S Y L L A B U S

General information	**Title and code of subject, number of credits**	ETR582 Theory of reception, processing and transmission of images – 6 ECTS	
	Department	Physics and Electronics	
	Program	Bachelor	
	Academic semester	2023 spring	
	Lecturer	Associate Professor, PhD Sevda N. Garibova	
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	Phone number:		
	Lecture room/Schedule	11 Mehseti Street, AZ1096 Baku, Azerbaijan (Neftchilar campus), room Lectures:	
	Consultations		
Course language	English		
Type of the subject	Major		
Textbooks and additional materials	***Textbooks*:** 1. Rafel C.Gonzalez, Richard E. Woods. *Digital image processing,* New Jersey,2002. 2. Cantatore, Angela: Muller, Pavel. *Introduction to computed tomography*.Kgs. Lynghy: DTU Mechanical Engineering, (2011). ***Additional materials:*** Harrison H. Barrett, William Swindell. *The theory of image formation, detection, and processing*. USA (1996).		
Teaching methods	**Lecture**		15
	Group discussions		15
Assessment	**Components**	**Date/ Deadline**	**Percent (%)**
	Presentation	By the end of the semester, students will have to present a presentation on a relevant topic given by their teacher	10
	Active participation and discussion	At each lesson	10
	Assignment and quizzes	3 quizzes during the semester	10
	Attendance		
	Midterm exam		30
	Final exam		40
	Final		**100**
Course description	Modern technology is developing so rapidly that there is always a need to improve science and techniques. Image reflects and transfer information about the investigated object, therefore, the study of methods of image processing is very important. In this course studied the various methods of digital image processing, analysis of the stages of obtaining and areas of application in detail. The differences between simple and digital images, their advantages are studied in the course, the wide uses of the digital image and their different methods of obtaining shows that modern life is impossible without a digital image processing. The main source of imaging is not only visible light, but also waves of invisible regions, sound waves, which are widely used in medicine, geological exploration of oil and gas, weather forecasting, astronomical research and etc. Therefore, the course describes in detail the nature of electromagnetic waves, how an image is digitized, which energies are used to obtain an image of an object that is invisible to us, in distant galaxies, and how an image of an organ is obtained. There are studied the x-ray and gamma ray imaging, imaging in ultraviolet and radio bands, ultrasonic imaging, about CAT, SEM, TEM, MRT, imaging sensors, angiography.		
Course objectives	Students will be analyze image processing by the components and fundamental steps, and able to do homework by designing a model of images, study elements of visual perception and structure of the human eye, sampling and quantization process of digitizing, will understand the base of the image formation by using sensors, perception, reception, processing and transmission of images by modern and high technology. Students will be able to work on graphic tasks using various picture and graphical programs, especially with OriginPro.		

Learning outcomes	At the end of the course the students will: • study physical process of digital image technology using various types of energy sources and the methods for imaging, • study the nature of electromagnetic spectrum and lighting, • know how image digitizing by using quantization and sampling processing, • analyze digital imaging with spatial and Gray – level resolution, • understand x-ray and gamma ray imaging, working principle of imaging radar and imaging sensors in image processing, components of image processing, picture elements, CAT, MRT, PET • By using the OriginPro students will be able to work on graphic tasks. As the result the information that students will receive in this course will develop the worldview of students and help them in their successful specialization in the future.
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 (quizzes) before midterm and final exams. Submission of the individual works by the end of course is obligatory. • **Exams (pass/fail)** 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. 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. Students who got 57% can retake the 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). • **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** 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. Students who attend the whole classes will get 5 marks. For three absences student loses 1 mark. • **Quizzes** There will be quizzes per two weeks. The quizzes will be announced in the classroom two weeks before and will relate to homework. Depending on the difficulty of the lesson, quizzes can be two or three times during the semester, each with three or five points. • **Activity** For activity during lessons in the whole semester, students are rewarded with 5 points. The activity of students is assessed by the preparation of home questions, which is given by the teacher after the lessons; it can also be oral discussions.

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	***14.02*** ***16.02***	Introduction to image processing, digital image processing, Examples of fields that use digital image processing *Oral questions. Homework- file formats of digital image*	[1] pages 1-6
2	***21.02*** ***23.02***	Physical principle of imaging with gamma- and X –rays. Graphing and data analysis with Originlab programm. *Practical work with OriginPro.*	[1] pages 8-10
3	***28.02*** ***02.03***	Imaging in the ultraviolet, visible and infrared bands. Image Enhancement in the frequency domain *Quizze 1*	[1] pages 11-18

4	***07.03*** ***09.03***	Imaging in microwave and radio bands. Image Enhancement in the spatial domain *Testing. Homework- uses various resolution in image processing. Practical work with OriginPro. Evaluation of the students for activity.*	[1] pages 18-20
5	***14.03*** ***16.03***	Physical principle of acoustic and sound wave imaging, infrasound and ultrasound. Color image processing. *Practical work with OriginPro.Evaluation of the students for activity.*	[1] pages 20-25
6	***28.03*** ***30.03***	Digital image processing basics and fundamental steps in digital image processing and technology. Graphing and data analysis with Originlab programm. *Testing and discussion. Homework – using fundamental steps of digital imaging take any image form.*	[1] pages 25-28
7	***04.04*** ***06.04***	Components of digital image processing system. Graphing and data analysis with Originlab programm. *Quizze 2. Homework- using components of imaging take any image form*	[1] 28-30
8	***11.04*** ***13.04***	Elements of visual perception, structure of the human eye. Structure and working principle of light microscope. *Preparation to midterm exam*	[1] 34-37
9	***18.04*** ***20.04***	Image formation in the eye.Brightness, adaptation and discrimination. Lens as optical instrument, imaging by the lenses. ***MIDTERM EXAM***	[1] 37-40
10	***25.04*** ***27.04***	Light and the electromagnetic spectrum, nature and properties of the light. *Submit individual presentation work*	[1] pages 42-45
11	***02.05*** ***04.05***	Image sensing and acquisition, image fromation by using sensors, light sensors, works, application. *Quizze 3*	[1] pages 45-50
12	***11.05*** ***13.05***	Sampling and quantization process of digital image. Color image processing. *Submit individual presentation work*	[1] pages 52-56
13	***16.05*** ***18.05***	Spatial and Gray –level resolution. Image restoration. *Submit individual presentation work*	[1] pages 57-62
14	***23.05*** ***25.05***	Computed tomography, CT technology *Submit individual presentation of the student project*	[2] pages 12-22
15	***27.05*** ***30.05***	Non-destructive testing. *Final exam material discussing*	[2] pages 4-10
		Final Exam