MODULE DESCRIPTION

Module title	Module code
Physical Fundamentals of Electronics	

Lecturer(s)	Department where the module is delivered
Coordinator: assoc. prof. dr. Aloyzas Pažėra **Other lecturers:**	Department of Solid State Electronics Faculty of Physics Vilnius University

Cycle	Type of the module
First	Optional

Mode of delivery	Semester or period when the module is delivered	Language of instruction
Face-to-face	4 semester	Lithuanian

Prerequisites
Prerequisites: Mathematics for Software Engineering I and II

Number of credits allocated	Student's workload	Contact hours	Self-study hours
5	130	72	58

Purpose of the module: programme competences to be developed

Purpose of the module – to provide the students physical fundamentals of electronics relating them to physical instruments, computers, servers, monitors, measurement devices, information transmission and registration systems that could be used in software engineering.

Specific competences:

- Knowledge and skills of underlying conceptual basis *(SK4).*
- Technological and methodological knowledge and skills, professional competence *(SK6).*

Learning outcomes of the module: students will be able to	Teaching and learning methods	Assessment methods
To apply knowledge of computer science, possibilities of physical computer system to development of software systems	Lectures using visual demonstration material, practical auditoria works, educational cognitive sessions in physics laboratory or in physical demonstration room, educational cognitive excursion to Research Center of Lasers, individual reading.	Exam (written), control works (written)
To use effectively computer hardware and technical equipment for information storage and transmission when developing and maintaining software systems		

Content: breakdown of the topics	Contact hours							Self-study work: time and assignments	
	Lectures	Tutorials	Seminars	Practice	Laboratory work (LW)	*Tutorial during LW*	**Contact hours**	**Self-study hours**	**Assignments**
Purposes of physics, methods and language. Microscopic electrical particles.	1						**1**		
Main laws of electrostatics. Materials in electric field. Electrostatic memory.	2			2			**4**	**4**	
Electric current in matter. Electronic theory of metal conduction. Analysis of electric circuits. Kirchhoff's Rules.	2	1		3			**6**	**5**	
Magnetic field, magnetic inductance. Biot-Savart-Laplace's law and Ampere's law. Motion of electric particles in electric and magnetic field.	3			3			**6**	**5**	
Magnetic dipole moment of atoms. Material in magnetic field. Feromagnetism. Information registration, storage and regeneration in magnetic medium.	3						**3**	**2**	
Faraday's law of electromagnetic induction. Lenz's law. Alternating current. Vortex current. Surface effect.	3			1			**4**	**2**	
Displacement current. Analysis of circuits of alternating current.	2	1		2			**6**	**5**	
Oscillatory motion. Equation of harmonic oscillation. Electromagnetic oscillations in oscillatory circuit. Open oscillatory circuit.	2			3			**5**	**5**	
Electric signals, spectral Fourier analysis. Modulation and detection of electric signals. Spectrum of modulated signal. Modulator and detector.	3	1		2			**6**	**5**	Individual reading, acquaintance with material for practical lectures
Work function of electrons in metal. Contact potential difference. Metals, dielectrics, semiconductors.	2						**2**	**1**	
Energy band model of solids. Conduction theory of semiconductors.	3						**3**	**2**	
Contact and thermoelectric phenomena in junctions of two metals, metal and semiconductor, and two semiconductors. Features of p-n junction.	3	1					**4**	**3**	
Semiconductor devices. Diodes. Rectifiers, diode limiters, diode logical schemes. Photodiodes and light-emitting diodes, their applications.	2						**2**	**1**	
Bipolar transistor. Field transistor. Transistor amplifiers.	3						**3**	**3**	
Alternating current generator. Electronic element switch mode. Differentiating and integrating circuits.	2						**2**	**3**	
Integrated circuits and basic processes of their technology. Operational amplifiers. Feedback in amplifiers.	3	1					**4**	**3**	
Electromagnetic waves. Natural and polarized light. Optical fibers. Information transmission and registration in radio waves. Vidicon.	3						**3**	**3**	

Features of lasers. Information registration, storage and regeneration in holograms, electro-photographic layers, magnetic medium, CD, DVD.	3	1					**5**	**3**	
Visualization at electric image. Oscillograph, kinescope, monitor, liquid crystal display.	3						**3**	**3**	
Exam (written)							**2**		
Total	**48**	**6**		**16**			**72**	**58**	

Assessment strategy	**Weight %**	**Deadline**	**Assessment criteria**
Control works (written)	20	During semester	2 control works. During every control work student solves one task and answers one question, which is related to topic of practical works. Rating is in 10 point system and valuation is produced by 0.1 (maximal valuation of two control works is 2 points).
Exam (written)	80	During session of exams	During exam student answers two theoretical questions. Rating is in 10 point system and valuation is produced by 0.8 (maximal valuation is 8 points). Final mark is estimated as sum of exam and control works valuations (maximal mark can be 8+2=10 points).

Author	**Publishing year**	**Title**	**Number or volume**	**Publisher or URL**
Required reading				
B. Martinėnas, J. Kaulakys, J. Jakimavičius	2000	Physics fundamentals. Electro-magnetism. Wave and quantum optics. Quantum and nuclear physics (in Lithuanian)		Vilnius, Technika
S. Masiokas	1994	Electrotechnics (in Lithuanian)		Vilnius, Mokslas
S. Štaras	2006	Solid and functional electronic devices (in Lithuanian)		Vilnius, Technika
Vaclovas Bartkevičius, Alvydas Dosinas	2012	Applied electronics (in Lithuanian)		Technologija, Kaunas
John D. Cutnell, Kenneth W. Johnson	2006	Essential of Physics		John Wiley & Sons, Inc.
Recommended reading				
A. N. Matvejevas.	1991	Electricity and Magnetism (in Lithuanian)		Vilnius, Mokslas
Donald A. Neamen	2003	Semiconductor Physics and Devices. Basic Principles	3 Ed.	The McGraw-Hill Companies, Inc. New York
Vaidotas Arnoldas Dzenkauskas	2011	Digital devices (in Lithuanian)		Technologija, Kaunas