S Y L L A B U S

General information	**Title and code of subject, number of credits**	ETR 408 Electrodynamics and propagation of radiowaves (6 credits)	
	Department	Physics and Electronics	
	Program	Bachelor	
	Academic semester	2023 fall	
	Lecturer	Doctor of philosophy (PhD) in Physics & Mathematics Shahmerdan Sh. Amirov	
	E-mail:	phys_med@mail.ru	
	Phone number:		
	Lecture room/Schedule	11 Mehseti Street, AZ1096 Baku, Azerbaijan (Neftchilar campus), room Lectures: Seminars:	
	Consultations		
Course language	English		
Type of the subject	Major		
Textbooks and additional materials	***Textbooks*:** **1. David J. Griffith Introduction to Electrodynamics** **2. Sh.Sh. Amirov Lecure materials** **Auxiliary Web sources:** https://www.youtube.com/watch?v=BgvRi0Jl43g https://www.youtube.com/watch?v=VJfIbBDR3e8&list=PL5351D9CFF725FA6A https://www.youtube.com/watch?v=dEdR4iOdLh0&list=PL5DUVGfj6BJa4THJwSN8wJljvkHvInrMq https://www.youtube.com/watch?v=4ZoKGFLg0HQ https://www.youtube.com/watch?v=Gv0VMx25_Dk https://www.youtube.com/watch?v=9SUHgtREWQc https://www.youtube.com/watch ?v=Ok9ILIYzmaY https://www.youtube.com/watch?v=v38-I58H2Uc&list=PLc1hOdhp9OEF-PbWusarZmubWggC_zp3K		
Teaching methods	**Lecture**		15
	Group discussions at seminars		15
Assessment	**Components**	**Date/ Deadline**	**Percent (%)**
	Tests	During the semester	10
	Active participation	At each lesson	5
	Individual research papers and presentations	At the end of the semester	10
	Attendance	During the semester	5
	Midterm exam		30
	Final exam		40
	Final		**100**
Course description	The course “Electrodynamics and propagation of radiowaves” taught by the students of electronic engineering discipline provides following knowledge’s: Vector algebra. Triple products. “Ordinary “derivatives. Gradient. The operator “Del”. The divergence. The curl. Product rules. Line, surface, and volume integrals. The fundamental theorem of calculus. The fundamental theorems for Gradients, Divergences and Curls. Spherical polar and cylindrical coordinates. Coulomb’s law. Electric field. Continuous charge distributions. Divergence and curl of electrostatic field. Field lines. Flux and Gauss law. The divergence of electric field. Applications of gauss law. The curls of electric field. The Lorentz force law. Magnetic fields. Magnetic forces. Currents. The Biot-Savart Law. Steady currents. The magnetic field. Of a steady current. The magnetic field. Of a steady current. The divergence and curl of magnetic field induction. Straight line currents. The divergence and curl of B. Applications of ampere’s law. Comparison of magnetostatics and electrostatics. Charge and Energy. The continuity equation. Poynting’s theorem. Newton’s third law in thermodynamics. Conservation of momentum. Angular momentum. Ohm’s law. Electromotive force. Motional EMF. Faraday’s law. The induced electric field.		

	Inductance. Energy in magnetic fields. Maxwell's equations.Magnetic charge. Maxwell's equations in matter. Boundary conditions. . Electromagnetic waves in one dimension. The wave equation. Sinusoidal waves. Boundary conditions: reflection and transmission. Polarization. Electromagnetic waves in vacuum. The wave equation for the electric and magnetic fields. Monochromatic plane waves. Energy and momentum in electromagnetic waves. Electromagnetic waves in matter. Propagation in linear media. Reflection and transmission at normal incidence. Reflection and transmission at oblique incidence. Absorption and dispersion. Electromagnetic waves in conductors. Reflection at a conducting surface.The frequency dependence of permittivity. Wave guides. TE waves in a rectangular wave guide. The coaxial transmission line.
Course objectives	**Course objectives for the students:** • Develop a high level of understanding of the fundamental principles of DC and AC current Systems. Develop basic laboratory skills demonstrating the application of physical principles. • Work cooperatively to facilitate a collegial atmosphere conducive to learning for all students in the class. • Prepare for and attend each class by reading the assigned sections before class, completing homework, and participating in class discussions and team activities. **Course objectives for the instructor:** • To provide all students with the tools necessary to succeed in their pursuit of a high level of understanding of the principles of **Electrodynamics** and propagation of radiowaves**.** • To provide all students with an atmosphere conducive to learning the principles of physics. • To provide sufficient feedback to students, enabling them to gauge their progress towards achieving their goal in learning the principles of physics. • To facilitate student learning using appropriate activities, appropriate technology, and the illustration of physics applications in the real world.
Learning outcomes	At the end of the course, students and trainees are expected to acquire the following knowledge and skills: They should know: • Basics of electrodynamics. • Laws of electrodynamics. • Processes of propagation, reflection, and refraction of waves. • Spleen propagation in waveguides with different configurations, in irregular structures. • transmission of electromagnetic waves in resonators. • Basic definitions of electrodynamics. • Features of construction and practical application of feeder tracts, existing samples of radio technical devices and systems. They should be able to: • To solve the problems arising in various electrical circuits. • Construction of functional electrical schemes and circuits based on capacitor and coil. • Measuring the parameters of details using measuring devices. • monitoring input and output signals by means of an oscillograph. • To create functional electrical circuits based on what they learned from electrodynamics.
Rules (Educational policy and behavior)	• **Lesson organization** General information on the subject will be provided for the students during lectures. Student's knowledge on the previous topics will be evaluated and new topic will be explained by mins of visual aids during seminars. Student's knowledge level will be tested oraly and in written forms before midterm and final exams. Submission of the individual works by the end of course is obligatory. • **Effectiveness (pass/fail)** This course strictly follows the assessment policy conducted by the subject teaching faculty. Hencew a student must score at least 60% to pass the course normally. In case of failure he will be forced to repeate the course in the next term or year. • **Plagiarism** Cheating or other forms of plagiarism during review surveys, midterms and final exams will result in disqualification. In this case a student will automatically receive zero "0" without furher discusstion. • **Professional conduct directives** Students will behave professionally during class hours to create a conductive academic environment. Off course discussions and unethical behavior are strictly prohibited. • **Attendance**

	Participation of students at all classis is important. Students should inform dean's office about missing lessons for particular reasons (illness, family issues and etc.). Students, missing more than 25% of lessons, are not allowed to take the exam. • **Quizzes.** Quizzes will be four times during semester. The time of quizzes will be announced in the classrom three weeks before.The quizzes will be related to the homework material. • **Activity** Students who are active in all seminar classes will be evaluated with 5 points, those who are active in 60% of seminars will be evaluated with 3 points.

This program reflects the comprehensive information about the subject and information about any changes will be provided in advance.

Week	Dates (planned)	Subject topics	Textbook/ Assignments
1	13.09.2023 14.09.2023	***Lecture №1.*** **Introduction.** Vector algebra. Triple products. Ordinary "derivatives. Gradient. The operator "Del". The divergence. The curl. Product rules	[1] p. 1-12 [3]
		Seminar №1: *Solving problems* Vector algebra. Triple products. Ordinary "derivatives. Gradient. The operator "Del". The divergence. The curl. Product rules	[1] p
2	20.09.2023 21.09.2023	***Lecture №2.*** Line, surface, and volume integrals. The fundamental theorem of calculus. The fundamental theorems for Gradients, Divergences and Curls. Spherical polar and cylindrical coordinates.	[1] p.24-43- [3]
		Seminar №2: *Solving problems.*. Line, surface, and volume integrals. The fundamental theorem of calculus. The fundamental theorems for Gradients, Divergences and Curls. Spherical polar and cylindrical coordinates.	[1] p. p.24-43-
3	04.10.2023 05.10.2023	***Lecture №3***. Coulomb's law. Electric field. Continuous charge distributions. Divergence and curl of electrostatic field. Field lines. Flux and Gauss law. The divergence of electric field. Applications of Gauss law. The curls of electric field.	[1] p.58-76 [3]
		Seminar №3: *Solving problems.* . Coulomb's law. Electric field. Continuous charge distributions. Divergence and curl of electrostatic field. Field lines. Flux and Gauss law. The divergence of electric field. Applications of Gauss law. The curls of electric field.	[1] p. p.58-76
4	11.10.2023 12.10.2023	***Lecture № 4.*** Polarization. Induced dipoles. Alignment of polar molecules. Polarization. Bound charges. Physical interpretation of bound charges. The field inside a dielectric.	[1] p. 160-163 [1] p. 166-170
		Seminar №4: *Solving problems.*Charge and Energy. The continuity equation. Poynting's theorem. Newton's third law in thermodynamics. Conservation of momentum. Angular momentum.	[1] p. 160-163 [1] p. 166-170
5	18.10.2023 19.10.2023	***Lecture №5***. Linear dielectrics. Susceptibility, permittivity , dielectric constant. Energy in dielectric systems. Force on dielectrics.	[1] p.179-193 [1]
		Seminar №5: *Solving Problems* . Linear dielectrics. Susceptibility, permittivity , dielectric constant. Energy in dielectric systems. Force on dielectrics.	[1] p. 179-193
6	25.10.2023 26.10.2023	***Lecture №6.*** The Lorentz force law. Magnetic fields. Magnetic forces. Currents. The Biot-Savart Law. Steady currents. The magnetic field. Of a steady current.	[1] p.202-215 [3]

		Seminar №6: : *So lving Problems* . The Lorentz force law. Magnetic fields. Magnetic forces. Currents. The Biot-Savart Law. Steady currents. The magnetic field. Of a steady current	[1] p. p.202-215
7	01.11.2023 02.11.2023	***Lecture №7.*** The divergence and curl of magnetic field induction. Straight line currents. The divergence and curl of B. Applications of ampere's law. Comparison of magnetostatics and electrostatics.	[1] p.221-232 [3]
		Seminar №7: : *Solving Proble ms* . The divergence and curl of magnetic field induction. Straight line currents. The divergence and curl of B. Applications of ampere's law. Comparison of magnetostatics and electrostatics.	[1] p. p.221-232
8	08.11.2023 11.11.2023	***Lecture №8***. Charge and Energy. The continuity equation. Poynting's theorem. Newton's third law in thermodynamics. Conservation of momentum. Angular momentum.	[1] p.345-358 [3]
		Seminar №8: *Solving Problems* . Charge and Energy. The continuity equation. Poynting's theorem. Newton's third law in thermodynamics. Conservation of momentum. Angular momentum.	[1] p.345-358
9	15.11.2023 17.11.2023	***Mid term exam***	
10	22.11.2023 23.11.2023	***Lecture №9.*** Ohm's law. Electromotive force. Motional EMF. Faraday's law. The induced electric field. Inductance. Energy in magnetic fields.	[1] p.285-317[3]
		Seminar №9: *Solving Problems* Ohm's law. Electromotive force. Motional EMF. Faraday's law. The induced electric field. Inductance. Energy in magnetic fields.	[1] p. p.285-317
11	29.11.2023 01.12.2023	***Lecture №10.*** Maxwell's equations.Magnetic charge. Maxwell's equations in matter. Boundary conditions.	[1] p. 321-331 [3]
		Seminar №10: *Solving Problems* Maxwell's equations.Magnetic charge. Maxwell's equations in matter. Boundary conditions.	[1] p.321-331
12	06.12.2023 08.12.2023	***Lecture №11.*** Electromagnetic waves in one dimension. The wave equation. Sinusoidal waves. Boundary conditions: reflection and transmission. Polarization.	[1] p.364-374
		Seminar №11: *Solving Problems* Electromagnetic waves in one dimension. The wave equation. Sinusoidal waves. Boundary conditions: reflection and transmission. Polarization.	[1] p.364-374
13	13.12.2023 15.12.2023	***Lecture №12.*** Electromagnetic waves in vacuum. The wave equation for the electric and magnetic fields. Monochromatic plane waves. Energy and momentum in electromagnetic waves.	[1] p.375-380
		Seminar №12: *Solving Problems* Electromagnetic waves in vacuum. The wave equation for the electric and magnetic fields. Monochromatic plane waves. Energy and momentum in electromagnetic waves.	[2] p. 375-380
14	20.12.2023 21.12.2023	***Lecture №13.*** Electromagnetic waves in matter. Propagation in linear media. Reflection and transmission at normal incidence. Reflection and transmission at oblique incidence.	[2] p. 382-386
		Seminar №13: *Solving problems.* Electromagnetic waves in matter. Propagation in linear media. Reflection and transmission at normal incidence. Reflection and transmission at oblique incidence	[2] p.382-386
15	27.12.2023 29.12.2023	***Lecture №14.*** Absorption and dispersion. Electromagnetic waves in conductors. Reflection at a conducting surface.The frequency dependence of permittivity.	[1] p. p.392-404
		Seminar №14: *Solving Problems* Absorption and dispersion. Electromagnetic waves in conductors. Reflection at a conducting surface.The frequency dependence of permittivity.	[1] p.392-404
16		Lecture ***№15.*** Wave guides. TE waves in a rectangular wave guide. The coaxial transmission line.	[1] p. 405-411
		Seminar №15: *Solving Problems*. Wave guides. TE waves in a rectangular wave guide. The coaxial transmission line	[1] p. . 405-411
		Final Exam