COURSE UNIT (MODULE) DESCRIPTION

Course unit (module) title	Code
Laser technology	

Lecturer(s)	Department(s) where the course unit (module) is delivered
Coordinator: Assoc. prof. Ona Balachninaitė **Other(s):**	VU Department of Quantum Electronics

Study cycle	Type of the course unit (module)
The first study cycle	Obligatory

Mode of delivery	Period when the course unit (module) is delivered	Language(s) of instruction
Auditoria	5th semester (autumn)	Lithuanian/English

Requirements for students	
Prerequisites: Physics (Optics), Laser physics	**Additional requirements (if any):**

Course (module) volume in credits	Total student's workload	Contact hours	Self-study hours
5	150	67	83

Purpose of the course unit (module): programme competences to be developed

- Course acquaints the audience with laser systems for materials processing, medicine, diagnostics and other application areas, their operating principles and design features. The understanding of the capabilities of such systems is formed.
- Main subjects of the course are: development and tendencies of laser technology applications; laser material processing; photolithography and applications; optical information storage; optical communications systems; applications of lasers in metrology and monitoring; applications of lasers in building, geodesy and agriculture; basics of laser medicine; basics of laser diagnostics; basics of laser spectroscopy. The understanding of the operation basics of the laser systems used in material processing, medicine, spectroscopy and etc. is developed. During the laboratory work the skills at the practical use of some laser systems are developed.

Learning outcomes of the course unit (module)	Teaching and learning methods	Assessment methods
By the end of the course the students are expected to be able to understand the operation basics of the laser systems used in material processing, medicine, spectroscopy and etc. (1.1, 1.3, 2.2,3.4, 5.3)	Lectures+seminars+laboratory work+exam	Final mark consists of mark for the fulfilment and defence of laboratory work (20%), mark for seminar presentation and paper (20 %) and exam mark (60%).

Content: breakdown of the topics	Contact hours	Self-study work: time and assignments

	Lectures	Tutorials	Seminars	Exercises	Laboratory work	Internship/work placement	**Contact hours**	**Self-study hours**	**Assignments**
1. ***Development and tendencies of laser technology applications.*** Main types of lasers and their applications.	2						**2**	**3**	
2. ***Laser material processing***. Physical principles of the laser-material interaction. Laser systems used in laser material processing. The main processes of the laser material processing: drilling, cutting, welding, marking, laser micromachining and etc.	4						**4**	**6**	
3. ***Photolithography and its applications.*** Principles of direct and deep photolithography. Submicronic photolithography by using UV lasers. Basics of photopolimerization. Ultrafast laser 3D lithography and its applications	4						**4**	**6**	
4. ***Optical information storage.*** Principles of writing and reading of the information in the optical discs. The construction of the discs. Types of optical discs, construction, corrections of the errors. Laser printer: principles, construction and parameters. Bar code reading equipment: working principles and application	6						**6**	**9**	
5. ***Optical communications.*** Principles and components of the systems: lasers, optical fibers and detectors	4						**4**	**6**	
6. ***Laser applications in metrology and monitoring.*** Length, velocity, angle and etc. measurement technique by using laser.	2						**2**	**3**	
7. ***Laser applications in building, geodesy and agriculture.*** Applications of laser for leveling and measurement of hight.	2						**2**	**3**	
8. ***Basics of laser medicine.*** Bio stimulation and photochemical influence of biological objects. Lasers for therapy and acupuncture. Photosesibilised cancer therapy and diagnostics. Photosensitisers. Lasers for Photosesibilised cancer therapy Optical biopsy. Fundamentals of laser surgery. Lasers for surgery, ophtalmology and dermatology.	5						**5**	**8**	
9. ***Basics of laser spectroscopy.*** Lasers in absorption and fluorescence spectroscopy. Basics and applications of laser scattering spectroscopy. Laser time resolved spectroscopy.	3						**3**	**5**	
10. Laboratory work				24			**24**	**12**	Each student has to do 3 laboratory works.
11.Seminars and papers			8				**8**	**12**	4 seminars 2 hours

									each. Each student gives presentation (~20 min) and prepares a paper on laser technology subject.
Exam							**3**	**10**	
Total	**32**		**8**		**24**		**67**	**83**	

Assessment strategy	**Weight,%**	**Deadline**	**Assessment criteria**
Laboratory work	20 %	At the end of semester	Estimated quality of the assigned tasks (if all the tasks are performed, if there are all the requested results, if the interpretation of the results is correct, if all theoretical questions are answered).
Seminars and papers	20 %	During the semester	Each student chooses the subject on the topic of laser technology and prepares a presentation (~ 20 minutes duration) and writes a short paper. The quality of the presentation and paper is estimated. Student's understanding of the subject presented and the answers to the questions during the presentation are evaluated.
Exam	60 %	During examinations	Questions and tasks for the entire semester subjects (> 10 complex questions / tasks).

Author	**Year of publication**	**Title**	**Issue of a periodical or volume of a publication**	**Publishing place and house or web link**
Compulsary reading				
7. O. Balachninaitė, A. Bargelis, A. Dementjev, R. Jonušas, G. Račiukaitis, V. Sirutkaitis	2008	Lazerinė technologija		Vilniaus Universiteto Leidykla (VUL), Vilnius
8. Edited by Colin E. Webb and Julian D.C. Jones	2004	Handbook of Laser Technology and Applications		IOP Publishing Ltd
9. J. C. Ion	2005	Laser Processing of Engineering Materials		Elsevier Butterworth-Heinemann
10. M.H.Niemz	2007	Laser-tissue interaction		Berlin. Springer. 3-d. edition
11. R.Rotomskis, E.Žurauskas, E.Žurauskienė, S.Bagdonas, V.Žalgevičienė	2008	Fluorescencinis vaizdinimas biomedicinoje		Vilnius: Lietuvos mokslas
12. W. Demtroder	2003	Laser Spectroscopy, Basic concepts and instrumentation		Springer-Verlag, Third edition
Optional reading				
5. O. Balachninaitė, A. Bargelis, M. Barkauskas, R. Jonušas, K. Juzėnas, J. Kalpokas, V. Kudriašov, M. Peckus, V. Sirutkaitis	2008	Lazerinių technologijų laboratoriniai darbai		Vilniaus Universiteto Leidykla (VUL), Vilnius

6.	R.Rotomskis, G.Streckytė, L.Griciūtė	2002	Fotosensibilizuota navikų terapija: pirminiai vyksmai		Vilnius:Lietuvos mokslas
7.	D.Čiplys, A.Krotkus, V.Smilgevičius	2008	Šviesolaidžių optika		Vilniaus Universiteto Leidykla, Vilnius
8.	M. F. Ashby and D. R. H. Jones	2011	Engineering Materials 1, An introduction to Their Properties and Applications		4th edition, Elsevier Butterworth-Heinemann