

## WROCLAW UNIVERSITY OF TECHNOLOGY – PHD STUDIES

<b>FACULTY OF .....</b>	
<b>SUBJECT CARD</b>	
Course name in Polish	<b>Podstawy teorii Galois</b>
Course name in English	<b>Foundations of Galois Theory</b>
Course language	
University-wide general course type:1) 1) basic course (mathematics, physics, chemistry, other) 2) humanity course 3) managerial skills 4) English language 5) other modern language Departmental course developing professional skills: 1) specialized course 2) interdisciplinary course 3) seminar (interdisciplinary, specialized, departmental)	
Type of course (obligatory, optional)	
<b>Educational effects according to ZW 26/2017: P8S_WG, P8U_U, P8S_UW , P8S_UU, P8S_KK</b> .....	
Subject code <b>MAP9030</b>	

\*delete as applicable

	Lecture	Laboratory	Seminar
Number of hours of organized classes in University (ZZU)	30		
Number of hours of total student workload (CNPS)	90		
Form of crediting	Exam **	Exam / crediting with grade*	Oral presentation
Number of ECTS points	3		
including number of ECTS points for practical (P) classes			
including number of ECTS points for direct teacher-student contact (BK) classes			

\*delete as applicable \*\*In case of didactic courses also inspections and evaluation classes

<b>PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES</b>	
1.	Knowledge of higher algebra - basic course

<b>SUBJECT OBJECTIVES</b>	
C1	Getting acquainted with the main ideas of the Galois theory, in particular the understanding of the relationship between group structure of automorphisms of field and the field extension by radicals

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C2	The possibility of applying Galois theory to specific algebraic equations

**SUBJECT EDUCATIONAL EFFECTS**

**Relating to knowledge:**

PEK\_W01 – Student has knowledge of group theory

PEK\_W02 – Student has knowledge of field theory

PEK\_W03 – Student has knowledge of Galois theory

**Relating to skills:**

PEK\_U01 – Student can to apply Galois theory to decide which algebraic equation can be solved by radicals

PEK\_U02 – Student can apply methods of mathematical analysis to determine group automorphism of given concrete algebraic equation

...

**Relating to social competences:**

PEK\_K01 – Student understands the importance scientific research and didactics

PEK\_K02 – Student can discuss the importance of solving equations and their methods at the popular science level

...

**PROGRAM CONTENTS**

<b>Form of classes – lecture</b>		Number of hours
Lec 1	Group and subgroup notion, group rank, space of cosets, Lagrange theorem	2
Lec 2	Homomorphism of groups, group of all automorphisms	2
Lec 3	Normal group, quotient group, theorem on homomorphisms of groups	2
Lec 4	Symmetric group, decomposition of the group onto cycles, Cayley theorem	2
Lec 5	Field and subfield notion, algebraically closed field, algebraic closedness of the field of all complex numbers	2
Lec 6	Field extension, theorem on existence of algebraically closed field extension	2
Lec 7	Algebraic elements, transcendental real numbers and two proofs of their existence	2
Lec 8	Irreducible polynomials, the Eisenstein theorem, rank of the algebraic element	2
Lec 9	Field extension by the algebraic element, Artin-Schreier theorem on primitive element	2

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Lec 10	Basis and rank of the algebraic extension, minimal polynomial of algebraic element	2
Lec 11	Group of automorphisms of field, Galois extension and their group	2
Lec 12	Normal extension. Galois theorems	2
Lec 13	Roots of polynomials of the second, third and fourth degree	2
Lec 14	Field extension by radicals and their relationship with the solvable groups	2
Lec 15	Solvability of $S_4$ group and unsolvability of $S_5$ group, algebraic equation which are not have solution by radicals	2
Total hours		<b>30</b>

Form of classes – laboratory		Number of hours
Lab 1		
Lab 2		
Lab 3		
Lab 4		
...		
Total hours		

Form of classes – seminar		Number of hours
Sem 1		
Sem 2		
Sem 3		
Sem 4		
...		
Total hours		

TEACHING TOOLS USED	
N1	Blackboard
N2	Chalk
...	

EVALUATION OF ACHIEVED SUBJECT EDUCATIONAL EFFECTS		
<b>Evaluation:</b> F – forming (partial) C – concluding	Educational effect number	Way of evaluating achievement of educational effects
F1	PEK_W01,PEK_W02 PEK_U01 PEK_U02,PEK_K01 PEK_K02	exam

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C

**PRIMARY AND SECONDARY LITERATURE****PRIMARY LITERATURE:**

- [1] W. Narkiewicz, Teoria Galois dla nauczycieli, wyd. UW r 1993
- [2] S. Lange, Algebra, PWN Warszawa, 1984
- [3] A. Białynicki-Birula, Algebra, BM t. 40, PWN 1971, 2014
- [4] A. Białynicki-Birula, Algebra, BM t. 40, PWN 1971, 2014

**SECONDARY LITERATURE:**

- [1] M. Bryński, J. Jurkiewicz, Zbiór zadań z algebry, PWN 1978

**SUBJECT SUPERVISOR**

(NAME AND SURNAME, E-MAIL ADDRESS)

**dr hab. inż. Robert Rałowski, email: robert.ralowski@pwr.edu.pl**