COURSE UNIT (MODULE) DESCRIPTION

Course unit (module) title	Code
Optical spectroscopy	

Lecturer(s)	Department(s) where the course unit (module) is delivered
Coordinator: Prof. Dr. (HP) Valdas Šablinskas **Other(s): Martynas Velička**	Faculty of Physics

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

Mode of delivery	Period when the course unit (module) is delivered	Language(s) of instruction
	V (autumn) 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	132	64	66

Purpose of the course unit (module): programme competences to be developed		
To obtain theoretical knowledge of spectroscopy and learn to use optical spectroscopy methods in experiments, such as characterization of physical/chemical objects of interest, along with learning to analyse and interpret scientific data critically		
Learning outcomes of the course unit (module)	**Teaching and learning methods**	**Assessment methods**
Be able to apply the knowledge of theoretical optics in understanding spectroscopic data or in finding possible solutions of the problems (1.2, 1.3)	Lectures, optical experiments in different scientific laboratories	Tests (written) and questions/discussion during lectures
Student will be trained to plan, organize and solve the given problems and provide a summary of main results (2.1)	Reports	Evaluation of the reports
Student will be able to understand english literature of the proposed topic and to discuss with the specialists of the field (4.1)	Reports	Evaluation of the reports
Student will manage to find, understand and apply the knowledge from the internet sources, publications and literature, and to critically compare the information obtained from different sources, analyse and organize it. (2.2)	Lectures, initial phase of report preparation	Analysis of the particular case, questions/discussion during lectures

Student will be able to apply theoretical knowledge to solve various problems arising in practice (3.1, 3.2)	Optical experiments in different scientific laboratories, report presentation	Evaluation of the reports
Will be able to apply the knowledge in optics along with practical and engineering skills to understand the principles of optical system operation and analysis, and to implement spectroscopic set-ups (3.1)	Lectures, optical experiments in different scientific laboratories	Exam, evaluation of the work in the laboratory
Will achieve the knowledge in semiconductor physics interpreting the obtained spectroscopic data (3.4)	Optical experiments in different scientific laboratories, reports	Evaluation of the reports

Content: breakdown of the topics	**Contact hours**							**Self-study work: time and assignments**	
	Lectures	Tutorials	Seminars	Exercises	Laboratory work	Internship/work	**Contact hours**	**Self-study hours**	**Assignments**
1. Introduction into Spectroscopy. Electromagnetic wave spectrum (UV-VIS and IR spectroscopy), main elements of spectrometer. Light sources, detectors: types, spectral range of operation. Grating, prism, beam focusing elements, filters. Monochromator: principle of operation, focal length, numerical aperture, bandpass, resolution.	2				2		**4**	**11**	Study of lecture material. Writing and presentation of 2 reports given from 1-6 topics (self-study hours in 1-6 rows is divided proportionally).
2. Reflectance, Transmittance. Absorption type spectroscopy. Absorption coefficient. Examples of spectra.	7				7		**14**	**11**	Participation in the experimental measurements in CPST laboratory. Study of lecture material. Writing and presentation of 2 reports given from various subtopics.
3. Emission type spectroscopy. Types of luminescence (photo-, electro-, magneto-, etc.). Examples and analysis of spectra.	7				7		**14**	**11**	Participation in the experimental measurements in CPST laboratory. Study of lecture material. Writing and presentation of 2 reports given from various subtopics.
4. FTIR spectroscopy. Michelson interferometer. Fourier transformation. Signal averaging. Examples of spectra.	7				7		**14**	**11**	Participation in the experimental measurements in CPST laboratory. Study of lecture material. Writing and presentation of

									2 reports given from various subtopics.
5. Scattering spectroscopy. Particle and electromagnetic wave ratio. Rayleigh scattering. Brillouin scattering. Raman scattering. Examples of spectra.	7				7		**14**	**11**	Participation in the experimental measurements in CPST laboratory. Study of lecture material. Writing and presentation of 2 reports given from various subtopics.
6. Sensitive methods of optical spectroscopy in Lithuania: modulation spectroscopy (photoreflectance, electroreflectance, wavelength modulated reflectance), spectroscopic ellipsometry, SERS spectroscopy. Examples of spectra.	2				2		**4**	**11**	Participation in the experimental measurements in CPST laboratory. Study of lecture material. Writing and presentation of 2 reports given from various subtopics.
Total	**32**				**32**		**64**	**66**	

Assessment strategy	**Weight,%**	**Deadline**	**Assessment criteria**
Activity in lectures and report rating	40	All course	Activity in lectures (asking questions, participation in discussions), writing and presentation of 2 reports (time for presentation and discussion 20+10 min at the end of lectures).
Tests	20	Middle and the end of course	Two tests, each of 10 questions. Total 10 points. Correct answer: 1 point, wrong answer: −1 point, no answer: 0 point. Negative evaluation is multiplied by weight factor and subtracted from the final mark. In case the test result is less or equal to 0, it is obligatory to write and present the additional report.
Exam (written form)	40	During the exam session	Written report on a given subtopic of the lecture material (duration ~2 hours), discussions with examinee. Evaluation of the completeness, correctness of the answers, quantity of errors.

Author	**Year of publication**	**Title**	**Issue of a periodical or volume of a publication**	**Publishing place and house or web link**
Compulsary reading				
Mark Fox	2012	Optical properties of solids. 2nd ed.		Oxford : Oxford University Press, 2012. xvi, 396 p.
G. Gauglitz and T. Vo-Dinh (Eds.)	2003	Handbook of spectroscopy. [electronic resource]		Weinheim : Wiley-VCH, 2003. xxxii, 538 p. DOI: 10.1002/3527602305
Optional reading				
V. Šablinskas, J. Čeponkus	2012	Modernioji virpesinė spektroskopija		
Peter Y. Yu, Manuel Cardona	2010	Fundamentals of semi-conductors: physics and materials properties		Berlin : Springer, 2010. xx, 775 p.