COURSE OUTLINE

(1) GENERAL

SCHOOL	**UNIVERSITY OF THESSALY**		
ACADEMIC UNIT	DEPARTMENT OF CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ΓΚ0106	**SEMESTER**	1
COURSE TITLE	LINEAR ALGEBRA AND ANALYTIC GEOMETRY		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	5	6
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialized general knowledge, skills development*	General background
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	
COURSE WEBSITE (URL)	http://eclass.uth.gr/eclass/courses/MHXC128/

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

The course, based on high school mathematics courses in algebra and geometry, focuses mainly on applications of Linear Algebra and Analytic Geometry without avoiding proofs of theorems where deemed necessary. The aim of the course is for the student to be able to know, understand, and compute matrices and determinants, to investigate and analytically solve linear systems, to understand the concepts and properties of vector spaces, to compute eigenvalues and eigenvectors, to carry out the diagonalization process for a given matrix, to use vector algebra in physics problems, to find equations of straight lines and planes in three-dimensional space, to construct and use equations of notable second-degree curves, and to calculate areas and volumes of basic solids.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking Working in an interdisciplinary environment*
Production of new research ideas	*……*
	Others…
	…….

The course aims at learning and applying methods of Linear Algebra and Analytic Geometry with emphasis on problems particularly coming from physics. At the same time, the aim is to promote critical thinking as well as productive and deductive thinking regarding the applicability of Higher Mathematics and in particular Linear Algebra in the study of Nature.

(3) SYLLABUS

ANALYTIC GEOMETRY

<u>Vector calculus</u>: vector algebra, collinear and co-planar vectors. Dot, vector, and mixed products of vectors. Coordinate systems.

<u>Straight lines and planes in space</u>: vector, parametric, and analytic equations of straight lines and planes, relative positions, distance of a point from a plane, common perpendicular and minimum distance of skew lines, straight line as an intersection of planes, projection of a straight line onto a plane, plane defined by parallel straight lines.

<u>Curves in the plane</u>: analytic and parametric equations, polar coordinates, conic sections, equations of notable plane curves, change of coordinate system (parallel displacement and rotation of axes) in the plane and in space.

<u>Stereometry</u>: convex regular polyhedra, parallelepiped, cube, pyramid, cylinder, cone, sphere.

LINEAR ALGEBRA

Properties and algebra of matrices, inverse, orthogonal, symmetric, and complex matrices. Determinants. Linear systems, Gauss' method, Cramer's method. Vector spaces and subspaces, linear combination of vectors and linear dependence and independence, sum of subspaces, basis and dimension of vector spaces. Matrices and linear mappings, change of base, similar matrices, linear geometric transformations in the plane, rotation matrices. Rank of a matrix and investigation of linear systems. Gram-Schmidt orthogonalization. Eigenvalues and eigenvectors, diagonalization of matrices, similarity transformations, Cayley-Hamilton theorem.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face

USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non- directed study according to the principles of the ECTS*	

Activity	*Semester workload*
Lecture hours	56 hours
Study and analysis of bibliography	35 hours
Individual study	36 hours
Exam preparation	20 hours
Exam	3 hours
Course total	150

STUDENT PERFORMANCE EVALUATION ***Description of the evaluation procedure*** *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open- ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Language of evaluation: Greek The evaluation is carried out through (a) optional exercises which the student submits at regular intervals (b) a written examination at the end of the semester The assessment includes: Written examinations (80% of the final grade if the student has handed in exercises, otherwise 100%) Optional exercises (20% of the final grade) Assess whether the examinee has the competence: - to apply matrix algebra and to calculate determinants - to investigate and solve linear systems of equations - to understand the concepts and properties of vector spaces - to calculate eigenvalues and eigenvectors and carry out the diagonalization process for a given matrix - to find equations of straight lines and planes in three-dimensional space and use equations of notable second-degree curves occurring in the context of engineering science - to calculate areas and volumes of basic solids Assessment criteria are discussed in class at the beginning of the semester.

(5) ATTACHED BIBLIOGRAPHY

-Suggested bibliography (in Greek)

Δονάτος Γ.-Αδάμ Μ., *Γραμμική Άλγεβρα – Θεωρία και Εφαρμογές*, 2008, Εκδ. Gutenberg

Ιωαννίδου Θ., *Εισαγωγή στη Γραμμική Άλγεβρα & Αναλυτική Γεωμετρία*, 2010, Εκδ. Τζιόλα

Καδιανάκης Ν.- Καρανάσιος Σ., *Γραμμική Άλγεβρα, Αναλυτική Γεωμετρία και Εφαρμογές*, 2017, Εκδ. Τσότρας

Μάργαρης Αθ., *Γραμμική Άλγεβρα*, 2015, Εκδ. Τζιόλα

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Ξένος Θ., *Αναλυτική Γεωμετρία*, 2004, Εκδ. Ζήτη

Σουρλάς Δ., *Γραμμική Άλγεβρα και Αναλυτική Γεωμετρία*, 2013, Εκδ. Παν/μίου Πατρών

Φελλούρης Α., *Γραμμική Άλγεβρα και Αναλυτική Γεωμετρία*, 3η έκδ., 2017, Εκδ. Τσότρας

Χατζάρας Ι.-Γραμμένος Θ., *Εισαγωγή στη Γραμμική Άλγεβρα*, 2012, Εκδ. Τζιόλα

Χρυσάκης Θ., *Γραμμική Άλγεβρα και Αναλυτική Γεωμετρία*, 2η έκδ., 2013, Εκδ. Τσότρας

Banchoff T.-Wermer J., *Η Γραμμική Άλγεβρα μέσω Γεωμετρίας*, 2009, Εκδ. Leader Books

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Lay D.C., Lay S.R., McDonald J.J., *Γραμμική άλγεβρα και εφαρμογές*, 2022, Broken Hill

Strang G., *Γραμμική Άλγεβρα και εφαρμογές*, 2021, Π.Ε.Κ.

- Related academic journals: