

Algebraic and geometrical methods in physics II - opis przedmiotu

Informacje ogólne	
Nazwa przedmiotu	Algebraic and geometrical methods in physics II
Kod przedmiotu	13.2-WF-FizP-AGMP-S17
Wydział	Wydział Fizyki i Astronomii
Kierunek	Fizyka
Profil	ogólnoakademicki
Rodzaj studiów	Program Erasmus pierwszego stopnia
Semestr rozpoczęcia	semestr zimowy 2017/2018

Informacje o przedmiocie	
Semestr	2
Liczba punktów ECTS do zdobycia	4
Typ przedmiotu	obowiązkowy
Język nauczania	angielski
Sylabus opracował	dr hab. Maria Przybylska, prof. UZ

Formy zajęć					
Forma zajęć	Liczba godzin w semestrze (stacjonarne)	Liczba godzin w tygodniu (stacjonarne)	Liczba godzin w semestrze (niestacjonarne)	Liczba godzin w tygodniu (niestacjonarne)	Forma zaliczenia
Wykład	15	1	-	-	Egzamin
Ćwiczenia	30	2	-	-	Zaliczenie na ocenę

Cel przedmiotu

Learning students of more advanced concepts, facts and methods of linear algebra with chosen elements of abstract algebra and analytical geometry. Obtaining the ability to solve certain typical exercises illustrating introduced notions. The aim of the course is also to develop the students' precise thinking skills and to prepare the methods and techniques of linear algebra in various branches of physics.

Wymagania wstępne

algebraic and geometric methods in physics

Zakres tematyczny

1. Algebraic structures. Sets, relations, operations (two-arguments), properties of operations, examples. Definition of a group, a ring, a ring with unity and a field, Examples of applications of various algebraic structures with particular emphasis on groups, examples of various groups.
2. Linear spaces. General definition of a linear space, linear subspaces, linear independence, base, dimension, subspace, intersection and the sum of a simple subspace. Examples of various linear spaces
3. Linear mappings and their basic properties. Examples of mappings. Kernel and image of linear mapping. Composition of linear mappings, inverse mapping.
4. Matrix representation of a linear mapping. Definition of matrix representation of linear mapping, mutual uniqueness between linear mappings and matrices. Theorems on the form of the matrix of the composition of linear mappings and the matrix of the inverse mapping to a given automorphism.
5. Matrix of transition and its properties. Theorem on the change of the mapping matrix when changing the domain bases and the counter-domain. Invariant subspaces. Eigenvectors and eigenvalues
6. Transformation of the linear transformation matrix when changing the vector space base. Diagonalization of the matrix. Jordan's theorem. Matrix functions.
7. Euclidean spaces. General definition, scalar product, angle between vectors, orthogonal and orthonormal base, orthogonal decomposition, Gram-Schmidt orthogonalization.
8. Quadratic forms. Linear transformations of quadratic forms, canonical forms, specificity of forms. Classification of curves and second degree algebraic surfaces in $\mathbb{R}^2$ and in $\mathbb{R}^3$.

Metody kształcenia

Conventional lecture examples of application of algebra and analytic geometry in physics.

Calculation classes, within which students solve tasks illustrating the content of the lecture enriched with physical applications.

Efekty uczenia się i metody weryfikacji osiągnięcia efektów uczenia się

Opis efektu	Symbole efektów	Metody weryfikacji	Forma zajęć
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Opis efektu	Symbole efektów	Metody weryfikacji	Forma zajęć
The student knows and understands selected topics of linear and abstract algebra and analytic geometry. He knows the terminology used in these sciences		- egzamin - ustny, opisowy, testowy i inne - sprawdzian	- Wykład - Ćwiczenia
The student knows and applies the general concepts: operations, groups, fields, linear space, vector, linear independence, vector space base, linear transformation, norms, Euclidean space, square form, knows different examples of linear spaces, especially those used in physics; performs operations on vectors belonging to different vector spaces and knows their physical applications; understands the concept of linear transformation between vector spaces, can determine eigenvectors and eigenvalues, finds a diagonal form of the matrix, knows the structure of the Jordan form; can bring square forms to the canonical form; can classify curves and second degree algebraic surfaces in $\mathbb{R}^2$ and $\mathbb{R}^3$.		- egzamin - ustny, opisowy, testowy i inne - sprawdzian	- Wykład - Ćwiczenia
The student can use a mathematical apparatus to describe and model phenomena and physical processes.		- egzamin - ustny, opisowy, testowy i inne - sprawdzian	- Wykład - Ćwiczenia
The student uses a variety of materials in Polish and English, provided both by lecturer and self-found using modern technologies. Acquires a critical attitude towards materials of poorly established origin found on the web.		- egzamin - ustny, opisowy, testowy i inne - sprawdzian	- Wykład - Ćwiczenia

Warunki zaliczenia

Lecture: Positive passing of exam (written).

Classes: Positive passing of all tests (written).

Before taking the exam a student must gain positive grade during the class.

Final grade: the arithmetic average of the exam grades and pass the exercises.

Literatura podstawowa

[1] T. Jurlewicz, Z. Skoczylas, *Algebra liniowa 2*, Oficyna Wydawnicza GiS, Wrocław 2011

[2] T. Jurlewicz, Z. Skoczylas, *Algebra i geometria analityczna*, Oficyna Wydawnicza GiS, Wrocław 2011.

[3] J. Klukowski, I. Nabitak, *Algebra dla studentów*, Wydawnictwo Naukowo-Techniczne, Warszawa 1999.

[4] A. Mostowski, M. Stark, *Algebra liniowa*, Państwowe Wydawnictwo Naukowe, Warszawa 1977.

[5] Strona: <http://wazniak.mimuw.edu.pl/index.php?title=Algebra liniowa z geometrią analityczną>

[6] W.D. Clark, S.L. McCune, *Linear Algebra*, McGraw-Hill Companies, Inc, 2013

[7] R.S. Lipschutz, M. Lipson, *Schaum's Outline of Theory and Problems of Linear Algebra*, McGraw-Hill Companies, Inc, 2001

[8] A.V. Pogorelov, *Analytical Geometry*, Mir Publisher, Moscow, 1980

[9] Materiały udostępnione przez prowadzących zajęcia.

Literatura uzupełniająca

[1] R. Larson, *Elementary Linear Algebra*, CENGAGE Learning, 2017

[2] [6] E. W. Swokowski, *Calculus with Analytic Geometry*, Alternate Edition -PWS Publisher 1983.

Uwagi

Zmodyfikowane przez dr hab. Maria Przybylska, prof. UZ (ostatnia modyfikacja: 01-08-2018 00:23)

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