

COURSE SYLLABUS

1.	Course: Selected Tools of Modern Theoretical Physics 1B	
2.	Scientific discipline: physical sciences	
3.	Teaching language: English	
4.	University department: Faculty of Physics and Astronomy	
5.	Course/module type – mandatory (compulsory) or elective (optional): mandatory	
6.	University subject (programme/major): Physics, specialty Master's Study of Theoretical Physics	
7.	Study level (I or II): II	
8.	Year: 1	
9.	Semester (autumn/spring) autumn	
10.	Form of tuition and number of hours: lectures – 15, classes - 15	
11.	Initial requirements (knowledge, skills, social competences) regarding the course/module: linear algebra, mathematical analysis, basic probability theory.	
12.	Learning objectives for the subject: elementary functional analysis, representation theory of groups and its applications to form mathematical tools of quantum mechanics.	
13.	Course content: Introduction to modern mathematical tools of theoretical physics. The basic Hilbert space theory: geometry, tensor products, simple sum of Hilbert spaces. Basic theory of linear operators in Hilbert spaces. Bounded and unbounded operators, adjoint and self-adjoint operators. Introduction to the theory of group representations. Regular, unitary and irreducible representations. The Schur's lemma. Elements of representation decomposition (compact groups). Group representations and the theory of special functions (Legendre). Irreducible unitary representations of group $SU(2)$.	
14.	Learning outcomes: <ul style="list-style-type: none"> • knowledge of basic Hilbert space theory and linear operators applied to the representation of groups • ability of practical use of the theory to the problems in quantum physics • student recognizes the need to broaden knowledge when solving new problems 	Learning outcomes for the course: F2_W01,F2_W02, F2_U01,F2_U05, F2_U10,F2_U11, F2_K01,F2_K03
15.	Obligatory literature: P Ługiewicz: Hilbert Space Methods and Representations of Groups (PDF copy will be provided by lecturer during the course) Recommended literature: A Wawrzyńczyk: Group Representation and Special Functions, Kluwer 1984	
16.	Methods for verifying the assumed learning outcomes: - written semester work	

	- preparation of an oral short presentation	
17.	Conditions and form of passing individual components of the subject: - constant monitoring of attendance and progress in the scope of classes - final control work - short oral presentation	
18.	Student's workload	
	The form of carrying out classes by the student	Number of hours allocated to carry out a given type of classes
	classes (according to the study plan) with the instructor:	
	- lecture:	15
	- conversation classes:	15
	student's own work:	
	- preparation for classes:	30
	- reading the indicated literature:	15
	Total number of hours	75
	Number of ECTS	3