

General information	Title and code of subject, number of credits	ETR476, Radio Transmitting and Antenna Devices, 6 ECTS	
	Department	Physics and Electronics	
	Program	Bachelor	
	Academic semester	Spring 2026	
	Lecturer	PhD, Associate Prof. Elchin Hasanov	
	E-mail:	elgafgas@yahoo.com	
	Phone number:		
	Lecture room/Schedule	11 Mehseti Street, AZ1096 Baku, Azerbaijan (Neftchilar campus), room Office hours: Wednesday 14:00 – 15:00	
Prerequisites			
Course language	English		
Type of the subject	Major		
Textbooks and additional materials	<i>Textbooks:</i> 1. Constantine A. Balanis Antenna Theory, Analysis and Design, 4 th edition, 2016 2. Chuck Fung. Antenna basic theory, 2011 3. Richard C.Johnson. Antenna Engineering Handbook, 2015 4. Kraus & Marhefka, Antennas: For All Applications (3rd Ed., 2002/2003)		
Teaching methods	Case analysis		x
	Group discussion		x
	Lecture		x
	Simulation		x
Evaluation Criteria	Components	Date/ Deadline	Percent (%)
	Quizzes	2 times during the semester	10
	Activity	At each lesson	5
	Presentations	2 times during the semester	10
	Attendance	At each lesson	5
	Midterm exam		30
	Final exam		40
	Final		100
Course description	This course provides a comprehensive study of radio transmission systems and antenna technologies used in modern communication. It covers the fundamental principles of electromagnetic wave propagation, antenna theory, and design, as well as various types of radio transmitters and their operational characteristics. Students will explore the relationship between transmitter parameters, antenna performance, and signal coverage, including practical considerations for efficiency, bandwidth, and radiation patterns. The course also emphasizes hands-on analysis, design, and testing of antennas and transmitting devices, enabling students to		

	<p>understand and implement effective solutions in real-world radio communication systems. By the end of the course, students will be able to analyze, design, and evaluate radio transmitters and antennas for diverse communication applications.</p>
Course objectives	<ul style="list-style-type: none"> • To provide students with a comprehensive understanding of the principles and operation of radio transmitting equipment. • To introduce various types of antennas, their characteristics, and design considerations for different communication systems. • To develop the ability to analyze and evaluate the performance of radio transmitters and antenna systems. • To enhance students' practical skills in configuring, testing, and troubleshooting radio transmission devices. • To familiarize students with modern trends and technologies in radio communication and antenna design. • To strengthen problem-solving and analytical skills related to radio frequency propagation, antenna selection, and system optimization.
Learning outcomes	<p>After completing this course, students will be able to:</p> <ul style="list-style-type: none"> • Explain the fundamental principles of radio transmitters and antenna operation. • Identify and describe different types of antennas and their applications in communication systems. • Analyze the performance parameters of radio transmitting devices and antenna systems. • Design and select suitable antennas for specific radio communication requirements. • Apply practical skills to set up, test, and troubleshoot radio transmitting equipment. • Evaluate the impact of radio frequency propagation on transmission quality and system efficiency. • Understand and apply modern technologies and standards in radio communication and antenna design.
Class Policy	<p>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 means of visual aids during seminars. Student's knowledge level will be tested orally and in written forms before midterm and final exams. Submission of the individual works by the end of course is obligatory.</p> <p>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.</p> <p>Lates Those students who are late for lessons for more than 15 minutes are not allowed to participate at the lesson. Despite this, the student is allowed to take part in the second part of the lesson.</p> <p>Tests</p>

	<p>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.</p> <p>Exams</p> <p>All the issues related to the participation and admission to the exam are regulated by the faculty dean.</p> <p>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.</p> <p>Violation of the rules of the exams</p> <p>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).</p> <p>The rule for completing the course</p> <p>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.</p> <p>Rules of conduct for Students</p> <p>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.</p> <p>Attendance</p> <p>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.</p> <p>Quizzes.</p> <p>Quizzes will be 2 times during semester. The time of quizzes will be announced in the classroom three weeks before.The quizzes will be related to the homework material.</p> <p>Presentation</p> <p>Presentations will be 2 times during the semester. The time of presentation will be announced in the classroom three weeks before. The quizzes will be related to the syllabus material.</p> <ul style="list-style-type: none"> • Activity <p>Students who are active in all classes will be evaluated with 5 points, those who are active in 60% of classes will be evaluated with 3 points.</p>
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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
<i>1</i>	<i>19.02.25</i>	Introduction. Types of Antennas. Radiation Mechanism. Single wire. Wire configurations for radiation. Two wires. Dipole. Current distribution on a thin wire antenna.	[1] p. 7-27 [2]
		Examination knowledges of students individually on the material of respective lecture. Analysis the lecture material in details. Solving problems.	[1] p.2-2

2	26.02.25	Fundamental parameters of antennas.Radiation Pattern. Radiation Power Density.Radiation intensity . Beamwidth. Directivity.Numerical techniques. Antenna Efficiency.Gain.	[1] p.27-69 [3]
		Examination knowledges of students individually on the material of respective lecture. Analysis the lecture material in details. Solving problems.	[1] p.
3	05.03.25	Beam efficiency. Bandwidth. Polarization. Input impedance. Antenna radiation efficiency. Antenna vector effective length and equivalent areas. Maximum directivity and maximum effective area.Friis transmission Equation and Radar Range equation. Antenna temperature.	[1] p.69-95 [3]
		Examination knowledges of students individually on the material of respective lecture. Analysis the lecture material in details. Solving problems.	[1] p.
4	12.03.25	Linear wire Antennas. Infinitesimal Dipole. Small Dipole. Region separation. Finite length dipole. Half-wavelength dipole. Linear elements near or on infinite perfect conductors. Ground effects.	[1] p. 151-205 [3]
		Examination knowledges of students individually on the material of respective lecture. Analysis the lecture material in details. Solving problems.	[3]
5	19.03.25	Loop antennas. Small circular loop. Circular loop of constant current. Circular loop with nonuniform current. Ground and Earth curvature effects for circular loops. Polygonal loop antennas. Ferrite loop antennas. Mobile communication systems applications.	[1] p.231-266 [3]
		Examination knowledges of students individually on the material of respective lecture. Analysis the lecture material in details. Solving problems.	[1] p.
6	26.03.25	Linear, planar and circular arrays. Two-element array. N-element linear array:Uniform amplitude and spacing. Directivity.Design procedure. Three-dimensional characteristics.	[1] p.283-320 [3]
		Examination knowledges of students individually on the material of respective lecture. Analysis the lecture material in details. Solving problems. Rectangular-to-Polar Graphical solution.N-element linear array:Uniform spacing.Nonuniform amplitude .Superconductivity. Planar array.Design considerations.Circular array.	[1] p.322-365
7	02.04.25	Continuous sources.Schelkunoff Polynomial method. Fourier Transform method.Woodward-Lawson Method. Taylor-line-source. Triangular, cosine, and cosine-squared amplitude	[1] p.385-419

		distributions.Line-source phase distributions.Continuous aperture sources.	[3]
		Examination knowledges of students individually on the material of respective lecture. Analysis the lecture material in details. Solving problems.	[1] p.
8	09.04.25	Integral equation method.Finite diameter wires. Moment method solution. Self impedance. Mutual impedance between linear elements.Mutual coupling in arrays.	[1] p.433-478 [2]
		Examination knowledges of students individually on the material of respective lecture. Analysis the lecture material in details. Solving problems.	[1] p.
9	16.04.25	Mid term exam	
10	23.04.25	Broadband dipoles and matching techniques.Biconical antenna. Triangular sheet,bow-tie and wire simulation.Cylindrical dipole.Folded dipole.Discone and Conical Skirt Monopole.Matching techniques. Traveling wave antennas. Broadband antennas.	[1] p.497-556 [3]
		Examination knowledges of students individually on the material of respective lecture. Analysis the lecture material in details. Solving problems.	[1] p.
11	30.04.25	Frequency independent antennas.Theory. Equiangular Spiral antennas.Log-periodic antennas.Fundamental limits of electrically small antennas. Fractal antennas.	[1] p.611-641 [3]
		Examination knowledges of students individually on the material of respective lecture. Analysis the lecture material in details. Solving problems.	[2] p.
12	07.05.25	Aperture antennas. Field equivalence principle: Huygens' principle. Radiation equation. Directivity. Rectangular apertures. Circular apertures. Design considerations. Babinet's principle. Fourier transforms in aperture antenna theory. Ground plane.	[1] p.653-701
		Examination knowledges of students individually on the material of respective lecture. Analysis the lecture material in details. Solving problems.	
13	14.05.25	Horn antennas. E-plane sectoral horn. H-plane sectoral horn. Pyramidal horn. Conical horn. Corrugated horn. Aperture-attached horns. Multimode horns. Dielectric loaded horns. Phase center.	[1] p.739-799
		Examination knowledges of students individually on the material of respective lecture. Analysis the lecture material in details. Solving problems.	[2] p.

14	21.05.25	Microstrip antennas. Rectangular patch. Circular patch. Quality factor, bandwidth, efficiency. Input impedance. Coupling. Circular polarization. Arrays and feed networks.	[1] p.811-865
		Examination knowledges of students individually on the material of respective lecture. Analysis the lecture material in details. Solving problems.	[2] p.
15	28.05.25	Reflector antennas. Plane reflector. Corner reflector. Parabolic reflector. Spherical reflector. Smart antennas. Sartr-antenna analogy. Cellular radio systems evolution. Signal propagation. Antenna beamforming.	[1] p.883-958
		Examination knowledges of students individually on the material of respective lecture. Analysis the lecture material in details. Solving problems.	[1] p.
		<i>Final Exam</i>	

