S Y L L A B U S

General information	**Title and code of subject, number of credits**	ETR 408 Electrodynamics- 6 ECTS credits	
	Department	Physics and Electronics	
	Program	Bachelor	
	Academic semester	2020 Fall	
	Lecturer	Associate professor,PhD in technical, Hasanov Elchin	
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	Lecture room/Schedule	11 Mehseti Street, AZ1096 Baku, Azerbaijan (Neftchilar campus), room	
	Consultations	II, 15:00 – 16:00	
	Office hours	Saturday 17-00	
Prerequisites	EENG 245		
Course language	English		
Type of the subject	Major		
Textbooks and additional materials	***Textbooks*: Hugh D.Young, Roger A.Freedman** ***University Physics. Pearson International Edition.P.1551*** **1. David J. Griffiths. Introduction to Electrodynamics, New Jersey 07458** ***Supplementary books.*** ***2.*. Douglas C. Giancoli.** ***Physics for scientists and engineers. Pearson International Edition.2017*** ***3. Konstantin K.Likharev Problems and solutions on electromagnetism 2018***		
Teaching methods	**Lecture**		+
	Group discussions at seminars		+
Assessment	**Components**	**Date/ Deadline**	**Percent (%)**
	Active participation	At each lesson	5
	Quizzes	4 quizzes, for each 5 points	20
	Attendance	During the semester	5
	Midterm exam		30
	Final exam		40
	Final		**100**
Course description	This course introduces Electrostatics. Coulomb's Law. Vector addition of electric forces on a line and in plane. Electric field vector for a point charge. Superposition principle. Field of a ring charge. Field of a uniformly charged disk. Field of two oppositely charged infinite sheets. Electric field lines . Electric Potential Energy in a Uniform Field. Electric Potential Energy of Two point charges. Electric Potential Energy with several Point charges. Finding Electric Potential from Electric field. Electric Potential. . Magnetostatics. Magnetic field of a moving charge. Magnetic field of a current element. Magnetic field of a straight current carrying conductor. Magnetic field of a circular current loop. Ampere's law Dipole radiation. Electric and magnetic dipole radiation. Radiation from arbitrary source. Radiation pressure.		
Course objectives	The main objective of this course is to enable students to develop a basic familiarity with all the major topics of electrodynamics: Differential Calculus. Gradient. The Operator ∇. The Divergence . The Curl. Gauss's Law in differential form . Electric potential . Poisson's Equation and Laplace's Equation in one dimension. Method of images. Induced surface charge. Other image problems. Maxwell's equations . Maxwell's equations in matter. Boundary conditions. Charge and energy. The continuity equation. Poynting's theorem. Newton's third law in Electrodynamics. Conservation of momentum. Angular momentum. Dipole radiation. Electric and magnetic dipole radiation. Radiation from arbitrary source. Radiation pressure. The special theory of relativity. Einstein's postulates. The Lorentz transformations. Proper time and proper velocity. Relativistic energy and momentum. Relativistic		

	kinematics. Relativistic dynamics. Students need to learn Differential Calculus. Gradient. The Operator ∇. The Divergence . The Curl. Gauss's Law in differential form . Electric potential . Poisson's Equation and Laplace's Equation in one dimension. Method of images. Induced surface charge. Other image problems. Maxwell's equations . Maxwell's equations in matter. Boundary conditions. Charge and energy. The continuity equation. Poynting's theorem. Newton's third law in Electrodynamics. Conservation of momentum. Angular momentum. Dipole radiation. Electric and magnetic dipole radiation. Radiation from arbitrary source. Radiation pressure. The special theory of relativity. Einstein's postulates. The Lorentz transformations. Proper time and proper velocity. Relativistic energy and momentum. Relativistic kinematics. Relativistic dynamics.
Learning outcomes	What students should know by the end of the course: Differential Calculus. Gradient. The Operator ∇. The Divergence . The Curl. Gauss's Law in differential form . Electric potential . Poisson's Equation and Laplace's Equation in one dimension. Method of images. Induced surface charge. Other image problems. Maxwell's equations . Maxwell's equations in matter. Boundary conditions. Charge and energy. The continuity equation. Poynting's theorem. Newton's third law in Electrodynamics. Conservation of momentum. Angular momentum. Dipole radiation. Electric and magnetic dipole radiation. Radiation from arbitrary source. Radiation pressure. The special theory of relativity. Einstein's postulates. The Lorentz transformations. Proper time and proper velocity. Relativistic energy and momentum. Relativistic kinematics. Relativistic dynamics. Ionizing Radiation, Radiation dosimetry, risk and protection. Radiation Biology. Radiography, Film-screen and digital, Mammography & Fluoroscopy. Optical imaging. Ultrasound Imaging. Ultrasound Image Analysis. Computed Tomography. Magnetic Resonance Imaging (MRI). Nuclear Medicine Imaging. Imaging applications in Therapy.
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. 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 30% of lessons, are not allowed to take the exam. Tests Those students who have informed the teacher and the dean's office about missing the test in advance for particular reasons, are allowed to take the test next week. Exams All the issues related to the participation and admission to the exam are regulated by the faculty dean. Topics of midterm and final exams are provided for the students before the exams. The questions of midterm exam are not repeated in the final exam. Violation of the rules of the exams Disrupting the test and taking copy during midterm and final exams is forbidden. Test papers of the student who do not follow these rules are canceled and the students are expelled from the test by getting 0 (zero). The rule for completing the course In accordance with the University rules the overall success rate to complete the course should be 60% or above. The students who failed the exam would be to take this subject next semester or next year. Rules of conduct for Students Disruption of the lesson and not following ethical norms during the lesson, as well as conduction of the discussions by the students without permission and using mobile phones is forbidden.

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	***19.09.20***	Electrostatics. Coulomb's Law. Vector addition of electric forces on a line and in plane. Electric f0 ield vector for a point charge. Superposition principle. Field of a ring charge. Field of a uniformly charged disk. Field of two oppositely charged infinite sheets. Electric field lines. Problem solving *Quiz **1***	[1] p.709-741

		Conduction of oral and written survey. Problem solving.	
2	***26.09.20***	Flux of electric field. Gauss's law. Applications of Gauss's law : Field of a charged conducting sphere. Field of a uniform line charge. Solid sphere of charge. Field of an infinite plate sheet of charge. Field between opposite charged parallel plates.Charges on conductors. Problem solving *Quiz 2*	[1] p.750-773 [1] p-780-795
		Conduction of oral and written survey. Problem solving..	
3	***03.10.20***	Electric Potential Energy in a Uniform Field. Electric Potential Energy of Two point charges. Electric Potential Energy with several Point charges. Finding Electric Potential from Electric field. Electric Potential. Electric Potential of a charged conduction sphere . Potential of a charged conducting cylinder. Potential of line of charge. Potential due to a ring of charge. Potential due to a charged disk. Equipotential Surfaces and Field lines . Potential Gradient *Quiz 3*	[1] p.800-815
		Conduction of oral and written survey. Problem solving.	
4	***10.10.20***	Electric Dipole. Dipole in an external field. Potential energy of a dipole. Electric field and Potential due to dipole. Concept of multipole. Current dipole. Dielectrics. Polarization of dielectrics.Problem solving *Quiz 4*	[1] p.815-838
		Conduction of oral and written survey. Problem solving.	
5	***17.10.20***	Dielectrics. Dielectrics. Polarization of dielectrics. Gauss's Law in Dielectrics. Dielectric in an electric field. Boundary value problems with linear dielectrics. Energy in dielectric systems. Forces on dielectrics.	
		Conduction of oral and written survey. Problem solving.	
6	***24.10.20***	Differential Calculus. Gradient. The Operator ∇. The Divergence. The Curl. Gauss's Law in differential form. The curl of $\vec{E}$. Electric potential. Poisson's Equation and Laplace's Equation in one dimension. Method of images. Induced surface charge. Other image problems.	[1] p.846-872
		Conduction of oral and written survey. Problem solving.	
7	***31.10.20***	Magnetostatics. Magnetic field of a moving charge. Magnetic field of a current element. Magnetic field of a straight current carrying conductor. Magnetic field of a circular current loop. Ampere's law. Conduction of oral and written survey. Problem solving *Quiz 5*	[1]p.881-900,
		Conduction of oral and written survey. Problem solving	
8	***07.11.20***	Aplications of Ampere's law. Magnetic field lines and magnetic flux. Gauss 's law for magnetic field. Motion of charged particles in a magnetic Field. Magnetic force on current carrying conductor. Force and Torque on a current loop. Force between parallel conductors. Comparison of magneto-	[1] p.957-984

		statics and electrostatics. Magnetic vector potential. Magnetostatic boundary conditions. Problem solving ***Quiz 6***	
		Conduction of oral and written survey. Problem solving.	
9	***14.11.20***	***Mid term exam***	
10	***21.11.20***	Magnetic properties of matter. Magnetizability. Types of magnets(Para-,Dia- and Ferro magnets. Magnetization vector. Torques and forces on magnetic dipoles. Bound currents. Problem solving	[1] p.916-947
		Conduction of oral and written survey. Problem solving	
11	***28.11.20***	Ohm's law. Electromotive force. Motional EMF. Faraday's law. Lenz's law. The induced electric fields. Inductance.Electrodynamics before Maxwell. Eddy currents. Displacement current. Problem solving	[4]p. 73-96
		Conduction of oral and written survey. Problem solving	
12	***05.12.20***	Maxwell's equations . Maxwell's equations in matter. Boundary conditions. Charge and energy. The continuity equation. Poynting's theorem. Newton's third law in Electrodynamics. Conservation of momentum. Angular momentum.	[1] p.1061-1085
		Conduction of oral and written survey. Problem solving	
13	***12.12.20***	Electromagnetic waves in one dimension. Wave equation. Sinusoidal waves. Boundary conditions. Reflection and transmission. Polarization. Energy and momentum in EM waves. Problem solving	[3]p.555-611
		Conduction of oral and written survey. Problem solving.	
14	***19.12.20***	Propagation of EM waves in linear media. Reflection and transmission at normal incidence. Reflection and transmission at oblique incidence. Electromagnetic waves in conductors. Reflection at a conducting surface.	[1] page 9-6
		Conduction of oral and written survey. Problem solving	[1] page 10-6
15	***26.12.20***	Dipole radiation. Electric and magnetic dipole radiation. Radiation from arbitrary source. Radiation pressure. Conduction of oral and written survey. Problem solving	[1] page 11-6