S Y L L A B U S

General information	**Title and code of subject, number of credits**	ETR 515- Microwave electronics and antenna theory – 8 ECTS	
	Department	Physics and Electronics	
	Program	Master	
	Academic semester	2023 Spring	
	Lecturer	PhD, Assistant Professor Elchin Hasanov	
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	Lecture room/Schedule	11 Mehseti Street, AZ1096 Baku, Azerbaijan (Neftchilar campus), room	
	Consultations	II, 15:00 – 16:00	
	Office hours	Sunday 10-00	
Prerequisites			
Course language	English		
Type of the subject	Major		
Textbooks and additional materials	***Textbooks*:** 1. Automatic design of antennas and microwave devices / D. I. Voskresensky, S. D. Kremenetsky, A. Yu. Grinev. - M .: Radio and communication. 1988 2 Sazonov, D. M. Antennas and microwave devices. Textbook for radio engineering specialties of universities / D. M. Sazonov. - M .: Higher school. 1988 3 Yanushkevich, VF Guidelines for laboratory work on the course "Microwave Devices and Antennas" / VF Yanushkevich. - Novopolotsk: PGU. 1994 4 Yanushkevich, VF Guidelines for coursework on the course "Microwave Devices and Antennas" / VF Yanushkevich. - Novopolotsk: PGU. 1997		
Teaching methods	**Lecture**		+
	Group discussions at seminars		+
Assessment	**Components**	**Date/ Deadline**	**Percent (%)**
	Tests	During the semester	5
	Active participation	At each lesson	10
	Quizzes	During the semester	15
	Attendance	During the semester	5
	Midterm exam		30
	Final exam		35
	Final		**100**
Course description	Microwave multipoles. Types of matrices (dissipation, resistance, conductance, transmission) and the relationship between them. Methods for measuring matrix elements, imposed conditions of reciprocity, symmetry and absence of losses. Drawing up matrices using examples of tees and balanced devices (double T-bridge, slotted bridge). The processes of radiation and reception of radio waves by antennas, as well as the processes of transmission of electromagnetic waves in microwave paths and the elements that form them, are very complex wave processes. Their adequate mathematical description is given by the general theory of the electromagnetic field		

	(electrodynamics), based on the solution of the system of Maxwell's differential equations, supplemented by constitutive equations for media and boundary conditions.
Course objectives	1. The purpose of teaching discipline The main goal of teaching the discipline is the understanding by students of the basic theoretical concepts, calculation methods and principles of designing modern microwave devices and antennas, preparation for mastering modern methods of designing microwave devices and antennas of various classes. 2. The tasks of studying the discipline - study of the theory of transmitting and receiving antennas and their power paths, designs of typical elements of antenna systems; - acquisition of skills in measuring and analyzing antenna parameters - directivity, gain, input impedance, effective surface. Noise temperature, etc.; - getting an idea about the danger of exposure to microwave radiation on the human body and the study of safety regulations. 3. The list of disciplines indicating the sections (topics), the assimilation of which by students is necessary for the study of this discipline:
Learning outcomes	The student must know the - exercises on the use of a circular nomogram in the calculations of matching devices, finding scattering matrices of simple microwave units, analysis and synthesis of directional couplers, power dividers, phase shifters, switches, etc. - exercises on the construction of current distributions in vibrator and slot antennas, radiation patterns of several coherent sources with different amplitude-phase distributions. - Solution of typical tasks on preliminary design antenna systems according to specified parameters (beam width, side-lobe level, directivity gain, etc.) - Using circular monograms in calculations, finding the scattering matrices of microwave nodes
Rules (Educational policy and behavior)	▪ **Preparation for the lesson**. This course makes your study and preparation outside of the classroom essential. Lectures are based on what is presented in the text. A visual explanation will greatly help your understanding of the lecture. After the lecture, you should study your notes and work through the relevant tasks and cases from the end of the chapter and the sample exam questions. • **Withdrawal (pass/fail)** This course strictly follows grading policy of the School of Humanities, Education and Social sciences. Thus, a student is normally expected to achieve a mark of at least 60% to pass. In case of failure, he/she will be required to repeat the course the following term or year. ▪ **Cheating/plagiarism** Plagiarism during midterm and final exams will result in the cancellation of the work. In this case, the student automatically gets zero (0), without any reasoning. ▪ **Rules of professional conduct** Students must behave appropriately for the university in order to create an appropriate aura during their studies. Unauthorized discussions and unethical behavior are strictly prohibited. **Attendance**

	Students who attend the whole classes will get 5 marks. for three absence student loses 1 mark. • **Quizzes** There will be a quizzes per two weeks. The quizzes will be announced in the classroom two weeks before and will relate to homework. • **Activity** Students who will be active during discussion of past lessons will be awarded with one activity mark.

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	***18. 02. 23***	The purpose of the microwave paths and the requirements for them Typical path of pulse radar .. Design and operation features of microwave paths	[1] p.709-741
2	***25.02/23***	Mutual irregular elements and devices of the waveguide path Microwave multipoles. Electrical models and methods for their description	[1] p.750-773 [1] p-780-795
		Problem solving..	
3	***04/03/23***	Mutual irregular microwave multipoles, designs, principles of operation Double waveguide tee Waveguide slot bridge	[1] p.800-815
		Problem solving.	
4	***11/03/23***	Frequency filters and wavetype filters Directional coupler specifications Directional coupler with two connection ports in the narrow wall of the waveguide	[1] p.815-838
		Problem solving.	
5	***18/03/23***	Wave Type Filters Wave Type Transformers Varieties and design features of wave-type filters	
		Problem solving.	
6	***25/03/23***	Waveguide devices with longitudinally magnetized ferrite.	[1] p.846-872

		Designs, principles of operation Polarization plane rotator	
		Problem solving.	
7	***01/04. 23***	Waveguide devices with transverse magnetized ferrite. Designs, principles of operation Non-reciprocal phase shifter resonant gates	[1]p.881-900,
		Problem solving	
8	***08/04/23***	Antenna switches Mechanical antenna switches; Discharge Antenna Switches Semiconductor Switches. Dielectric phase shifters.	[1] p.957-984
		Problem solving.	
		Mid term exam	
09	***15/04/23***	Waveguide absorbing loads Waveguide attenuators Waveguide phase transformers.	[1] p.916-947
		Problem solving	
10	***22/04/23***	Oscillatory systems of microwave frequencies Oscillatory systems of resonant type Oscillatory systems of non-resonant type (retarding systems).	[4]p. 73-96
		Problem solving	
11	***29/04/23***	Varieties and parameters of retarding systems .. Field structure in probing systems Dispersion characteristics.	[1] p.1061-1085
		Problem solving	
12	***06/05. 23***	Characteristics and parameters of the transmitting antenna Purpose of the transmitting antenna Antenna classification. Brief information about antennas	[3]p.555-611

		different types . Characteristics and directivity parameters of the transmitting antenna	
		Problem solving.	
13	***13/05. 23***	Characteristics and directivity parameters of the receiving antenna Directional diagram. The power delivered by the antenna to the load. Effective area, area utilization factor	[1] page 9-6
		. Problem solving	[1] page 10-6
14	***20. 05/23***	Antenna as a system of emitters The concept of an antenna as a system of emitters The multiplication rule for radiation patterns. System multiplier ..	[1] page 11-6
15	***27.05.23***	Linear Systems of Continuous Emitters Influence of the amplitude distribution on the directional properties of the antenna. System with uniform amplitude distribution	[1] page 14-21