Unit of Study Information

Code	Unit	Evaluation Method	Mode	Session options
MA71B	Analytic geometry and Linear algebra	Grade and Attendance	Presencial	Semestral

Workload					
TC	PC	OA	SPA	PACC	Total
6	0	6	0	0	90

- TC: Theorethic Classes (per week);
- PC: Practical Classes (per week);
- OA: Out-of-class Activities (hours per session);
- SPA: Supervised Practical Activities (classes per session);
- PACC: Practical Activities as Curricular Components (classes per session, included in OA and SPA);
- Total: total workload in hours.

Learning Outcomes

State and explain the concepts of analytic geometry and linear algebra. To present the fundamental theorems of analytic geometry and linear algebra that aid in problem solving.

Syllabus

Matrices and linear systems. Vector algebra. Lines and planes. Vector spaces. Linear transformations. Inner product. Eigenvalues and eigenvectors. Conic and quadrics.

Content

Order	Syllabus	Content
1	Matrices and linear systems	Definition and notations. Types of matrices. Operations and their properties. Elementary operations on the rows of a matrix and equivalent matrices. Invertible matrices and their properties. Inverse matrix calculation through elementary operations. Determinant: definition and properties. Definition of systems of linear equations. Representation of a linear system in matrix form. Types of systems: homogeneous and non-homogeneous. Elementary operations and equivalent systems. Existence and uniqueness of solutions. Resolution of systems of linear equations by scaling.
2	Vector algebra	oriented segments. Vector definition. Geometric vector operations and their properties. Cartesian expression of a vector. Operations with vectors, analytically, and their properties. Collinear and coplanar vectors. Scalar product: definition, geometric interpretation and properties. Norm of a vector, distance between two points and angles between two vectors. Orthogonality between two vectors and orthogonal projection. Vector product: definition, geometric interpretation and properties. Area of the parallelogram. Mixed product: definition, geometric interpretation and properties. Volume of a parallelepiped. Double vector product.
3	Lines and planes	Equation of the line in the form: vector, parametric, symmetrical and reduced. Condition of collinearity of three points. Relative positions between two straight lines. Angle between two straight lines. Plane equation in the form: general, vector and parametric. Condition of four points coplanarity. Relative positions between line and plane. Relative positions between two planes. Angle between two planes. Distance between point and line, between two lines, between point and plane, between line and plane, and between planes.
4	Vector spaces	Definition and examples. Vector subspaces: definition and examples. Dependence and linear independence. Finely generated vector subspaces. Intersection, sum and direct sum of vector subspaces. Bases, dimension and related theorems. Coordinates of a vector with respect to an ordered base. Base change.
5	Linear transformations	Definition, examples and properties. Core and image: definition, examples and properties. Core and image theorem. Matrix representation of a linear transformation. Invertible transformations and their properties.
6	Inner product	Definition, examples and properties. Norm: definition and properties. Orthogonality and orthonormality. Relationship between internal product and the coordinates of a vector. Gram-Schmidt orthogonalization process. Orthogonal complement.
7	Eigenvalues and eigenvectors	Definition, examples and properties. Characteristic polynomial. Algebraic and geometric multiplicity. Diagonalizable operators. Diagonalization: necessary and sufficient conditions.
8	Conic and quadrics	Analytical study of the ellipse. Analytical study of hyperbole. Analytical study of the parable. Analytical study of quadrics. Translation and rotation of conics and quadrics using eigenvalues and eigenvectors.

Basic Resources

LAY, David C. Álgebra linear e suas aplicações. 4. ed. Rio de Janeiro, RJ: LTC, 2013. xvii, 445 p. ISBN 9788521622093.

ANTON, Howard; RORRES, Chris. Álgebra linear com aplicações. 10. ed. Porto Alegre, RS: Bookman, 2012. 768 p. ISBN 978-85-407-0169-4.

SANTOS, Fabiano José dos; FERREIRA, Silvimar Fábio. Geometria analítica. Porto Alegre, RS: Bookman, 2009. 216 p. ISBN 9788577804825.

KOLMAN, Bernard; HILL, David R. (Autor). Introdução à álgebra linear com aplicações. 8. ed. Rio de Janeiro, RJ: LTC, c2006. xvi, 664 p. ISBN 85-216-1478-0.

STEINBRUCH, Alfredo; WINTERLE, Paulo. Geometria analítica. 2. ed. São Paulo, SP: McGraw-Hill, Pearson Makron Books, c1987. 292 p. ISBN 0074504096.

Aditional Resources

SANTOS, Reginaldo J. Um curso de Geometria Analítica e Álgebra Linear. Belo Horizonte: UFMG, 2014.

SANTOS, Reginaldo J. Introdução à Álgebra Linear. Belo Horizonte: UFMG, 2010

CALLIOLI, Carlos A.; COSTA, Roberto C. F; DOMINGUES, Hygino H. Álgebra linear e aplicações. 6. ed. reform. São Paulo, SP: Atual, 1990. 352 p. ISBN 8570562977.

STEINBRUCH, Alfredo; WINTERLE, Paulo. Álgebra linear. 2. ed. São Paulo, SP: Pearson Makron Books, c1987. x, 583 p. ISBN 9780074504123.

WINTERLE, Paulo. Vetores e geometria analítica. 2. ed. São Paulo, SP: Pearson, 2014. xii, 242 p. ISBN 9788543002392.

BOULOS, Paulo; CAMARGO, Ivan de (Autor). Geometria analítica: um tratamento vetorial. 3. ed. São Paulo, SP: Pearson Prentice Hall, 2005. xiv, 543 p. ISBN 9788587918918.

BOLDRINI, José Luiz et al. Álgebra linear. 3. ed. ampl. e rev. São Paulo, SP: Harbra, c1986. 411 p. ISBN 8529402022.

VALLADARES, Renato José da Costa. Geometria analítica do plano e do espaço. Rio de Janeiro: LTC- Livros Técnicos e Científicos, 1990. 347 p. ISBN 85-216-0651-6