection to the curriculum	Compulsory
Training hours (this including independent education)	**Total hours-300.** **Audience Training hours - 120.** Lecture training hour – 60 Laboratory training hour – 30 Practical training hour – 30 **Independent education -120 hours**
ECTS	10
The purpose and tasks of subject / learning outcomes	**The purpose of teaching science -** the main goal of teaching the "Physics" course is to form in students a culture of looking at phenomena and processes in nature from a scientific perspective, as well as to prove the objectivity and possibility of mastering physical laws based on theoretical and experimental materials. **The task of science is to** reveal the role and importance of science in human life and society by providing students with theoretical knowledge, practical skills, a methodological approach to financial phenomena and processes, and a scientific worldview. **Learning outcomes:** 1. Physics studies the essence of physical phenomena in nature and technology through fundamental concepts in physics 2. Calculates the balance of matter and heat in technological cycles 3. Able to analyze the determination of electrical conductivity and elastic modulus 4. Formulates studies on creating a physical model of nuclear reactions to solve problems such as calculating them and explains the difference between them
Course content (topics)	**I. Main Theoretical Part (Lecture Sessions)** **Topic 1:** Teaching and goals of physics. Fundamentals of kinematics. **Topic 2:** Dynamics of a material point. Forces in nature and their properties. **Topic 3:** Types of energy. Conservation laws in mechanics. **Topic 4:** Mechanical vibrations and mechanical waves. **Topic 5:** General properties of liquids and gases. **Topic 6:** Fundamentals of molecular kinetic theory. **Topic 7:** Fundamentals of thermodynamics. **Topic 8:** Electrostatic field and its properties. **Topic 9:** Work done by electrostatic field forces. Potential. **Topic 10:** Dielectrics and conductors in an electrostatic field. **Topic 11:** The laws of electric current. **Topic 12:** Electric current in various media. **Topic 13:** Electric current in metals and semiconductors. **14-Topic:** Electric current in gases and in a vacuum. **15-Topic:** Alternative energy sources. **Topic 16:** Electromagnetism. Magnetic field strength. **Topic 17:** Magnetic properties of substances. **Topic 18:** Types of magnets. **Topic 19:** Current-carrying conductors in a magnetic field. **Topic 20:** The phenomenon of electromagnetic induction. **Topic 21:** Mutual induction. Alternating current. Transformer. **Topic 22:** Electromagnetic oscillations and waves.

Topic 23: Laws of geometric optics.

Topic 24: The wave nature of light. Interference of light. Diffraction of light.

Topic 25 Dispersion and polarization of light.

Topic 26 Laws of thermal radiation. Quantum nature of light. Elements of quantum optics.

Topic 27 Atomic structure. Corpuscular-wave dualism of microparticles.

Topic 28 Bohr theory of the hydrogen atom.

Topic 29 Structure and properties of the atomic nucleus.

Topic 30 Modern physical picture of the universe.

II. Instructions and recommendations for organizing laboratory exercises.

During laboratory sessions, students develop practical skills and competencies in measuring various parameters of physical processes, conducting experiments, performing calculations, and drawing tables and graphs. The recommended topics are selected based on available opportunities and conditions.

Recommended topics for laboratory work:

1. Determination of the acceleration due to gravity using the ring vibration method.
2. Determination of the acceleration of free fall using a physical pendulum.
3. Determination of the moment of inertia of a body using a dynamic method.
4. Determination of the moment of inertia of bodies using Maxwell's pendulum and verification of the law of conservation of energy.
5. Determination of the coefficient of internal friction of a liquid using the Stokes method.
6. Determination of the specific heat capacity of bodies by mixing
7. Study of gas laws. Dependence of gas pressure on volume at constant temperature. (Boyle-Mariotte law)
8. Determination of the resistance of a conductor using a constant current bridge
9. Study of the magnetic field of a straight conductor and a rotating ring
10. Study of measuring the magnetic field of an inductive coil without a magnetic core
11. Determination of the capacitance of a capacitor.
12. Determination of the focal length of a lens.
13. Determination of the wavelength of monochromatic light using a diffraction grating.
14. Checking the dependence of the photocell current on the angle of illumination and distance. Checking the dependence of the photocell current on illumination.
15. Study of Malus's law.

III. Practical training instructions and recommendations

The teacher's preparation for a practical training session begins with the study of preliminary documents (curriculum, thematic plan, etc.) and ends with the development of a lesson plan. The teacher should have an idea of the goals and objectives of the practical training session, the amount of work that each student must perform.

Methodological guidelines are the main methodological document of the teacher in preparing and conducting practical training sessions.

The purpose of the practical training session is to understand the theory, acquire skills. It is to consciously apply it in educational and professional activities, and to develop the ability to confidently form one's own point of view.

The following topics are recommended for practical training:

1. Fundamentals of kinematics

	2. Fundamentals of dynamics 3. Rotary motion of solids. 4. Mechanical vibrations and waves. 5. Molecular physics and thermodynamics. 6. Electrostatics. Coulomb's law. Electric field strength and potential. Capacitance, capacitors. 7. Basic laws of direct current. Ohm's law for a part of a circuit and a complete circuit. Kirchhoff's rules. Work and power of current. Joule - Lens law 8. Magnetic field. Biot-Savart-Laplace law and its application to various conductors. 9. Current-carrying conductor in a magnetic field. Ampere force. Lorentz force. 10. Parameters of power devices. Magnetic flux. Electromagnetic induction. Inductance 11. Electromagnetic oscillations. Thomson's formula. 12. Laws of geometric optics. Photometry. 13. Interference of light. Diffraction of light. Polarization of light. Use of light energy. 14. Laws of thermal radiation. Quantum nature of light. Photoelectric effect. 15. Radioactivity. Mass defect. Binding energy of atomic nuclei. **IV. Independent learning and independent work.** Independent learning competence serves to support students' independent self-development and increase the effectiveness of professional activities. Students perform independent work on their mobile devices under the guidance of a teacher in a traditional or electronic form. **Recommended topics for independent study:** 1. Fundamentals of Kinematics 2. Scientific discoveries of Uzbek thinkers - A.R. Beruni, Ibn Sina, M. Ulugbek, Abu Nasr Farobi, Al-Khwarizmi and others, their great contribution to world civilization. 3. Measurement of physical quantities. Types of errors. 4. Elements of kinematics. 5. Forces and conservation laws in nature 6. Kepler's laws. 7. The law of conservation and circulation of energy. 8. The motion of planets and satellites. Cosmic velocities. 9. Forces in nature. Frictional, elastic forces. 10. Dynamics of rotational motion of rigid bodies 11. Moment of inertia of bodies of various geometric shapes. 12. Mechanical vibrations and waves. 13. Pendulums and their types and applications. 14. Fluid and Gas Mechanics 15. Viscous Fluid Hydrodynamics. 16. Air Humidity. Saturated and Unsaturated Vapors. 17. Solids. Crystalline and Amorphous Bodies. 18. Surface Tension. Wetting and Non-Wetting. Capillary Phenomena. 19. Fundamentals of molecular physics and thermodynamics 20. Clapeyron-Mendeleev equation. Universal gas constant. 21. The basic equation of the molecular-kinetic theory of gases 22. Application of the first law of thermodynamics to isoprocesses. 23. Reversible and irreversible processes. Carnot cycle. 24. Van der Waals equation and isotherms. Internal energy of a real gas. 25. Migration phenomena. Diffusion, thermal conductivity and viscosity. 26. Energy. Electrostatics 27. The basic law of electrostatics - Coulomb's law.

	28. Piezoelectrics, ferroelectrics and their application in technology. 29. Capacitor and its types. 30. Structure and operating principles of modern power devices. 31. Laws of constant current 32. Types of electric heating devices and their applications. 33. Kirchhoff's rules. Connecting conductors. 34. Electrolysis. Faraday's laws for electrolysis. 35. Determining the electrochemical equivalent of copper. 36. Types of independent gas discharges and their applications. 37. Plasma. Properties and applications. 38. Thermoelectric phenomena. 39. Alternative energy sources and their production. 40. Electromagnetism 41. Application of the Biot-Savart-Laplace law to various current circuits. 42. Types of magnets. Diamagnets. Paramagnets. 43. The phenomenon of electromagnetic induction and Faraday's experiments. 44. Transformers and their types, principle of operation. 45. Ferromagnets and the phenomenon of hysteresis. 46. Resistance, capacitance and inductance in an alternating current circuit. 47. Alternating current power. Power factor. 48. Electromagnetic oscillation circuit. Thomson's formula. 49. Electrical measuring instruments and their structure. 50. Laws of geometric optics 51. Lenses and their types. Image formation in a lens. 52. The principle of holography and its application. 53. Eye-optical system. Spectral sensitivity of the eye. 54. Methods of observing light interference. Interferometers. 55. Fiber optic systems 56. Elements of quantum optics 57. X-rays and their applications. 58. Laws of blackbody radiation. 59. Einstein equation for the external photoelectric effect. 60. Areas of application of lasers. 61. Chemical effects of light, photosynthesis 62. Atomic and nuclear physics 63. Atomic structure. Bohr postulates. 64. Quantum numbers and their meaning. Spin quantum number. Pauli principle. 65. Beta decay. Beta decay spectrum. Neutrino. 66. The problem of controlling thermonuclear fusion reactions. 67. Atomic energy and work in Uzbekistan. 68. Radioactivity, its types. Radiation dose. 69. Types of fundamental interactions. Unified field theory. 70. Methods of recording and observing charged particles. 71. The origin and evolution of the universe. Theories of the big bang and inflation. 72. Modern physics and its achievements 73. Physics and the scientific and technological revolution. 74. Nanoelectronic materials. 75. Liquid crystals and their properties. 76. Modern energy devices
Exam form	Written
Teaching/learning and examination requirements	Complete mastery of theoretical and methodological concepts and practical knowledge of the discipline, the ability to correctly reflect the

	results of analysis, independently reason about the processes being studied and carry out tasks in the current, intermediate forms of control and independent work, pass written work on the final control. When drawing up final exam questions, deviations from the content of the discipline program are not allowed. The bank of final exam questions for each discipline is discussed at the meeting and approved by the head of the department. No later than 1 week before the start of the final control, tickets signed by the head of the department, enclosed in an envelope, are sealed by the Dean's office and opened 5 minutes before the start of the exam in the presence of students. Final exam duration is 80 minutes. Answers to final exam questions are recorded in copybooks with the seal of the Dean's office. After completion of the final work, the work is immediately encrypted by a representative of the Dean's office, and the copybooks are handed over to the commission for verification. From the moment of completion of the final exam, a period of 72 hours is allotted for checking and posting the results on the electronic platform. The teacher who taught the students in this discipline is not involved in the process of conducting the exam and checking the students' answers. Student(s) who are dissatisfied with the final exam results may submit a written or oral appeal within 24 hours of the publication of the final exam results. Complaints submitted after 24 hours from the publication of the final exam results will not be accepted.
Scope of assessment criteria and procedure	CURRENT CONTROL Purpose: Determining and assessing the student's level of knowledge, practical skills, and competencies on course topics. Instructions: The student's activity in daily classes is assessed through the student's mastery of course topics, as well as constructively interpreting and analyzing the educational material, developing module-specific skills, acquiring practical skills (in terms of quality and the specified number) and competencies, solving problem situations aimed at applying professional practical skills, working in a team, preparing presentations, etc. Current control form: Activity in lessons Preparing educational materials Working with sources within the subject Using educational technologies Working in a team Preparing presentations Working with projects. MIDTERM CONTROL Purpose: Assessing the student's knowledge and practical skills and level of mastery of lecture material after completing the relevant section of the course. Form and procedure of intermediate control: Midterm examination is held during the semester during the training sessions after the completion of the relevant module of the curriculum of the subject. Midterm examination is held once in written form within the framework of this subject. Midterm examination questions cover all topics of the subject. INDEPENDENT LEARNING Purpose: Independent learning is aimed at fully covering the content of this course, expanding the theoretical knowledge acquired, and establishing independent learning activities for students. Form and procedure of independent education: independent work assignments are completed in the form of an educational project, presentation, case study, problem solving, information search, digest, colloquium, essay, article, abstract, etc. Completed assignments for independent study are placed in the electronic system and checked based on the anti-plagiarism program and evaluated by the subject teacher. In this case, the uniqueness of the completed assignment should not be less than 60%, otherwise the assignment will not be accepted for

assessment. The number of independent work assignments, depending on the nature of the subject, should not be less than 3 for one subject (module). Independent work assignments account for 60% of the points allocated for current and intermediate control.

FINAL CONTROL

Purpose: The final examination is held at the end of the semester to determine the level of mastery of the student's theoretical knowledge and practical skills in the relevant subject. The final examination is held at a specified time according to the examination schedule created by the Registrar's Office on the electronic platform.

Requirements: The student must have passed the current control, intermediate control and independent learning assignments by the deadline for the final control type in the relevant subject. A student who has not passed the current control, intermediate control and independent learning assignments, as well as who has received a score in the range of "0-29.9" for these assignments and control types, is not included in the final control type. Also, a student who has missed 25 percent or more of the classroom hours allocated to a subject without a reason is excluded from this subject and is not included in the final control type and is considered not to have mastered the relevant credits in this subject. A student who has not passed or was not included in the final control type and has received a score in the range of "0-29.9" for this type of control is considered to be an academic debtor.

Final control form: The final examination in this subject will be conducted in written form. If the final examination is conducted in written form, the requirements for assessment must also be reflected.

Criteria for assessing student knowledge

5 grade	100 points		Assessment criteria
5	90-100	Excellent	When a student is considered to be able to make independent conclusions and decisions, think creatively, observe independently, apply the knowledge he has gained in practice, understand, know, express, and narrate the essence of the subject, and have an idea about the subject.
4	70-89,9	Good	When the student is considered to be able to observe independently, apply the knowledge he has gained in practice, understand, know, express, and narrate the essence of the subject, and has an idea about the subject.
3	60-69,9	Satisfactory	When the student is found to be able to apply the knowledge he has gained in practice, understands, knows, can express, and narrate the essence of the subject, and has an idea about the subject.
2	0-59,9	Unsatisfactory	When it is determined that the student has not mastered the science program, does not understand the essence of the subject, and does not have an idea about the science.

Course assessment criteria and procedure

Assessment type	Total points allocated	Control (task) form	Distribution of points	Qualifying score
Current assessment	30 points	System tasks	20 points (divided by the number of tasks)	18 points

			Student activity (in seminars, practical, laboratory classes)	10 points	
	Midterm assessment	20 points	Supervision: Written work	10 points	12 points
			System tasks	10 points (divided by the number of tasks)	
	Final assessment	50 points	Written assignment (5 questions)	50 points (10 points per question)	30 points
	* Note: 60% of the points allocated for current and intermediate control are allocated to independent work assignments. Independent work assignments are evaluated as system assignments through the electronic platform.				

Recommended Literature

Main literature:

1. Douglas C. Giancoli, Physics: Principles with Applications, Prentice Hall; 6th edition January 17, 2004 USA.
2. Raymond A. Serway, John W. Physics for Scientists and Engineers with Modern Physics, Cengage Learning; 9. 2013, Brooks/cole 20 Channel Center Street Boston, MA 02210 USA.
3. Sultanov N. Fizika kursi. Darslik, T: Fan va Texnologiya, 2007
4. B.Izbosarov, I.Kamolov Molekulyar fizika va termodinamika asoslari , Toshkent, 2018
5. Orifjonov Elektromagnitizm.O`quv qo`llanma. T: Noshir, 2011
6. Izbosarov B.F., Kamolov I.R. Elektromagnitizm. Darslik, T: Iqtisod-moliya, 2006
7. Трофимова Т.И. Курс физики. Учебник -М.: «Академия », 2007
8. Детлаф А.А., Яворский Б.М., Курс физики.Учебник -М.: “Академия”, 2007
9. Qodirov O. Fizika kursi.(Mexanika, molekulyar fizika), 1- qism. T: Fan va texnologiya, 2005
10. Mamatqulov R., Tursunov A.A. Mamatqulov B.R. Termodinamika va statistik fizikadan masalalar,O`quv qo`llanma. T: O`zbekiston, 2003.
11. Otaqulov B.O., Po`latov Yu.P.,Xalilov N.A., G`oziev Z.A. Fizika (Mexanika bo`limi),O`quv qo`llanma. Toshkent-2004
12. Qodirov O., Boydedayev A. Fizika kursi. Qism-3: Kvant fizikasi – T: O’zbekiston,2005
13. Ismoilov M., Xabibullaev P.K., Xaliulin M. Fizika kursi. Darslik, T: O‘zbekiston, 2000
14. Abdumalikov A.A., Sattorov H.M. Mexanika. O`quv qo`llanma. T: Donishmand ziyosi, 2020
15. Abduraxmonov K.P., Egamov O‘. Fizika kursi. Darslik –Toshkent, 2010
16. Nazarov O`Q. Umumiy fizika kursi 2-qism.Elektr va magnetism. O`quv qo`llanma. T:O`zbekiston, 2002
17. Tursunov I.G., Begmatova D.A. Fizika .O`quv –uslubiy qo`llanma. T: Tafakkur bo`stoni, 2018
18. Turg`unov T. Amaliy fizika. Darslik. T: O`zbekiston, 2003
19. Toshxonova J.A., O`lmasova M.H., Ismoilov I., Rizayev T., Maxmudova X.M. Fizikadan praktikum (Mexanika va molecular fizika). T:O`zbekiston faylasuflari milliy nashriyoti.2006
20. Toshxonova J.A., O`lmasova M.H., Ismoilov I., Rizayev T., Maxmudova X.M. Fizikadan praktikum. (optika) T:O`zbekiston faylasuflari milliy nashriyoti.2006 yil 31-b.

21. Izbosarov B.F.,Kamolov I.R. Umumiy fizikadan laboratoriya ishlari,T: Voris , 2007
22. Otaqo'ziyev B., Po'latov Yu.va b. Fizika. Mexanika bo'limi , Toshkent, 2004
23. Mustafakulov A.A., Eshbekova S.O., Jo'rayeva N.M. va b.Umumiy fizikadan amaliy mashgulotlar uchun o`quv qo`llanma. Innovatsion rivojlanish nashryot-matbaa uyi, 2019 yil-248b.
24. Mustafaqulov A.A., Jo`rayeva N.M., Axmadjonova U.T. Fizikadan laboratoriya ishlari. O`quv qo`llanma. 2022
25. Маматкулов Б.Х. Оптика.Учебное пособие: Джизак «SANGZOR - PRINT» 2021г.109стр
26. Маматкулов Б.Х. Курс физики (часть вторая). Учебник.. Издательство «SANGZOR - PRINT»,2022г, 492стр..
27. Xayriddinov B., Jo'rayev Sh.Molekulyar fizika , Toshkent , 2013
28. Axmadjonov O. Fizika kursi. Darslik, 1-3 q.-T., "O'qituvchi", 1999
29. Kamolov J.,Ismoilov I. va boshqalar Elektr va magnitizm.Elektr va magnitizm.O`quv qo`llama,Iqtisod-Moliya,2007.
30. Volkenshteyn V.S. Umumiy fizika kursidan masalalar to'plami. T.: O'qituvchi, 1996
31. Chertov A., Vorobev A. Fizikadan masalalar to'plami. Darslik-T.: O'zbekiston, 1997
32. Begmatova D.A., Abdullayev R.M.Fizika.O`quv –uslubiy qo`llanma.T: Tafakkur avlodi, 2020.
33. Polvonov S., Bozorov E., Kanolov Z. Atom yadrosi va elementar zarrachalar fizikasi. O`quv qo`llanma. T: Go to print, 2020

Additional literatures

34. Mirziyoyev Sh.M. 2019 — 2030-yillar davrida O'zbekiston Respublikasining "yashil" iqtisodiyotga o'tish strategiyasini tasdiqlash to'g'risidagi O'zbekiston Respublikasi Prezidentining qarori, 04.10.2019 yildagi PQ-4477-son.
35. Mirziyoyev Sh.M. Tanqidiy tahlil, qat'iy tartib-intizom va shaxsiy javobgarlik – har bir rahbar faoliyatining kundalik qoidasi bo'lishi kerak. O'zbekiston Respublikasi Vazirlar Mahkamasining 2016 yil yakunlari va 2017 yil istiqbollariga bag'ishlangan majlisidagi O'zbekiston Respublikasi Prezidentining nutqi. //"Xalq so'zi" gazetasi. 2017 y., 16 yanvar, №11.
36. O'zbekiston Respublikasi Konstitutsiyasi. - T.: O'zbekiston, 2017. - 46 b.
37. O'zbekiston Respublkasini yanada rivojlantirish bo'yicha Harakatlar strategiyasi to'g'risida. - T.:2017 yil 7 fevral, PF-4947-sonli Farmoni.
38. Mirtadjieva K.T., Axunov T.A., Karabayeva M.A. Mexanika va molekulyar fizika. O`quv qo`llanma.-T: , Go To Print, 2020
39. Abdumalikov A.A. Elektrodinamika. Darslik-T.:Cho`lpon, 2011
40. Yusupov D.B., Kamolxo'jaev Sh.M., Gaibov A.G., Uzoqov A.A. Fizika fanidan laboratoriya ishlari uchun uslubiy ko'rsatma .- T: ToshDTU, 2015
41. Polvonov S.R.,Daliyev X.S., Bozorov E.X., Palvanova G.S. Umumiy fizikadan masalalar to`plami. - T: Ijod- Pres, 2019
42. Yuldashev U.,Sultonov M.U. Neytron va yadro fizikasi masalalari.O`quv qo`llanma.- T:Lesson press, 2021
43. Sodiqova Sh.,Otajonov Sh., Kurbanov M. Lazerlar va ularning amaliyotdagi o`rni. O`quv qo`llanma. Toshkent-2020
44. Yuldashev B.S., Polvonov S.R., Bozorov E.X.Amaliy yadro fizikasi.Darslik.-T: Donishmand ziyosi, 2020
45. Teshaboyev A.T. Nanozarrachalar fizikasi, kimyosi va texnologiyalari. O`quv qo`llanma. T: Tafakkur bo`stoni, 2014

46. Normuradov M.T., Umirzaqov B.E., Tashatov A.Q. Nanotexnologiya asoslari. O`quv qo`llanma. T: NIF MSh, 2020
47. Qosimov A., Jo'raqulov X., Safarov A.Fizika kursi. Mexanika 1-qism. O'zbekiston, Toshkent, 1994
48. Mo`minov A.E., Yuldashev U., Mustafaqulov A. Umumiy fizikadan laboratoriya ishlarini bajarish bo`yicha o`quv qo`llanma. Jizzax 2003
49. Mustafakulov A.A. va b. "Elektrotexnika materiallari". "Turon-Iqbol" nashryoti, Toshkent-2015.
50. Sattarov S.A., Mustafakulov A.A. va b. "Alternativ energiya manbalari", "Elektronika va asbobsozlik (elektronika sanoatida) bakalavriat ta'lim yunalishi talabalari uchun darslik, JiPI nashryoti, 233 b.
51. Jo`rayeva N.M., Axmadjonova U.T. Fizikadan laboratoriya ishlari uchun uslubiy qo`llanma(1-qism). 2023 yil
52. Abduraxmonov A. Mexanika va molekulyar fizika. Darslik. "JizPI tipografiyasi", Jizzax 2023 yil.
53. Qulboyev Z., O'rinov Sh. Mexanika va molekulyar fizika. Darslik. "JizPI tipografiyasi", Jizzax 2023 yil.
54. Raximov O., Xalilov O. Qurilishda fizika. O'quv qo'llanma "JizPI tipografiyasi", Jizzax 2023 yil.
55. Axmedov E., Abduraxmonov A. Elektr va magnitezm. Darslik. "JizPI tipografiyasi", Jizzax 2023 yil.

Internet resources:

1. www.ziyonet.uz – national educational materials search site.
2. www.gov.uz – Government portal of the Republic of Uzbekistan.
3. www.google.com – international educational materials search site.
4. www.energystrategy.ru – Information portal "Energy Policy and Strategy"
5. www.twirpx.com – international educational materials search site.