Identification	Subject (code, title, credits)	ETR 490 Optical Communication Engineering-6 ECTS credits
	Department	Physics and Electronics
	Program (undergraduate, graduate)	Undergraduate
	Term	2023 Spring
	Instructor	Ahmad Asimov ph.D
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	Phone:	+994124211093 (daxili255)
	Classroom/hours	302N Monday/Wednesday
	Office hours	Tuesday: 15:00-16:00/ Thursday: 15:00-16:00
Prerequisites		
Language	English	
Compulsory	Compulsory	
Required textbooks and course materials	1. Fundamentals of Electrical Engineering, by Don H. Johnson, Rice University, Houston, Texas, 2013. 2. Communication Systems, Simon Haykin, 4th Ed. Wiley, 2001, ISBN 0-471-17869-1	
Course description	This subject focuses in studying the optical fiber communications components and systems. Topics include, Optical fiber waveguides, Transmission characteristics of optical fibers, Optical fibers and cables, Optical sources: the laser, the light-emitting diode, Optical detectors, Optical amplification, 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	
Course objectives	Upon successful completion of this course, students will be able to: Students will analyze the structure of common communication system and can build the model of that system, will study both theoretical and practical aspects of information processing. At the end of the course the students understand how build the communication system, and why digital communication has wide uses in modern life. They will be able to construct the mathematical model and block diagrams of communication system, to analyze the input and output signals which have important roles for information communication.	
Learning outcomes	This is a calculus-based introductory physics course. After successfully completed course, students will be able to: Demonstrate basic fiber handling skills, including cleaving and splicing. Operate instrumentation for measuring fiber and optical system properties. Describe a suitable model for noise in communications, determine the signal-to-noise ratio performance of analog communications systems, determine the probability of error for digital communications systems, understand information theory and its significance in determining system performance, compare the performance of various communications systems.	
Teaching methods	**Lecture**	☑
	Group discussion	☑
	Experiential exercise	☑
	Quiz, Classroom Exams	☑

Evaluation	**Methods**	**Date/deadlines**	**Percentage (%)**
	Midterm Exam		30
	Individual research papers and presentations		
	Active participation	At each lesson	5
	Quizzes	3 quizzes during the semester	20
	Activity	During the semester	5
	Presentation		
	Final Exam		40
	Others		
	Total		100

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 relevant problems and cases from the end of the chapter and sample exam questions.

- **Withdrawal (pass/fail)**
  This course strictly follows grading policy of the School of Science and Engineering. 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**
  Cheating or other plagiarism during the Quizzes, Mid-term and Final Examinations will lead to paper cancellation. In this case, the student will automatically get zero (0), without any considerations.

- **Professional behavior guidelines**
  The students shall behave in the way to create favorable academic and professional environment during the class hours. Unauthorized discussions and unethical behavior are strictly prohibited.

Quizzes

- There will be a quiz examination per two weeks. The quizzes will be announced in the classroom two weeks before. Quiz is from homework problems.

The homework problems will be selected from questions and problems in the end of each chapter. The No. of homework problems will be announced after finishing each chapter.

- **Active participation**

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	Date/Day (tentative)	Topics	Textbook
1	14.02.23 16.02.23	Introduction to optical communication, structure of communication systems, fundamental signal, Advantages of optical fiber communication, Evolution of fiber optic system,	[1] Pages/ 1-10/
2	21.02.23 23.02.23	Optical fiber waveguides Single-mode fibers, Photonic crystal fibers	[1] Pages /11-82/
3	28.02.23 01.03.23	Transmission characteristics of optical fibers Linear scattering losses, Nonlinear scattering losses, Fiber bend loss, dispersion, Polarization	[1] / pages 86- 163/
4	7.03.23 9.03.23	Optical fibers and cables Vapor-phase deposition techniques, Optical fibers, Cable design.	[1] / pages 169- 207/
5	14.03.23 16.03.23	Optical fiber connections: joints, couplers and isolators Fiber splices, Fiber connectors, Optical isolators and circulators	[1] / pages 217- 287/
6	28.03.23 30.03.23	Optical sources 1: the laser Optical emission from semiconductors, The semiconductor injection laser	[1]/pages 294- 386/

7	04.04.23 06.04.23	Optical sources 2: the light-emitting diode LED structures, LED characteristics, Modulation.	[1]/pages 396- 439/
8		Midterm exam	
9	11.04.23 13.04.23	Optical detectors Introduction, Device types, Optical detection principles, Absorption, Semiconductor photodiodes without internal gain, The p–n photodiode, The p–i–n photodiode, Phototransistors	[1]/pages 444- 496/
10	18.04.23 20.04.23	Direct detection receiver performance considerations Noise, Thermal noise, Dark current noise, Quantum noise, Digital signaling quantum noise, Analog transmission quantum noise, Receiver noise	[1]/pages 502- 545/
11	25.04.23 27.04.23	Optical amplification, wavelength conversion and regeneration. Optical amplifiers, Semiconductor optical amplifiers, Fiber and waveguide amplifiers	[1]/pages 549- 600/
12	02.05.23 04.05.23	Integrated optics and photonics Integrated optics and photonics technologies, Optoelectronic integration, Photonic integrated circuits, Optical computation.	[1]/pages 606- 665/
13	11.05.23 16.05.23	Optical fiber systems 1: intensity modulation/direct detection. The optical receiver circuit, the optical transmitter circuit, digital system and analog system, Multiplexing strategies.	[1]/pages 673 – 811/
14	18.05.23 23.05.23	Optical fiber systems 2: coherent and phase modulated Modulation formats, Phase shift keying, Polarization shift keying, Demodulation schemes, Receiver sensitivities	[1]/pages 823- 897/
15	25.05.23 30.05.23	Optical fiber measurements Optical networks, Optical switching networks, Optical Ethernet.	[1]/pages /905 – 1041/
		Final Exam