General information	**Title and code of subject, number of credits**	ETR487, Electrical Communication Theory, 6 ECTS	
	Department	Physics and Electronics	
	Program	Bachelor	
	Academic semester	Spring 2026	
	Lecturer	Shahmardan Amirov, doctor of sciences in Physics	
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	Lecture room/Schedule	11 Mehseti Street, AZ1096 Baku, Azerbaijan (Neftchilar campus), room	
	Consultations		
Course language	English		
Prerequisites	ETR 346 – Telecommunication Networks		
Type of the subject	Major		
Textbooks and additional materials	**Textbooks:** [1]. Principles of electronics communication systems, by Louis E. Frenzel Jr. New York, 2016, 930 pages [2]. Reflector antennas by Rafael Abrantes Penchel 2015, 77pages Additional materials: Introduction to Digital Communication, by Rodger E. Zeimer and Roger L. Peterson, Second Edition, Prentice Hall, 2001.		
Teaching methods	**Case analysis**		x
	Group discussion		x
	Lecture		x
	Simulation		x
Evaluation Criteria	**Components**	**Date/ Deadline**	**Percent (%)**
	Presentation	At the middle and end of the semester 2 times (5 points for each)	10
	Activity	At each lesson	5
	Assignment and quizzes	4 quizzes during the semester (2.5 points for each)	10
	Attendance	At each lesson	5
	Midterm exam		30
	Final exam		40
	Final		**100**
Course description	This course provides a comprehensive introduction to the principles and techniques underlying modern electrical communication systems. Students will study the fundamental concepts of signal generation, transmission, and reception, along with the analysis of communication channels and the impact of noise and interference. The curriculum covers both analog and		

	digital communication methods, including amplitude, frequency, and phase modulation, as well as pulse code modulation and digital signaling techniques. Emphasis is placed on the theoretical foundations, mathematical modeling, and practical applications of communication systems. By integrating theory with problem-solving exercises, students develop the analytical and critical thinking skills necessary to design, analyze, and optimize electrical communication systems in real-world scenarios.
Course objectives	• Introduce the fundamental concepts of communication theory, including signals, systems, and communication channels. • Develop a solid understanding of analog and digital communication techniques and their mathematical models. • Explain the principles of modulation and demodulation (AM, FM, PM, and digital modulation schemes). • Analyze the effects of noise and interference on communication systems and introduce basic noise models. • Teach the concepts of bandwidth, power, and signal-to-noise ratio (SNR) in communication system design. • Provide theoretical background on information transmission, channel capacity, and basic information theory.
Learning outcomes	After successfully completing this course, students will be able to: • Clearly describe the fundamental principles of analog and digital communication systems. • Represent and analyze communication signals using mathematical and graphical methods. • Assess the effects of noise, interference, and channel characteristics on system performance. • Implement and compare different analog (AM, FM, PM) and digital (PCM, ASK, FSK, PSK) modulation methods. • Use theoretical knowledge to design, simulate, and troubleshoot basic communication systems. • Calculate and interpret key performance indicators such as bandwidth, signal-to-noise ratio, and data rate. • Demonstrate the ability to apply course concepts to real-world communication engineering scenarios.
Class Policy	▪ **Preparation for class** The structure of this course makes your individual study and preparation outside the class extremely important. The lecture material will focus on the major points introduced in the text. Reading the assigned chapters and having some familiarity with them before class will greatly assist your understanding of the lecture. After the lecture, you should study your notes and work on relevant problems and cases from the end of the chapter and sample exam questions. ▪ **Withdrawal (pass/fail)** This course strictly follows the grading policy of the School of Science and Engineering. Thus, a student is expected to achieve a mark of at least 60% to pass. In case of failure, he/she will be required to repeat the

	course thefollowing term or year. ▪ **Cheating/plagiarism** Cheating or other plagiarism during the Quizzes, Midterm, and Final Examinations will lead to paper cancellation. In this case, the student will automatically get zero (0) without consideration. ▪ **Professional behavior guidelines** The students shall behave in a way to create a favorable academic and professional environment during class hours. Unauthorized discussions and unethical behavior are strictly prohibited. ▪ **Quiz** Tests will be carried out 4 times, 2.5 points for each (totally 10 points). 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. ▪ **Presentation** By the middle and end of the semester 2 times the semester, students will have to present a presentation on a relevant topic given by the teacher. ▪ **Attendance** Students who attend the whole classes will get 5 marks. For two absence student loses 1 mark. ▪ **Activity** Students who will be active during discussion of past lessons will be awarded with one activity mark.

Tentative Schedule

Week	Dates (planned)	Subject topics	Textbook/ Assignments
1	***16.02.26*** ***23.02.26***	Introduction to electronic communication. Communication systems. Modulation and Multiplexing. The electromagnetic spectrum. *Discussing.*	[1] Pages/ 3-25/
2	***23.02.26*** ***02.03.26***	Electronic fundamentals of communications. Gain, attenuation, decibels. Tuned circuits. Filters. *Free discussing of communication*	[1] Pages /31-92/
3	***02.03.26*** ***09.03.26***	Amplitude modulation fundamentals. Modulation index and parcentage modulation. Single side-band modulation.	[1] pages /93-115/
4	***09.03.26*** ***16.03.26***	Amplitude modulator and demodulator circuits. Basic principles of amplitude modulation. SSB circuits. ***Quiz 1.***	[1] pages /118-150/

5	***16.03.26*** ***23.03.26***	Fundamentals of frequency modulation. Basic principles of frequency modulation Principles of phase-modulation. Modulation index and sidebands.	[1] pages 151-170/
6	***23.03.26*** ***30.03.26***	FM circuits. Frequency modulators and demodulators. Phasemodulators. Parallel and serial transmission. Pulse modulation Digital signal.	[1] pages /173-228/,
7	***30.03.26*** ***06.04.26***	Radio-transmitters. Transmitter fundamentals. Power amplifiers. Impedance-matching networks. ***Quiz 2***	[1] pages /237-290/
8	***06.04.26*** ***13.04.26***	Multiplexing and demultiplexing.. Multiplexing principles. Frequency division multiplexing. ***Midterm exam***	[1] pages /348-373/
9	***13.04.26*** ***20.04.26***	Digital data transmission. Data codes. Principles of data transmission. Transmission efficiency. Modem concepts and methods.	[1] pages /375-412/
10	***20.04.26*** ***27.04.26***	Transmission lines. Standing waves. Transmission lines as circuit elements.	[1] pages /463-495/
11	***27.04.26*** ***04.05.26***	Antennas and wave propagation. Antenna fundamentals. Radio wave propagation. *Presentation of student project*	[1] pages /505-554/
12	***04.05.26*** ***11.05.26***	Basic concepts of antennas. Radiation pattern. Field rehgions. Radiation intensity. Beam width. ***Quiz 3***	[2] pages /3-12/
13	***11.05.26*** ***18.05.26***	*Radiation by aperture antennas*	[2] pages /25-37/
14	***18.05.26*** ***25.05.26***	Reflector antennas	[2] pages /38-54/
15	***25.05.26***	Satellite communications.Satelliteorbits.Satellite communication systems. Global navigation satellite systems. ***Quiz 4***	[1] pages /656-695/
		Final Exam