Algebraic Methods in Computer Science

Course Description

Basic Information

Field of Study : Analytical Computer Science

Path : -

Organizational Unit : Faculty of Mathematics and Computer Science

Education Level : first-cycle studies

Form of Studies : full-time studies

Study Profile : general academic

Obligatory Status : mandatory

Education Cycle : 2022/23

Course Code : UJ.WMIIANS.110.03334.22

Languages of Instruction : Polish

Disciplines : Computer Science, Mathematics

ISCED Classification : 0541 Mathematics, 0613 Software and applications development and analysis

USOS Code : WMI.TCS.MAI.OL

Course Coordinator

Paweł Idziak

Course Instructors

Paweł Idziak, Andrzej Pezarski

Period Semester 1	Form of verification of learning outcomes exam Form of instruction and hours lecture: 45 tutorials: 60	Number of ECTS credits 8.0

Learning Outcomes for the Course

Code	Effects in terms of	Field-specific learning outcomes	Verification methods
Knowledge – The student knows and understands:			
W1	basic algebraic, geometric, and number theory concepts and their applications in computer science.	IAN_K1_W01	written exam, credit
W2	basic algorithms of algebra and number theory.	IAN_K1_W09, IAN_K1_W12	written exam, credit
Skills – The student can:			
U1	present mathematical reasoning in a comprehensible way, formulate definitions and theorems, and apply them in computer science practice.	IAN_K1_U01, IAN_K1_U02	written exam, credit
U2	apply mathematical knowledge to model simple tasks related to computer science	IAN_K1_U01	written exam, credit
Social competences – The student is ready to:			
K1	treat with reservation opinions and statements that have not been sufficiently and correctly justified; can precisely formulate questions to analyze a given topic.	IAN_K1_K01, IAN_K1_K05	written exam, credit
K2	critically evaluate their knowledge.	IAN_K1_K01, IAN_K1_K05	written exam, credit

ECTS Credit Balance

Student activity form	Average number of hours* dedicated to completed activity types
lecture	45
tutorials	60
preparation for tutorials	90
exam preparation	43
participation in exam	2

Total student workload	Number of hours 240	ECTS 8.0

* hour (lesson) means 45 minutes

Program Content

No.	Program Content	Learning outcomes for the course
1.	Permutations and groups.	W1, W2, U1, U2, K1, K2
2.	Fields, complex numbers.	W1, W2, U1, U2, K1, K2
3.	Numerical matrices; Determinants, inverse matrix; Vector and matrix norms.	W1, W2, U1, U2, K1, K2
4.	Linear spaces; Linear transformations; Linear functionals.	W1, W2, U1, U2, K1, K2
5.	Systems of linear equations; Image, rank, and kernel of a matrix.	W1, W2, U1, U2, K1, K2
6.	Eigenvalue problems of a linear operator (matrix); Diagonalization.	W1, W2, U1, U2, K1, K2
7.	Euclidean and unitary spaces.	W1, W2, U1, U2, K1, K2
8.	Finite fields, RSA and discrete logarithm	W1, W2, U1, U2, K1, K2
9.	Bilinear and quadratic forms.	W1, W2, U1, U2, K1, K2

Extended Information

Teaching Methods:

conventional lecture, multimedia presentation lecture, subject tutorials

Type of classes	Forms of credit	Course completion conditions
lecture	written exam	obtaining more than 50% of points in the weighted average of the written exam (with weight 40%) and tutorial credit (with weight 60%)
tutorials	credit	activity in class, including solving homework assignments; passing written tests

Prerequisites and Additional Requirements

The course "Formal Methods in Computer Science" must be completed simultaneously or earlier

Literature

Required

1. Herdegen A., "Wykłady z algebry liniowej i geometrii", Discepto, Kraków, 2005

2. Kostrikin A., "Zbiór zadań z algebry", PWN, Warszawa, 1995

Additional

1. Kostrikin A., "Wstęp do algebry 1: Podstawy algebry", PWN, Warszawa, 2004
2. Kostrikin A., "Wstęp do algebry 2: Algebra liniowa", PWN, Warszawa, 2004
3. Kostrikin A., "Wstęp do algebry 3: Podstawowe struktury algebraiczne", PWN, Warszawa, 2005