(*faculty stamp*)

COURSE DESCRIPTION

1. Course title: INTRODUCTION TO MODULES AND CATEGORY THEORY	**2. Course code**
3. Validity of course description: 2018/2019	
4. Level of studies: 1st cycle of higher education	
5. Mode of studies: intramural studies	
6. Field of study: MATHEMATICS	(FACULTY SYMBOL) RMS
7. Profile of studies: General	
8. Programme : All	
9. Semester: IV	
10. Faculty teaching the course: Institute of Mathematics	
11. Course instructor: dr Paweł Gładki	
12. Course classification: course of limited choice	
13. Course status: elective	
14. Language of instruction: English	
15. Pre-requisite qualifications: Intermediate level in English and standard course in abstract algebra	
16. Course objectives: To familiarize students with linear algebra over rings and use studied concepts to present basic notions in the category theory	

17. Description of learning outcomes:

Nr	Learning outcomes description	Method of assessment	Teaching methods	Learning outcomes reference code
1.	Know basic definitions, theorems and examples of modules. Understand how they generalize familiar notions from linear algebra, abelian groups and ring theory.	Test, homework	Lectures, labs	K1A_W04
2.	Know basic definitions, theorems and examples of the category theory. Being able to recognize modules, abelian groups, vector spaces and rings as categories.	Test, homework	Lectures, labs	K1A_W05
3.	Know English language on the level making it possible to understand English-language textbooks	Test, homework	Lectures, labs	K1A_W10
4.	Being able to solve selected problems in algebra with the use of basic theorems in the category theory	Test, homework	Lectures, labs	K1A_U07

18. Teaching modes and hours

Lecture -30, Seminar -30

19. Syllabus description:

Lectures:

1. **Modules, submodules, submodules generated by sets.**
2. **Module homomorphisms, quotient modules, factorization theorem.**
3. **Exact sequences.**
4. **Products of groups. Products and coproducts of abelian groups.**
5. **Products and coproducts of modules.**
6. **Split exact sequences.**
7. **Free abelian groups.**
8. **Free modules.**

9. **Projective modules.**
10. **Injective modules.**
11. **Hom functor and dualization**
12. **Introduction to category theory: products, coproducts, free objects.**
13. **Morphisms. Universal and couniversal objects, equalizers and coequalizers, kernels and cokernels.**
14. **Functors and natural transformations.**
15. **Adjoint functors.**

Labs:

Topics to be covered during labs coincide with the lecture plan.

20. Examination: No

21. Primary sources:

1. **T. Hungerford, Algebra, Springer, 1974**
2. **S. Mac Lane, Categories for the working mathematician, Springer, 1971**

22. Secondary sources:

1. **P. Aluffi, Algebra: Chapter 0, AMS, 2009**

23. Total workload required to achieve learning outcomes

Lp.	Teaching mode :	Contact hours / Student workload hours
1	Lecture	30/25
2	Classes	30/25
3	Laboratory	/
4	Project	/
5	BA/ MA Seminar	/
6	Other	20/20
	Total number of hours	80/70

24. Total hours:150

25. Number of ECTS credits: 5

26. Number of ECTS credits allocated for contact hours: 2.66

27. Number of ECTS credits allocated for in-practice hours (laboratory classes, projects):0

26. Comments: Final grade will be calculated based on tests, homeworks and class participation as follows:

1. **Two 90 minutes tests, each woth 30 ponits to the total of 60 points**
2. **Ten homework assignments, each worth 3 points to the total of 30 points.**
3. **Class participation worth maximum of 10 points.**

0-59 points: 2.0

60-69 points: 3.0

70-74 points: 3.5

75-84 points: 4.0

85-89 points: 4.5

90-100 points: 5.0

Approved:

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(date, Instructor's signature)

(*date , the Director of the Faculty Unit signature)*