S Y L L A B U S

General information	**Title and code of subject, number of credits**	ETR 642 Fundamental of microwave design 6 ECTS credits	
	Department	Physics and Electronics	
	Program	Magisters	
	Academic semester	2020 Fall	
	Lecturer	PhD, dosent, Hasanov Elchin	
	E-mail:	elgafgas@yahoo.com	
	Phone number:	+994 50 5287740	
	Lecture room/Schedule	11 Mehseti Street, AZ1096 Baku, Azerbaijan (Neftchilar campus), room	
	Consultations	II, 15:00 – 16:00	
	Office hours	Sanay 09-00	
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.Michael Steer, NC State Fundamentals of Microwave and RF Design 2019 *2.*. Michael Steer. Fundamentals of Microwave and RF Design *2019*		
Teaching methods	**Lecture**		+
	Group discussions at seminars		+
Assessment	**Components**	**Date/ Deadline**	**Percent (%)**
	Tests	During the semester	5
	Activity	At each lesson	10
	Quizzes	During the semester	15
	Attendance	During the semester	5
	Midterm exam		30
	Final exam		35
	Final		**100**
Course description	Understand the essential principles of RF, wireless and microwave measurements Describe key RF, wireless and microwave measurement parameters Understand different RF connector types and how to correctly care for them Understand how to use a range of RF, wireless and microwave measurement equipment Reduce the risk of expensive test equipment damage, downtime and repair costs Understand how to correctly perform a range of RF and microwave measurements Develop improved problem solving capability due to better understanding of measurements Better utilise test equipment features and functionality		
Course objectives	This course provides a solid grounding in radio frequency (RF), wireless and microwave measurements from high-frequency (HF) to 40 GHz. The course introduces basic theory and high-frequency measurement concepts before addressing a range of common RF, wireless and microwave measurements used in research and development (R&D), manufacturing test and production environments. The course includes a series of practical measurement demonstrations to help reinforce concepts, performed using the latest RF and microwave test and measurement instruments.		
Learning outcomes	Introduction Transmission Lines and S-parameters Connectors and Cable Care Vector Network Analysis Calibration, Verification and Accuracy of Vector Network Analysers		

	Spectrum Analysis Power Measurements Noise Figure Measurements Phase Noise Measurements Digital Modulation Measurements Antennas and EMC Practical Measurement Demonstrations
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. 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. • **Attendance** Students who attend the whole classes will get 5 marks. for three absence student loses 1 mark. 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** 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. • **Tests** Tests will be presented to the students based on the homework of each lesson during the semester and will be evaluated with 5 points at the end.

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	*17/09/22*	Apply the Smith chart to evaluate microwave networks . Tramsmission lines and wavequides.	[1] p.709-741
		Problem solving.	
2	*24/09/22*	Apply *N*-port representations for analysing microwave circuits; Radio Frequency Band, microwave and millimeter wave. Problem solving	[1] p.750-773 [1] p-780-795
		Problem solving..	
3	*01/10/22*	Apply the Smith chart to evaluate microwave networks.	[1] p.800-815

		Impedance Measurement- Measurement of unknown load impedance of a transmission line, Slotted Line Technique to measure unknown impedance.	
		Problem solving.	
4	***08/10/22***	Design and evaluate impedance matching networks. Distortion & Frequency Translation Measurement- Different types of distortion occurred at microwave frequencies, Procedures for frequency translation.	[1] p.815-838
		Problem solving.	
5	***15/10/22***	Design, evaluate and characterise directional couplers and power dividers. Different type of microwave detectors functions and applications, Sensors Definition & working principle, applications, measurement of scattering parameters.	
		Problem solving.	
6	***17.10/22***	Design and analyse attenuators, phase shifters and resonators; Other image problems. Concept of vector network analyzer, Basic block diagram of vector network analyzer (VNA)	[1] p.846-872
		Problem solving.	
7	***24/10./22***	Explain basic properties of ferrite devices (circulators, isolators). Application of vector network analyzers. Scalar Network Analyzer (SNA):	[1]p.881-900,
		Problem solving	
8	***31/10/22***	Radar systems and calibration, weather radar. Microwave remote sensing applications Definition of network analyzer, Difference between SNA&VNA, Basic block diagram Scalar Network Problem solving	[1] p.957-984
		Problem solving.	
9		***Mid term exam***	
10	***07/11/22***	Plane wave propagation, reflection, refraction, and attenuation. Antenna systems in microwave remote sensin Problem solving	[1] p.916-947
		Problem solving	
11	***14/11/22***	Passive microwave remote sensing and radiometry Microwave interaction with the atmosphere . Problem solving	[4]p. 73-96
		Problem solving	
12	***21/11/22***	Radiometer systems. Scattering and emission from natural	[1] p.1061-

		targets.	1085
		Problem solving	
13	***28/11/22***	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
		Problem solving.	
14	***05/12/22***	Basic block diagram of a spectrum analyzer, functions & applications of a spectrum analyzer.	[1] page 9-6
		. Problem solving	[1] page 10-6
15	***17. 12/22***	Time Domain Electrometer (TDR) & IC Technology: Introduction to Electrometer, Measurement of reflection coefficient using electrometer technique, Basic block diagram of a time domain electrometer.. Problem solving	[1] page 11-6