



COURSE UNIT (MODULE) DESCRIPTION

Course unit (module) title	Code
Materials for information technologies	

Lecturer(s)	Department(s) where the course unit (module) is delivered
Coordinator: Prof. habil. dr. Jūras Banyš Other(s): Prof. dr. Robertas Grigalaitis	Faculty of Physics

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

Mode of delivery	Period when the course unit (module) is delivered	Language(s) of instruction
face-to-face	1 st (autumn) semester	Lithuanian

Requirements for students	
Prerequisites: Solid state physics, electronics.	Additional requirements (if any):

Course (module) volume in credits	Total student's workload	Contact hours	Self-study hours
5	140	70	70

Purpose of the course unit (module): programme competences to be developed
The aim of this course is to provide knowledge about functioning principles of modern materials which are applied in nowadays information technologies, to develop analytical skills and critical thinking enabling to choose right materials for particular applications in telecommunications and contemporary electronics.

Learning outcomes of the course unit (module)	Teaching and learning methods	Assessment methods
To give the knowledge about ferroelectric, superionic and other modern technologies materials electric properties and their usage.	Lectures, laboratory practice, independent work	Examination
To show how properties of modern technology materials are used for the information recording, retrieving and archiving.	Lectures, laboratory practice, independent work	
To teach to use such properties for the information processing and transmission in various telecommunication and electronic devices.	Lectures, laboratory practice, independent work	

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. Introduction. Ferroelectrics, superionics and related materials in information technologies. Types of ferroelectrics. Main physical properties of ferroelectrics. Defects in ionic crystals. Ionic conductivity in superionic conductors. Types of superionic conductors.	9						9	10	
2. Interaction of electromagnetic waves with ferroelectrics. Properties of ferroelectrics polarization. Dipole interaction with electromagnetic field. Microwave interaction spectra. Practices: 1) Dielectric anomalies in the vicinity of the phase transition. 2) Dielectric hysteresis in ferroelectrics. 3) Pyroelectric phenomenon.	9				13		22	15	
3. Superionics in electric field. Impedance spectroscopy of superionics. Relaxational dispersion in superionics. Practices: 1) Electrical properties of solid electrolytes. 2) Investigation of ionistor. 3) Measurements of electric conductivity of superionics by four electrode method.	9				9		18	15	
4. Acoustic wave interaction with ferroelectrics. Properties of ultrasound propagation. Phonon interaction in ferroelectrics. Acoustic interaction spectra.	6						6	10	
5. Ferroelectrics, superionics and related materials applications. Memory and visualization devices. Optical devices with ferroelectrics. Ferroelectric and semiconductor combined devices. Piezoelectric and pyroelectric devices. Electrooptic and acoustooptic devices. Liquid crystals and their applications. Other perspective materials for the information technologies.	15						15	20	
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Total	48				22		70	70	

Assessment strategy	Weight, %	Deadline	Assessment criteria
Laboratory work	30	During the semester	The quality of laboratory work, interpretation of obtained results and formulation of conclusions is evaluated.
Exam in written form	70	During the	Open questions are provided. Answers to these questions are

		exam session	evaluated in 10 points system. The evaluation criteria are: the student's ability to consistently and clearly formulate answers and justify his or her opinion.

Author	Year of publication	Title	Issue of a periodical or volume of a publication	Publishing place and house or web link
Compulsary reading				
Habasaki, J., Leon, C., & Ngai, K. L	2016	<i>Dynamics of glassy, crystalline and liquid ionic conductors : Experiments, theories, simulations</i>		https://ebookcentral.proquest.com/lib/viluniv-ebooks/detail.action?docID=4721341
J. Grigas.	1996	Microwave Dielectric Spectroscopy of Ferroelectrics and Related Materials.		Amsterdam
Yu. M. Vysochanskii, T. Jansen, R. Curat, R. Folk, J. Banys, J. Grigas, V. Samulionis	2006	Phase Transitions in Ferroelectric Phosphorous Chalcogenide Crystals		Vilniaus universiteto leidykla, Vilnius
Optional reading				
K. Uchino	2000	Ferroelectric Devices.		Pensylvania
Antanas Feliksas Orliukas	2004	Superjoniniai laidininkai		Vilniaus universiteto leidykla, Vilnius
Kremer, F., & Loidl, A. (Eds.)	2018	The scaling of relaxation processes		https://ebookcentral.proquest.com/lib/viluniv-ebooks/detail.action?docID=5471938