

COURSE UNIT (MODULE) DESCRIPTION

Course unit (module) tit	Code				
Low temperature physics					
Lecturer(s)	Department (s) where the course	se unit (module) is delivered			
Coordinator: prof. Gediminas Juzeliūnas	Department of Physics, Vilnius U Vilnius	University, Saulėtekio al. 9/III,			

Other(s):

temperature systems.

Study cycle	Type of the course unit (module)
second	optional

Mode of delivery	Period when the course unit (module) is delivered	Language(s) of instruction
auditorial	3-rd semester	Lithuanian/english

Requirements for students						
Prerequisites:	Additional requirements (if any):					
Students must have completed courses on quantum						
mechanics, mathematical physics, statistical physics.						

Course (module) volume in credits	Total student's workload	Contact hours	Self-study hours
5	140	64	76

Purpose of the course unit (module): programme competences to be developed							
The course has two main objectives. Firstly the students will be acquinted with the main concepts of the low temperature							
physics, will learn the basics of the superconductivity and superfluidity of condensed systems, including both the							
phenomenological and microscopic approaches to the low temperature physics. The second objective is to show how these							
concepts are applied to the rapidly developing area of ultracold atomic gases cooled to the nano-Kelvin temperature range,							
to present the main cooling and trapping mechanisms	for ultracold atoms, to explain the	unique features of ultracold atomic					
fermions and bosons.	-						
Learning outcomes of the course unit (module)	Teaching and learning	Assessment methods					
	methods						
The basic knowledge of low temperature physics	Lectures, practices, seminars,	Evaluation of seminars and					
including both phenomenological and microscopic	self-studying.	written exam					
approaches to the superconductivity and							
superfluidity and other phenomena of low							
temperature physics.							
The basic knowledge of the physics of ultracold	1						
atoms, single and many body properties of the							
bosonic and fermionic ultracold atomis gases.							
Skills in solving various problems of low							

Content: breakdown of the topicssignify string		Contact hours			Self-study work: time and assignments					
1. Basic properties of superconductivity: 4 4 4 8 10 Read literature on the topic a. Introduction model c. Meissner effect	Content: breakdown of the topics	ures	rials	inars	rcises	ratory work	nship/work	tact hours	study hours	
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	Total	32		32				64	76	

Assessment strategy	Weigh t,%	Deadline	Assessment criteria
Seminar	40 %	15-16 week of	Excellence in problem solution, scientific literature overview,
		the semester	presentations. Maximum 4 points
Exam	60 %	Exam session	Perfect knowledge of the subject. Maximal evaluation - 6
			points
Final evaluation			Seminar eval. + exam evaluation

Author	Year of public ation	Title	Issue of a periodical or volume of a publication	Publishing place and house or web link
Compulsary reading				
Vladimir Eltsov	2017	Theory of Superconductivity		School of Science, Aalto University, Finland <u>https://mycourses.aalto.fi/co</u> <u>urse/view.php?id=14702&s</u> <u>ection=1</u> or <u>https://mycourses.aalto.fi/pl</u> <u>uginfile.php/450584/mod_r</u> <u>esource/content/1/theory_sc</u> <u>.pdf</u>
H. Perrin	2009	Review: Ultra cold atoms and Bose-Einstein condensation for quantum metrology	Eur. Phys. J. Special Topics 172, 37–55 (2009)	http://www-lpl.univ- paris13.fr/bec/bec/Teaching /LesHouches2007.pdf
Hui Zhai	2017	Lecture Note on Cold Atom Physics.		Institute for Advanced Study Tsinghua University, Beijing, China
Papildoma literatūra				
Optional reading	1		1	
Lev Pitaevskii and Sandro Stringari	2016	Bose-Einstein Condensation and Superfluidity		Oxford Scholarship Online
C. J. Pethick and H. Smith	2010	Bose–Einstein Condensation in Dilute Gases		Cambridge University Press