Attachment No. 5 to Rector's ordinance No. 22/2020

DESCRIPTION OF THE COURSE OF STUDY

Course code		
Name of the course in	Polish	**Teoria Galois**
	English	**Galois Theory**

1. LOCATION OF THE COURSE OF STUDY WITHIN THE SYSTEM OF STUDIES

1.1. Field of study	**mathematics**
1.2. Mode of study	**full-time studies**
1.3. Level of study	**Undergraduate (Bachelor) / Graduate (Master)**
1.4. Profile of study*	**general academic profile of studies**
1.5. Person/s preparing the course description	**Prof. UJK dr. hab Olena Karlova**
1.6. Contact	**o.karlova@ujk.edu.pl**

2. GENERAL CHARACTERISTICS OF THE COURSE OF STUDY

2.1. Language of instruction	**Polish and English**
2.2. Prerequisites*	**Linear and Abstract Algebra**

3. DETAILED CHARACTERISTICS OF THE COURSE OF STUDY

3.1. Form of classes		**lectures / classes / seminars**
3.2. Place of classes		**classes in the UJK teaching room**
3.3. Form of assessment		**Exam**
3.4. Teaching methods		**Lectures, practical tests, homeworks**
3.5. Bibliography	**Required reading**	**1) Ian Stewart, Galois Theory, Academic Press, 1989.**
	Further reading	**1) J.P. Escofier, Galois Theory, Springer, 2001.** **2) Emil Artin, Galois Theory, University of Notre Dame Press,1971**

4. OBJECTIVES, SYLLABUS CONTENT AND INTENDED LEARNING OUTCOMES

4.1. Course objectives ***(including form of classes)***

C1. Familiarization with the basics of the theory of extensions of fields

C2. Familiarization with the applications of the theory of fields in construction issues

C3. Presentation of the basics of the abstract Galois theory

Skills

C4. Mastering the calculation apparatus related to Galois theory

Social competence

C5. Developing the habit of learning, improving one's own work skills and formulating questions for deepening of own understanding of Galois's theory

4.2. Detailed syllabus ***(including form of classes)***

Lectures

1. Review of polynomial rings. Euclidean division. Euclidean algorithm for calculating gcd. Polynomials as functions. Roots as linear factors.
2. Fundamental Theorem of Algebra. Irreducibility of polynomials. Gauss's Lemma. Eisenstein Criterion. Reduction modulo p.
3. Field extensions. Degree. Simple extensions. Algebraic and transcendental extensions. Minimal polynomial. Field automorphisms.
4. Ruler and compass constructions. Solvable numbers.
5. Separability. Derivations. Perfect fields.
6. Linear independence of characters and embeddings (Dedekind's Lemma). Normal closure.
7. Galois extensions. The Galois group of a polynomial. Galois correspondence.
8. Primitive element theorem. Solvable fields. Solving for roots with radicals.
9. Finite fields. Cyclic extensions
10. Elementary symmetric polynomials. General polynomial. Discriminant.
11. Solving equations of degree at most 4. Calculating Galois groups. Cyclotomic extensions. Proving the Fundamental Theorem of Arithmetic.

Classes

Properties of basic algebraic structures. Examples of fields. Quotient structures. Algebraic field extensions, Galois group extensions. Fundamental Theorem of Galois Theory. Solvability and the Abel-Ruffini theorem. Galois theory in geometric applications. Information about diagrams and abstract Galois theory. Constructability by straightedge and compass.

4.3 Intended learning outcomes

Code	A student, who passed the course	Relation to learning outcomes
within the scope of **KNOWLEDGE:**		
W01	understands the role and importance of the construction of mathematical reasoning in the Galois theory.	MAT2A_W01
W02	knows the concepts and methods of Galois theory and its applications in algebra and construction problems of geometry	MAT2A_W08
W03	knows the relations between Galois theory and other areas of theoretical and applied mathematics	MAT2A_W17 MAT2A_W11
within the scope of **ABILITIES:**		
U01	constructs mathematical reasoning, proves theorems, selects refuting counterexamples to incorrect hypotheses, checks the correctness of conclusions in formal proofs	MAT2A_U01
U02	notices formal structures related to Galois theory and understands the importance of these structures	MAT2A_U03
U04	recognizes mathematical structures in selected practical and theoretical issues other fields of science	MAT2A_U12
U05	can search for necessary information in various sources, also in English	MAT2A_U13
within the scope of **SOCIAL COMPETENCE:**		
K01	analyses the logical accuracy of one's own and other people's statements, tends for precision in writing the text	MAT1A_K01 MAT1A_K02
K02	tends to completely understanding of issues by asking appropriate questions.	MAT1A_K02

4.4. Methods of assessment of the intended learning outcomes

Teaching outcomes *(code)*	Method of assessment (+/-)																					
	Exam oral/written*			Test*			Project*			Effort in class*			Self-study*			Group work*			Others* e.g. standardized test used in e-learning		
	Form of classes			*Form of classes*			*Form of classes*			*Form of classes*			*Form of classes*			*Form of classes*			*Form of classes*		
	L	*C*	...	*L*	*C*	...	*L*	*C*	...	*L*	*C*	...	*L*	*C*	...	*L*	*C*	...	*L*	*C*	...
W01	+				+					+	+		+	+							
W02	+				+					+	+		+	+							
W03	+				+					+	+		+	+							
U01					+					+	+		+	+							
U02					+					+	+		+	+							
U04					+					+	+		+	+							
U05					+					+	+		+	+							
K01	+									+	+		+	+							
K02	+									+	+		+	+							

delete as appropriate

4.5. Criteria of assessment of the intended learning outcomes

Form of classes	Grade	Criterion of assessment
lecture (L) (including e-learning)	**3**	at least 50% and no more than 60% of the total number of possible points
	3,5	more than 60% and no more than 70% of the total number of possible points
	4	more than 70% and no more than 80% of the total number of possible points
	4,5	more than 80% and no more than 90% of the total number of possible points
	5	more than 90% of the total number of possible points
classes (C)* (including e-learning)	**3**	at least 50% and no more than 60% of the total number of possible points
	3,5	more than 60% and no more than 70% of the total number of possible points
	4	more than 70% and no more than 80% of the total number of possible points
	4,5	more than 80% and no more than 90% of the total number of possible points
	5	more than 90% of the total number of possible points

others (...)* (including e-learning)	**3**	at least 50% and no more than 60% of the total number of possible points
	3,5	more than 60% and no more than 70% of the total number of possible points
	4	more than 70% and no more than 80% of the total number of possible points
	4,5	more than 80% and no more than 90% of the total number of possible points
	5	more than 90% of the total number of possible points

5. BALANCE OF ECTS CREDITS – STUDENT'S WORK INPUT

Category	**Student's workload**	
	Full-time studies	**Extramural studies**
NUMBER OF HOURS WITH THE DIRECT PARTICIPATION OF THE TEACHER /CONTACT HOURS/	**68**	
*Participation in lectures**	15	
*Participation in classes, seminars, laboratories**	30	
*Preparation in the exam/ final test**	8	
*Others (please specify e.g. e-learning)**		
INDEPENDENT WORK OF THE STUDENT/NON-CONTACT HOURS/	**45**	
*Preparation for the lecture**	10	
*Preparation for the classes, seminars, laboratories**	20	
*Preparation for the exam/test**	17	
*Gathering materials for the project/Internet query**		
Preparation of multimedia presentation		
*Others **		
TOTAL NUMBER OF HOURS	**100**	
ECTS credits for the course of study	**4**	

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Accepted for execution *(date and legible signatures of the teachers running the course in the given academic year)*

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