Course description

Course abbreviation:	KMA/LA	**Page:**	1 / 3
Course name:	Linear Algebra		
Academic Year:	2023/2024	**Printed:**	01.06.2024 11:24

Department/Unit /	KMA / LA			
Title	Linear Algebra			
Accredited/Credits	Yes, 4 Cred.			
Number of hours	Lecture 3 [Hours/Week] Tutorial 1 [Hours/Week]			
Occ/max	Status A	Status B	Status C	
Summer semester	0 / -	0 / -	0 / -	
Winter semester	0 / -	0 / -	0 / -	
Timetable	Yes			
Language of instruction	Czech			
Optional course	Yes			
Evaluation scale	1|2|3|4			
No. of hours of on-premise				
Auto acc. of credit	No			
Periodicity	K			
Substituted course	None			
Preclusive courses	KMA/LA-A and KMA/LAA			
Prerequisite courses	N/A			
Informally recommended courses	N/A			
Courses depending on this Course	N/A			

Academic Year	2023/2024
Type of completion	Exam
Type of completion	Combined
Course credit prior to	YES
Counted into average	YES
Min. (B+C) students	1
Repeated registration	NO
Semester taught	Winter, Summer
Internship duration	0
Ev. sc. – cred.	S|N

Course objectives:

The subject is dedicated to the study of basics of matrix algebra and linear algebra.

Requirements on student

Credit requirements: one test - 45 min., minimal result 50%
Student fulfill requirements for the credit after he /she consults his/her test with the lecturer and presents his/her index for signing the credit.

Exam: - test - 90 min., minimal result 50%
orals - two randomly chosen topics of the following ones:

1. polynomials, Horner scheme, polynomial factorization
2. determinant of a matrix, definition and basic properties
3. determinant expansion along a row or a column
4. vector space, linear dependence and independence
5. basis and dimension of a vector space, coordinates of a vector relative to a basis
6. rank of a matrix, Gaussian elimination, calculation of the rank using determinants
7. matrix inverse, Gauss-Jordan elimination
8. calculation of the matrix inverse using determinants
9. linear map (transformation), kernel and image and their dimensions
10. associated matrix of a linear map and its properties
11. inverse linear map, linear map composition and associated matrix
12. vector space isomorphism
13. homogeneous system of linear equations
14. nonhomogeneous system of linear equations
15. linear systems with an invertible matrix coefficient, Cramer's rule
16. eigenvalues and eigenvectors of a matrix
17. change of basis and change-of-basis matrix

18. change of a change-of-basis matrix by change of basis
19. similarity of matrices and its properties, Jordan normal form of a matrix
20. inner product and its properties, norm induced by the inner product
21. orthogonal and orthonormal basis for a space, the Gram-Schmidt process
22. orthogonal projection of a vector on a subspace, method of least squares
23. quadratic forms and real valued symmetric matrices
24. inertia of a quadratic form, Sylvester's law of inertia for quadratic forms

Content

Week 1. Polynomials, Horner scheme, polynomial factorization
Week 2. Vector space, linear dependence and independence, basis and dimension of a vector space, coordinates of a vector relative to a basis
Week 3. Determinant of a matrix, definition and basic properties, determinant expansion along a row or a column
Week 4. rank of a matrix, Gaussian elimination, calculation of the rank using determinants
Week 5. matrix inverse, Gauss-Jordan elimination, calculation of the matrix inverse using determinants
Week 6. linear map (transformation), kernel and image and their dimensions, associated matrix of a linear map and its properties
Week 7. inverse linear map, linear map composition and associated matrix, vector space isomorphism, change of basis and change-of-basis matrix
Week 8. systems of linear equations, homogeneous and non-homogeneous systems of equations, linear systems with an invertible matrix coefficient, Cramer's rule
Week 9. eigenvalues and eigenvectors of a matrix, similarity of matrices and its properties, Jordan normal form of a matrix
Week 10. inner product and its properties, norm induced by the inner product, orthogonal and orthonormal basis for a space
Week 11. the Gram-Schmidt process, orthogonal projection of a vector on a subspace
Week 12. method of least squares, quadratic forms and real valued symmetric matrices
Week 13. inertia of a quadratic form, Sylvester's law of inertia for quadratic forms

Fields of study

Guarantors and lecturers

- **Guarantors:** Doc. Ing. Roman Čada, Ph.D. (100%)

Literature

- **Basic:** Tesková, Libuše. *Lineární algebra*. 1. vyd. Plzeň : Západočeská univerzita, 2001. ISBN 80-7082-797-1.
- **Basic:** Tesková, Libuše. *Sbírka příkladů z lineární algebry*. 5. vyd. Plzeň : Západočeská univerzita, 2003. ISBN 80-7043-263-2.
- **Recommended:** Havel, Václav; Holenda, Jiří. *Lineární algebra*. 1. vyd. Praha : SNTL, 1984.
- **Recommended:** Holenda, Jiří. *Lineární algebra*. 2. vyd. Plzeň : Západočeská univerzita, 1992. ISBN 80-7082-075-6.

Time requirements

All forms of study

Activities	Time requirements for activity [h]
Contact hours	52
Preparation for formative assessments (2-20)	10
Preparation for an examination (30-60)	48
Total:	**110**

assessment methods

Knowledge - knowledge achieved by taking this course are verified by the following means:

Combined exam

Test

Skills demonstration during practicum

prerequisite

Knowledge - students are expected to possess the following knowledge before the course commences to finish it successfully:

Knowledge of secondary school mathematics required.

teaching methods

Knowledge - the following training methods are used to achieve the required knowledge:

Interactive lecture

Collaborative instruction

learning outcomes

Knowledge - knowledge resulting from the course:

After completing the course the student will be able to
- find roots of several types of polynomials,
- use the concept of a vector and a matrix,
- calculate the determinant of a square matrix and to find its inverse,
- solve algebraic systems of linear equations,
- define and verify a vector space structure,
- work with the concept of a linear map,
- find eigenvalues and eigenvectors of a square matrix and to interpret them geometrically,
- classify quadric surfaces,
- approximate functions (data) by the method of least squares.

Course is included in study programmes: