COURSE UNIT (MODULE) DESCRIPTION

Course unit (module) title	Code
Information elements and systems	

Lecturer(s)	Department(s) where the course unit (module) is delivered
Coordinator: doc. Vytautas Jonkus **Other(s):** doc. Rimvydas Aleksiejūnas	Faculty of Physics

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

Mode of delivery	Period when the course unit (module) is delivered	Language(s) of instruction
In class	2nd (spring) semester	Lithuanian

Requirements for students	
Prerequisites: First cycle modules: mathematics, mechanics and thermodynamics, electricity and magnetism	**Additional requirements (if any):**

Course (module) volume in credits	Total student's workload	Contact hours	Self-study hours
5	140	48	92

Purpose of the course unit (module): programme competences to be developed		
To provide knowledge about sensors, transducers and applications, enable students to characterize such information elements, explain the underlying physical phenomena, select suitable elements for a specific application; independently gather and process scientific material, present it before audience, develop analytical and critical thinking.		
Learning outcomes of the course unit (module)	**Teaching and learning methods**	**Assessment methods**
Students will possess knowledge about sensors, transducers, their properties, underlying physical phenomena, their characterization, signal processing, interfacing with computers and control systems.	Lecture, discussion, literature reading.	Presentations.
Students will be able to select a suitable sensing element for a specific application, estimate the effects of its environment and requirements for its operation.	Lecture, discussion, literature reading.	Presentations.
Students will be able to independently gather and organize scientific information, choose appropriate resources, complete tasks within deadlines.	Information gathering, preparing for presentation.	Presentations.
Students will be able to prepare information for presentation and deliver a presentation in an informative and succinct manner.	Information gathering, preparing for presentation.	Presentations.

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. **Information acquisition and processing.** Acquisition and processing of signals. Definition of sensor and transducer, their characteristics.	4						**4**	**6**	Literature reading.
2. **Sensing element types.** Electrical, capacitive, magnetic, inductive, electromagnetic, optical, acoustic, resistive, piezoelectric, piezomagnetic, galvanometric elements.	2						**2**	**3**	Literature reading.
3. Physical phenomena in sensors. Thermal, electrical, magnetic, electromagnetic, optical, acoustical phenomena.	12						**12**	**18**	Literature reading.
4. Passive elements for acquisition of physical parameters. Passive elements for acqiuisition of temperature, pressure, velocity, humidity, magnetic field, concentration of gas and vapor.	4						**4**	**6**	Literature reading.
5. Transducers. Electroacustic, piezoelectrical, optoacoustic and other transducers.	2						**2**	**3**	Literature reading.
6. Microsensors. Microaccelerometers, microgyroscopes, flow microsensors, smart and integrated elements.	4						**4**	**6**	Literature reading.
7. Control systems. Control systems, amplifiers, analog-digital converters. Data transfer and processing systems. Noise in sensors and circuits.	4						**4**	**6**	Literature reading.
8. **Research assignments.** Gathering and presenting scientific material on sensors, transducers and applications.			16				**16**	**44**	Gather information and prepare a presentation.
Total	**32**		**16**				**48**	**92**	

Assessment strategy	Weight, %	Deadline	Assessment criteria
Presentation of research assignments	100	End of semester	Students will be required to complete two research assignments and deliver a presentation on each one. Presentations will take place during seminars. Time allocated: 20-25 minutes for presentation, 10 minutes for questions and discussion. Assessment criteria: A: Content. The main criteria are structure, scope, thoroughness, conformity to the topic, diversity of resources (it is recommended to use not only books, but also scientific journals and conference publications). B: Quality of presentation. Conciseness, accuracy, keeping within the time limit, quality of slides (graphical material,

			attention to detail, not overcrowding the slides, correct language). C: Answers to questions. The questions can be about the presentation material and also more broadly about the selected topic or general knowledge about sensors from course material. Grading: G = 0.5*A + 0.3*B + 0.2*C The final module grade is the average of grades of the two presentations.

Author	**Year of publication**	**Title**	**Issue of a periodical or volume of a publication**	**Publishing place and house or web link**
Compulsory reading				
Jacob Fraden	2004	Handbook of Modern Sensors: Physics, Designs, and Applications (Handbook of Modern Sensors)	3rd	AIP Press
J. W. Gardner, V. K. Varadan, O. O. Awadelkarim	2001	Microsensors, MEMS, and Smart Devices	1st	Wiley
Optional reading				
		Sensors Journal		IEEE http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=7361
		Sensors and Actuators A, B		Elsevier https://www.sciencedirect.com/journal/sensors-and-actuators-a-physical https://www.sciencedirect.com/journal/sensors-and-actuators-b-chemical
		Sensors and Materials		MYU K.K. http://myukk.org/SM2017/index.php?theme=archives
Ian Sinclair	2001	Sensors and Transducers	3rd	Newnes
Jon Stenerson	2004	Fundamentals of Programmable Logic Controllers, Sensors, and Communications	3rd	Prentice Hall
Clarence W. de Silva	2007	Sensors and Actuators: Control System Instrumentation	1st	CRC