General Information

Name of Course: # APPLIED MATHEMATICS 1

Course Code: IVB007AN
Semester: **Computer Science Engineering Bsc 2nd**
Credit Units: 6
Allotment of Hours per Week: 2 Lecture Lessons /Week, 2 Practical Lessons /Week
Evaluation: Two Midterm Exams (with grade) and one Homework
Prerequisites: **none**

Instructors: **Dr Mihály KLINCSIK, professor**
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Introduction, Learning Outcomes:

After successful completion of the course the student will

(1) know basic methods for solving systems of linear equations,
(2) be familiar with the basic matrix operations,
(3) know how to compute determinants, and will understand the role of determinants in the theory of solvability of linear equations, and invertability of matrices,
(4) understand the role of the rank of a matrix for the solution set of linear equations,
(5) know the basic concepts of eigenvalues and eigenvectors,
(6) be familiar with typical engineering applications of matrices,

The students must solve two intermediate (or midterm) tests successfully. The language of the exam is English.

Prerequisites
To understand and apply concepts of linear algebra you need to have taken basic math classes such as Algebra and Calculus.

General Course Description and Main Content:

The Linear Algebra includes the following topics

- Geometry and algebra of 2D and 3D vectors
- Linear systems of equations
- Gaussian Elimination
- Matrices and matrix operations
- Rank and inverse of a matrix
- Determinants
- Linear dependence and independence of vectors
- Basic vector spaces, orthogonality and basis
- Eigenvalues and eigenvectors of a matrix
- Symmetric Matrices and diagonalization
- Applications

Methodology:

The course gives an introduction to important mathematical techniques of exercise solving problems from linear algebra and understands the basic theory. Equal emphasis is given to learning new mathematics concepts and to learning how to construct and write down correct linear algebraically arguments.

A graphing calculator with matrix capabilities is highly desirable.

Schedule:

week	Topics	Midterm tests, Homework
1.	Euclidean space or inner product space. Geometry and algebra of 2D and 3D vector space. R^n n-dimensional vector space. Norm, dot product and distance in R^n . Orthogonality of vectors. Cross product in R^3.	
2.	System of linear equations, solution set. Gauss-Jordan elimination process. Augmented matrix. Reduced row echelon form (rref) of a matrix. Parameterized solutions,	
3.	General vector space and subspace. Examples: R^n n-dimensional vector space, space of sequences, space of polynomials, function spaces. Linear combination of vectors, spanning subspace. Linear independence and dependence of vectors. Dimension, basis. Linear systems in vector form.	
4.	Matrix and matrix operations: sums, multiplication by scalar, matrix multiplication, transpose. Properties of matrix operations. Linear system in matrix form.	
5.	Inverse of a matrix. Calculating inverse by elementary row operations. Special matrices: zero, identity, triangular, diagonal, elementary, square and symmetric.	
6.	Matrix as a linear transformation; rows pace, column space, range, null space. Rank of matrix and calculations using Gauss-elimination. Theorem on dimension, Change of basis. Linear transformation on R^2 plane.	
7.	Determinant of square matrices. Calculation of determinants by expansion using cofactors. Properties of determinant under elementary matrix operations.	
8.	Solve similar exercises as in the 2st midterm test	1st midterm test based on weeks 1-7.
9.	**Spring holiday**	
10.	Determinant of matrix product. Adjoint matrix and calculation of inverse matrix. Solving linear equation with square matrix applying Cramer's rule. Determinant as an area and volume in 2D and 3D spaces	Homework exercises
11	Eigenvalues and eigenvectors of square matrices. Characteristic polynomial. Eigenspace: subspace of eigenvectors. Creating diagonal form by similarity transformation.	
12.	Orthogonal basis. Orthogonal complements. Gram - Schmidt process. Orthogonal projection onto subspace. Least square problem and solution by normal equations.	
13.	Eigenvalues of symmetric matrices are real numbers. Orthogonal diagonalization of symmetric matrices.	
14.	Solve similar exercises as in the 2st midterm test	
15.		2nd midterm test based on week 10-14.

Attendance:

Attending is required all classes, and will impact the grade (max. 5%).. Unexcused absences will adversely affect the grade, and in case of absence from more than 30% of the total number of lesson will be grounds for failing the class. To be in class at the beginning time and stay until the scheduled end of the lesson is required, tardiness of more than 20 minutes will be counted as an absence. In the case of an illness or family emergency, the student must present a valid excuse, such as a doctor's note.

Evaluation + Grading

Midterm Exam # 1 (40 %)
Midterm Exam # 2 (40 %)
Homework and Attendances (20 %)

1. Satisfactory work: Achieving more than 40% of the total points in the two written midterm assessments during the semester then the grading scale table will be applied to obtain the final result.
2. Unsatisfactory work: When the total points of the two midterm written tests are less than 40% together then a new test need to write from the whole topics of the semester in the exam period. A minimum of 40% is required to pass on this test.

Grading Scale:

Numeric Grade:	excellent (5)	good (4)	satisfactory (3)	pass (2)	fail (1)
Evaluation in percentages:	[85%,100%]	[70%,85%)	[55%,70%)	[40%,55%)	[0%,40%)

PTE Grading Policy:
Information on PTE's grading policy can be found at the following location:
http://erasmus.pte.hu/en/content/grading-system?language=en

Students with Special Needs:
Students with a disability and needs to request special accommodations, please, notify the Deans Office. Proper documentation of disability will be required. All attempts to provide an equal learning environment for all will be made.

Readings and Text books:

[1] Howard Anton, Chriss Rorres, Elementary Linear Algebra, Application version, 11th Edition, Wiley, 2014.
[2] David C. Lay, *Elementary Linear Algebra and its Applications, 4th edition,* Addison Wesley, 2012.
Materials are found on platform of Neptun Meet Street https://neptun.pte.hu/ and login as a student.