S Y L L A B U S

General information	**Title and code of subject, number of credits**	**ETR 490 Optical communication Engineering -** (6 ECTS credits)	
	Department	Physics and Electronics	
	Program	Bachelor	
	Academic semester	2020 spring	
	Lecturer	Doctor of philosophy (PhD), associate professor, Farida Tatardar	
	E-mail:	**farida.tatardar@khazar.org , tatardar.farida@rambler.ru**	
	Phone number:	(+994 12) 421-10-93	
	Lecture room/Schedule	11 Mehseti Street, AZ1096 Baku, Azerbaijan (Neftchilar campus) room	
	Office hours	Monday, 10:00-11:00	
Prerequisites	EENG 245 – Basic Electronics		
Course language	English		
Type of the subject	Major		
Textbooks and additional materials	1. John M. Senior assisted by M. Yousif Jamro, Optical Fiber Communications Principles and Practice, Third edition, 2009. 2. Djordjevic, Ivan B, Advanced Optical and Wireless Communications Systems, 2018 3. *Govind P. Agrawal*. Fiber optic communication systems, 2002 4. *Harry J. R. Dutton.* Understanding Optical Communications, International Technical Support Organization, 2000 **Course website** **https://eceagmr.files.wordpress.com/2014/09/optical-fiber-communications-principles-and-pr.pdf** **https://www.springer.com/us/book/9783319631509** www.McGraw-Hill.ru		
Teaching methods	**Lecture**		+
	Group discussions at seminars		+
Assessment	**Components**	**Date/ Deadline**	**Percent (%)**
	Assignment and quizzes	During the semester	10
	Active participation	At each lesson	5
	Individual research papers and presentations	During the semester	10
	Attendance	At the end of the semester	5
	Midterm exam		30
	Final exam		40
	Total		**100**
Course description	The course addresses the fundamentals of optical communications engineering and provides an overview of existing and emerging optical communications. It covers Advantages of optical fiber communication, Optical fiber waveguides, Transmission characteristics of optical fibers, Optical fibers and cables, Optical sources: the laser, the light-emitting diode, Optical detectors, Optical amplification, wavelength conversion and regeneration and Optical networks and including past and future generation networks. Simulation of optical communication under different channel environments will be integral part of this course. The first section explains the theory of multimode and single-mode fibers, then the technological features, including manufacturing, cabling, and connecting. The second section describes the various components (passive and active optical components, integrated optics, opto-electronic transmitters and receivers, and optical amplifiers) used in fiber optic systems. Finally, the optical transmission system design is explained, and applications to optical networks and fiber optic sensors are detailed, including the most recent developments in switched networks, high bit-rate systems, and FTTH or radio over fiber.		
Course objectives	Optical communications engineering is one of the fastest growing fields in the engineering world, and a tremendous interest for this topic exists among undergraduate students. To understand the examples of optical communications theory of multimode and single-mode fibers, cabling, and connecting. To study the different generations the optical transmission system design is explained, and applications		

	to optical networks and fiber optic sensors are detailed, including the most recent developments in switched networks, high bit-rate systems, and FTTH or radio over fiber. To understand the concepts of optical communication and to optical networks.
Learning outcomes	What students should know by the end of the course: The main form of delivery of course material is lectures. An important aspect of Optical communication lectures is that real and computer physical experiments must be used, educational films, and model computer programs should be used. Important sections of the course syllabus may be included in the workshop sessions. Typically, seminars address theoretical materials that require sophisticated mathematical apparatus and various problem-solving methods. Students can take different homework assignments to reinforce the material they receive during the course.
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. 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. 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.

Week	**Dates (planned**	**Subject topics**	**Textbook/ Assignments**
1	***11.02.20***	***Introduction to optical communication*** *Historical development*	[1] / pages 1-10/
	13.02.20	*Advantages of optical fiber communication*	
2	***18.02.20***	***Optical fiber waveguides***	[1] / pages 12-82/
	20.02.20	*Single-mode fibers, Photonic crystal fibers*	
3	***25.02.20***	***Transmission characteristics of optical fibers***	[1] / pages 86-163/
	27.02.20	*Linear scattering losses, Nonlinear scattering losses, Fiber bend loss, dispersion, Polarization.*	
4	***03.03.20***	***Optical fibers and cables***	[1] / pages 169-207/

	05.03.20	*Vapor-phase deposition techniques, Optical fibers, Cable design.*	
5	***10.03.20***	***Optical fiber connections: joints, couplers and isolators***	[1] / pages 217-287/
	12.03.20	*Fiber splices, Fiber connectors, Optical isolators and circulators*	
6	***17.03.20***	***Optical sources 1: the laser***	[1]/pages 294-386/
	19.03.20	*Optical emission from semiconductors, The semiconductor injection laser.*	
7	***31.03.20***	***Optical sources 2: the light-emitting diode***	[1]/pages 396-439/
	02.04.20	*LED structures, LED characteristics, Modulation.*	
8	***07.04.20***	***Optical detectors***	[1]/pages 444-496/
	14.04.20	*Introduction, Device types, Optical detection principles, Absorption, Semiconductor photodiodes without internal gain, The p–n photodiode, The p–i–n photodiode, Phototransistors*	
9	***16.04.20***	***Mid term exam***	
10	***21.04.20***	***Direct detection receiver performance considerations***	[1]/pages 502-545/
	23.04.20	*Noise, Thermal noise, Dark current noise, Quantum noise, Digital signaling quantum noise, Analog transmission quantum noise, Receiver noise*	
11	***28.04.20***	***Optical amplification, wavelength conversion and regeneration***	[1]/pages 549-600/
	30.04.20	*Optical amplifiers, Semiconductor optical amplifiers, Fiber and waveguide amplifiers.*	
12	***05.05.20***	***Integrated optics and photonics***	[1]/pages 606-665/
	07.05.20	*Integrated optics and photonics technologies,* ***Optoelectronic integration, Photonic integrated circuits, Optical computation.***	
13	***12.05.20***	***Optical fiber systems 1: intensity modulation/direct detection***	[1]/pages 673 – 811/
	14.05.20	***The optical receiver circuit,*** *the optical transmitter circuit, digital system and analog system, Multiplexing strategies.*	
14	***19.05.20***	***Optical fiber systems 2: coherent and phase modulated***	[1]/pages 823-897/
	21.05.20	*Modulation formats, Phase shift keying, Polarization shift keying, Demodulation schemes, Receiver sensitivities*	
15	***26.05.20***	***Optical fiber measurements***	[1]/pages /905 – 1041/
	29.05.20	***Optical networks,*** *Optical switching networks, Optical Ethernet.*	
		Final Exam