Analytic Geometry and Linear Algebra

Level:	**Language:**	**Duration:**	**Occurrence:**
Bachelor	Ukrainian	2 semesters	$1^{st} - 2^{nd}$ semesters
Credits:	**Total Hours:**	**Contact Hours:**	**Self-study Hours:**
7	210	105	105

Description of Course Work and Examinations

Module-rating system, results are evaluated on a 100-point scale. Each semester contains 6 short quizzes 2.5 pts/15 min each, two midterms 20 pts/180 min each, a higher complexity problem set for 15 pts that should be completed during the semester, and a final exam 30 pts/180 min.

Prerequisites

None

Syllabus

Matrix Algebra: rectangular and square matrix, column and row vectors, elementary operations on matrices, matrix transpose, matrix inverse, determinant, minors and cofactors, rank, adjoint matrix, methods of determinant computation, matrix multiplication, elementary operations as matrix multiplications, determinant of a matrix product and a matrix inverse, special matrices (orthogonal, Hermitian), systems of linear equations (SLE), Cramer's formula, Rouche-Capelli theorem, Fredholm solvability condition, Gauss-Jordan elimination, SLE solution space, fundamental and normal fundamental system of solutions, general solution.

Vector Spaces: axioms of vector spaces, examples (metric, normed, Euclidean spaces), linear combination, linearly dependent and independent vectors, basis and dimension of a vector space, coordinates of a vector in a given basis, change of basis, transformation matrix, physics applications.

Spaces with Scalar Products: axioms of the scalar product, Euclidean space, norm of a vector, Cauchy-Schwarz inequality, orthonormal system of vectors, Gram-Schmidt process, Gramian matrix, mutual basis, covariant and contravariant coordinates and their transformation rules, unitary space.

Vector Product: definition and axioms, mixed product and double vector product, geometrical interpretation, calculation of vector and mixed products in a given basis, Levi-Civita symbols.

Literature

1. V. Ilyin, E. Pozniak. *Linear Algebra*, Moscow 1984, 280 p, ISBN 978-5-9221-0481-4.

Instructors

Professor Stanislav I. Vilchinskiy/Assistant Professor Lidiya Zadorozhnya.