KARTA PRZEDMIOTU

I. Dane podstawowe

Nazwa przedmiotu	Algebra abstrakcyjna
Nazwa przedmiotu w języku angielskim	Abstract algebra
Kierunek studiów	Matematyka (Mathematics)
Poziom studiów (I, II, jednolite magisterskie)	I
Forma studiów (stacjonarne, niestacjonarne)	Stacjonarne (Full-time studies)
Dyscyplina	Matematyka (Mathematics)
Język wykładowy	Angielski (English)

Koordynator przedmiotu/osoba odpowiedzialna	Dr hab. Dariusz Partyka

Forma zajęć *(katalog zamknięty ze słownika)*	Liczba godzin	semestr	Punkty ECTS
wykład	60		7
konwersatorium			
ćwiczenia	30		
laboratorium			
warsztaty			
seminarium			
proseminarium			
lektorat			
praktyki			
zajęcia terenowe			
pracownia dyplomowa			
translatorium			
wizyta studyjna			

Wymagania wstępne	Basic knowledge of mathematical logic, set theory, linear algebra and mathematical analysis.

II. Cele kształcenia dla przedmiotu

C1. Presentation of basic concepts and facts of abstract algebra.
C2. Familiarize students with applications of abstract algebra in other areas of mathematics and natural sciences like e.g. number theory.

III. Efekty uczenia się dla przedmiotu wraz z odniesieniem do efektów kierunkowych

Symbol	Opis efektu przedmiotowego	Odniesienie do efektu kierunkowego
WIEDZA		
W_01	Student understands what is the process of proving in mathematics. Understands the importance of counterexamples in mathematical reasoning. (K_W02, K_W05)	K_W02, K_W05
W_02	Student knows basic algebraic structures. (K_W05)	K_W05
W_03	Student has knowledge of basic concepts and facts of abstract algebra. Is familiar with examples illustrating these concepts. Knows basic theorems of abstract algebra and their proofs. (K_W04, K_W05)	K_W04, K_W05
UMIEJĘTNOŚCI		
U_01	Student uses the basic algebraic structures like groups, rings and fields. Can apply their basic properties. Recognizes these structures in different areas of mathematics, not only in algebra. (K_U01, K_U04, K_U17)	K_U01, K_U04, K_U17
U_02	Student can examine compounds between algebraic structures by means of a homomorphism. Understand the importance of an isomorphism of algebraic structures. Can determine the kernel and image of a homomorphism. Can use algebraic substructures and their generators. (K_U01, K_U04, K_U17)	K_U01, K_U04, K_U17
U_03	Student can create quotient algebraic structures. Employs the notions of the normal divisor of a group and ideal of a ring. Can examine the structure of a group. (K_U01, K_U04, K_U05, K_U17).	K_U01, K_U04, K_U05, K_U17
KOMPETENCJE SPOŁECZNE		
K_01	Student understands the need to further develop his knowledge and skills in algebra. Can formulate questions in order to better understand the subject. (K_K01, K_K02)	K_K01, K_K02

IV. Opis przedmiotu/ treści programowe

1. Structures and substructures.
2. Inner operations in a class. Structures with inner operation.
3. Groupoids. Commutativity, associativity and distributivity of operations in groupoids. Neutral and inverse elements of a groupoid.
4. Iterations and the degree of an element in a groupoid.
5. Algebraic structures and substructures. Generators of algebraic structures.
6. Basic types of algebraic structures.
7. Algebraic extensions of algebraic structures.
8. Homomorphisms of algebraic structures. The kernel and image of homomorphism.
9. Quotient algebraic structures.
10. Algebraic structures induced by mappings.
11. The ring of integers and ring of integers modulo p.
12. Fundamental theorem on a homomorphism of algebraic structures. A canonical homomor-

phism.

13. Divisors of algebraic structures.
14. Divisors of groups – normal divisors. Quotient groups. Fundamental theorem on a homomorphism of groups. The center of a group. Groups of automorphisms.
15. Divisors of rings – ideals.
16. Symmetric groups and permutations. Groups of transformations and Cayley's theorem.
17. Cyclic groups.
18. Finite groups, index of a subgroup and Lagrange's theorem, p-groups and Sylov's theorem. The little Fermat theorem.
19. Direct products of groups. The decomposition of commutative and finite groups on cyclic groups.
20. The structure of commutative and finitely generated groups.

V. Metody realizacji i weryfikacji efektów uczenia się

Symbol efektu	Metody dydaktyczne *(lista wyboru)*	Metody weryfikacji *(lista wyboru)*	Sposoby dokumentacji *(lista wyboru)*
WIEDZA			
W_01	Conventional lecture.	Exam, oral test.	Evaluated written test.
W_02	Conventional lecture.	Exam, oral test.	Evaluated written test.
W_03	Conventional lecture.	Exam, oral test.	Evaluated written test.
UMIEJĘTNOŚCI			
U_01	Practical classes.	Test.	Evaluated test.
U_02	Practical classes.	Test.	Evaluated test.
U_03	Practical classes.	Test.	Evaluated test.
KOMPETENCJE SPOŁECZNE			
K_01	Discussion.	Observation.	Observation report.

VI. Kryteria oceny, wagi…

LECTURE:
The completion of classes is required.
Written and oral exam together constitute the final grade:
91 – 100% (5,0)
81 – 90% (4,5)
71 – 80% (4,0)
61 – 70% (3,5)
51 – 60% (3,0)
Less than 51% (2,0)

CLASSES:
At least 80% of attendance is required.
Two tests together constitute the final grade:
91 – 100% (5,0)
81 – 90% (4,5)

71 – 80% (4,0)
61 – 70% (3,5)
51 – 60% (3,0)
Less than 51% (2,0)

Detailed rules of evaluation are given on lectures and classes.

VII. Obciążenie pracą studenta

Forma aktywności studenta	Liczba godzin
Liczba godzin kontaktowych z nauczycielem	120
Liczba godzin indywidualnej pracy studenta	90

VIII. Literatura

Literatura podstawowa
Lecture notes and lecture notes in electronic form as well as: 1. A. I. Kostrikin, Introduction to Algebra, Springer-Verlag, New York, 1982. 2. A. I. Kostrikin (Ed.), Exercises in Algebra. A Collections of Exercises in Algebra, Linear Algebra and Geometry, Gordon and Breach Publishers, 1996. 3. Białynicki-Birula, Zarys algebry, PWN, Warszawa 1987. 4. Białynicki-Birula, Algebra, PWN, Warszawa 1976. 5. Z. Opial, Algebra Wyższa, PWN, Warszawa 1976. 6. A. I. Kostrikin, Wstęp do algebry, cz.1 Podstawy algebry, Wyd. Nauk. PWN, Warszawa 2004. 7. I. Kostrikin, Wstęp do algebry, cz. 2 Algebra liniowa, Wyd. Nauk. PWN, Warszawa 2004. 8. I. Kostrikin, Wstęp do algebry, cz. 3 Podstawowe struktury algebraiczne, Wyd. Nauk. PWN, Warszawa 2005. 9. I. Kostrikin (red.), Zbiór zadań z algebry, Wyd. Nauk. PWN, Warszawa 2005.
Literatura uzupełniająca
1. S. Lang, Algebra (Revised Third Edition), Graduate Texts in Mathematics 211, 2002 Springer Science + Business Media, New York 2002. 2. J. Browkin, Teoria ciał, PWN, Warszawa 1977. 3. M.I. Kargapałow i J.I. Mierzlakow, Podstawy teorii grup, PWN, Warszawa 1989. 4. A.G. Kurosz, Algebra Ogólna, PWN, Warszawa 1965. 5. S. Lang, Algebra, PWN, Warszawa 1984.