Identification	Subject (code, title, credits)	ETR 540 Optoelectronic devices-6 ECTS credits	
	Department	Physics and Electronics	
	Program (undergraduate, graduate)	Master	
	Term	2023 spring	
	Instructor	Ahmad Asimov ph.D	
	E-mail:	fizikasimov@gmail.com	
	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. Bhattacharya P., Semiconductor Optoelectronic Devices,, PHI, New Delhi. 2. Physics of Semiconductor Devices, 2nd edition, S. M.Sze, John Wiley&Sons, 3. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. 4. S. O. Kasap, "Optoelectronics and Photonics: Principles and Practices," *Prentice-Hall,*		
Course description	The aim of this course is to provide students with an understanding of various semiconductor and non-semiconductor based optoelectronic devices (light emitters, laser, detectors, modulators etc.). Topics include a variety of different subjects including a detailed discussion of the design and operation of optical LEDs, the basic physics and operation of lasers and photodetectors, details of the basic physics and operation of solar cells and the operation of quantum well electro-absorption modulators		
Student Learning Objectives/Outcomes	• To know the basics of solid state physics and understand the nature and characteristics of light • Acquire fundamental understanding of the basic physics behind optoelectronic devices • To understand different methods of luminescence, display devices and laser types and their applications. • To learn the principle of optical detection mechanism in different detection devices. • Theoretical and practical preparation of students to acquire and apply knowledge and skills in Optoelectronics and Lasers • Conducting experiments in laboratory and industrial environment		
Teaching methods	**Lecture**		
Teaching methods Evaluation	**Group discussion**		☑
	Experiential exercise		☑
	Quiz, Classroom Exams		☑
		Date/deadlines	**Percentage (%)**
Evaluation	**Midterm Exam**		30
	Active participation		5
	Quizzes		20
	Activity	4 quizzes during the semester	5
	Final Exam	During the semester	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.

Tentative Schedule

Week	Date/Day (tentative)	Topics	Textbook
1	15.02.23 17.02.23	Introduction to course. Wave nature of light, Polarization, Interference, Diffraction	Chapter 1
2	22.02.23 24.02.22	Quantum mechanics: a. Crystal structures b. Particle in a box c. Bandgap	Chapter 2
3	17.02.23 24.02.23	Review of Semiconductor Device Physics: Energy bands in solids, the E-k diagram, Density of states,	Chapter 3
4	01.03.23 03.03.23	Fermi level and quasi Fermi levels, p-n junctions, Schottky junction and Ohmic contacts	Chapter 4
5	08.03.23 10.03.23	Electronic Properties and Optical Processes in Semiconductors	Chapter 5
6	15.03.23 17.03.23	P-N Junction Theory. Semiconductor Photon Sources: Electroluminescence.	Chapter 6
7	22.03.23 24.03.23	The LED: Device structure, materials and characteristics. The Semiconductor Laser: Operating Principles, Basic structure, theory and device characteristics;	Chapter 7
8	29.03.23 05.04.23	Solar Cells	Chapter 8
		Midterm exam	

9	07.04.23 12.04.23	Optoelectronic Modulator: Introduction, Analog and Digital Modulation	Chapter 9
10	14.04.23 19.04.23	Electro-optic modulators, Optical, Switching and Logic Devices.	Chapter 10
11	21.04.23 26.04.23	Optical Detection Devices: Photo Detector, Thermal Detector, Photo Diodes	Chapter 11
12	28.04.23 03.03.23	Synthesis and Fabrication of Optoelectronic Materials And Devices: a. Fabrication: Lithography (PL, EBL FIB, etc.), etching, and deposition	Chapter 12
13	05.03.23 10.05.23	b. 0D systems: Nanocrystals and quantum dots c. 1D systems: Nanowires and nanotubes d. 2D systems: Graphene, other atomic monolayers, chalcogenides	Chapter 13
14	12.05.23 17.05.23	Spectroscopy and Characterization Techniques a. Optical techniques i. EL, PL	Chapter 14
15	19.05.23 24.05.23	Raman.Electronic techniques i. 4 point probe,	Chapter 15
16	26.05.23 31.05.23	Hall effect c. Electron microscopy techniques i. SEM, TEM, EDS,	Chapter 16
		Final exam