



COURSE UNIT (MODULE) DESCRIPTION

Course unit (module) title	Code
Optoelectronics	

Lecturer(s)	Department(s) where the course unit (module) is delivered
Coordinator: dr. Ramūnas Adomavičius	Faculty of Physics
Other(s):	

Study cycle	Type of the course unit (module)
First cycle	Compulsory

Mode of delivery	Period when the course unit (module) is delivered	Language(s) of instruction
	IV (spring) semester	Lithuanian/English

Requirements for students	
Prerequisites: Knowledge of general physics, solid-state physics, background of chemistry	Additional requirements (if any):

Course (module) volume in credits	Total student's workload	Contact hours	Self-study hours
5	140	72	68

Purpose of the course unit (module): programme competences to be developed		
To learn the theory of optoelectronics, to apply theoretical knowledge solving practical problems; to analyse and interpret critically results published in scientific journals, be able to perform the description of the physical processes as well as to understand the relationship between the investigated phenomena; to acquire and develop the practical skills in characterization of optoelectronics components		
Learning outcomes of the course unit (module)	Teaching and learning methods	Assessment methods
The student will understand the main principles of investigation and appliance of ultrafast processes taking place in semiconductors (3.1, 3.2)	Problem Lectures, practical work	Oral questioning, written quiz
The student will be able to choose the most appropriate photosensor for a particular application (1.3)	Project	Research work
The student will be able to choose the most suitable research technique for the both, particular semiconductor and particular application (2.2, 3.1)	Problem Lectures, Explaining	Analysis of particular case, oral questioning
The student will be able to find the relevant scientific literature and critically evaluate its content (2.2)	Seminars, self-study work	Evaluation of seminar reports

Content: breakdown of the topics	Contact hours	Self-study work: time and assignments
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	Lectures	Tutorials	Seminars	Exercises	Laboratory work	Internship/work placement	Contact hours	Self-study hours	Assignments
1. Photosensor operating principles. Photoresistance, p-n and p-i-n derivatives, zener bond, MSM, and other derivatives. The main parameters of a photosensor.	1						1		
2. p-i-n photodiodes for the visible light and NIR range. Physical principles of operation. Static and dynamic parameters. Semiconductor materials used in p-i-n photodiodes. New p-i-n structures.	1		1	1			3	4	Preparation for seminars, solving of problems
3. Avalanche photodiodes. The operating principle and basic parameters. Phototransistors. The main parameters and principles of operation. Circuits with phototransistors. Gain and nonlinear circuits.	2		1	1			4	4	Preparation for seminars, solving of problems
4. MSM photodiodes. Static and dynamic parameters. Ultraviolet photodetectors. Semiconductors for UV detection.	2		1	1			4	4	Preparation for seminars, solving of problems
5. Noise in optoelectronic detection systems.	1						1		
6. Detectors for FIR range. Principles of coherent and non-coherent detection.	4		4	4			12	12	Preparation for laboratory works, preparation for seminars, solving of problems
7. Electromagnetic pulse propagation in non-homogenous medium. THz time-domain spectroscopy.	3			4	4		13	12	Preparation for seminars, solving of problems
8. Sources of visible and IR radiation.	2		1	1			4	4	Preparation for seminars, solving of problems
9. Semiconductor LEDs and lasers. Principle of operation and main types. 2D, 1D, 0D structures for optoelectronic devices.	5		2	2			9	8	Preparation for seminars, solving of problems
10. Pump-probe techniques for investigation of semiconductors. Operation with radiation from different ranges of spectrum.	7		4	1	4		16	10	Preparation for laboratory works, preparation for seminars, solving of problems
11. Solar cells. Principles of operation. Main parameters.	2		1	1			4	4	Preparation for seminars, solving of problems
12. Semiconductor absorbers for laser mode-locking.	2		1				3	6	Repetition for exam.
Total	32		16	16	24		72	68	

Assessment strategy	Weight, %	Deadline	Assessment criteria
Laboratory work rating	10	All course	Readiness to answer theoretical questions, the ability to describe the results.
Seminars rating	20	All course	The ability to present knowledge, completeness of the discussion.
Test	30	End of	15 questions with multiple choice answers. The result is

		the course	multiplied by the weight percent.
Exam (written form)	40	During the exam session	2 questions and 2 problems. Assessed the responses for completeness, consistency, error.

Author	Year of publication	Title	Issue of a periodical or volume of a publication	Publishing place and house or web link
Compulsary reading				
D. Decoster, J. Harari	2009	Optoelectronic Sensors		London: John Wiley & Sons, Inc.
A. Krotkus	2008	Puslaidininkų optoelektronikos sistemos ir prietaisai		Vilnius: ProgreTus
Optional reading				
P. Bhattacharya	1997	Semiconductor optoelectronic devices		London: Prentice Hall Intern.