Course description

Course abbreviation:	KMA/LA	Page:	1/3		
Course name: Academic Year:	2023/2024 Printed:	12.07.2025	08:32		
Department/Unit /	KMA / LA Academic Year	2023/2024			
Title	Linear Algebra Type of completion	Exam			
Accredited/Credits	Yes, 4 Cred. Type of completion	Combined			
Number of hours	Lecture 3 [Hours/Week] Tutorial 1 [Hours/Week]				
Occ/max	Status A Status B Status C Course credit prior to	Yes			
Summer semester	0/- $0/-$ Counted into average	YES			
Winter semester	0/- $0/ 0/-$ Min. (B+C) students	1			
Timetable	Yes Repeated registration	NO			
Language of instruction	Czech Semester taught	Winter, Su	mmer		
Optional course	Yes Internship duration	0			
Evaluation scale	1 2 3 4 Ev. sc. – cred.	S N			
No. of hours of on-premise					
Auto acc. of credit	No				
Periodicity	every year				
Specification periodicity					
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					

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. <i>Lineární algebra</i> . 1. vyd. Plzeň : Západočeská univerzita, 2001. ISBN 80-7082-797-
• Basic:	Tesková, Libuše. <i>Sbírka příkladů z lineární algebry</i> . 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

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: