COURSE OUTLINE

(1) GENERAL

SCHOOL	Engineering		
ACADEMIC UNIT	Industrial Design and Production Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**1001**	**SEMESTER**	**1**
COURSE TITLE	Linear Algebra		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	3	3
Exercises / Tutorials	1	2
	4	**5**

COURSE TYPE	General background
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.uniwa.gr/courses/IDPE337/

(2) LEARNING OUTCOMES

Learning outcomes

Upon successful completion of this course, the student will be able to:

- acquire the required theoretical background and ability to decide on the application of an appropriate method,
- develop the ability to use basic techniques of Linear Algebra related to the study and solution of linear systems, inverse calculation, determinant calculation and their applications, finding eigenvalues, eigenvectors, minimum polynomial.

General Competences

- Production of free, creative and inductive thinking
- Working independently
- Team work
- Decision-making
- Search for, analysis and synthesis of data and information, with the use of modern scientific tools for solving problems in specialized applications
- Working in an interdisciplinary environment

The above General Competences correspond to Level 6 of the European Qualifications Framework.

(3) SYLLABUS

Matrix algebra. Inverse matrix. Square matrix. Inverse matrix. Diagonal matrix. Symmetric/ antisymmetric matrix. Rectangular matrix. Composite matrix. Similarity of matrices. Trace of matrix.

Systems of linear equations. Gauss-Jordan elimination. Reduced scaled matrix form. LU factorization. Matrix rank. Inverse calculation with Gauss-Jordan elimination.

Matrix determinant. Definition. Properties. Cramer Theorem. Adjoint matrix. Cramer systems.

Vector spaces. Vector spaces. The $\mathbb{R}^2$ space. Linear case. Linear dependency. Base and dimension of vector space. Subtractions and subspaces sections. Linear sum of subspaces. Dimension theorem. Basic matrix sub-spaces (column space, row space, zero space and left zero space). Vector spaces with inner product. Cartesian bases.

Typical matrix amounts. Eigenvalues. Eigenvectors. Polynomial matrices. Diagonalization of matrices. Cayley-Hamilton Theorem. Minimum polynomial.

Analytic geometry. Vector calculus (inner, outer, mixed vector product and applications). Line to space. Level. Sphere.

Use of Matlab for applications. Managing matrices and vectors in Matlab. Numerical (direct and iterative) methods for solving linear systems. Calculate vector norm and matrix norm. QR matrix factorization, special matrix factorization (SVD) and projections. Matrices and minimal squares. Regression. Matrix index status estimation. Iterative methods for calculating matrix eigenvalues.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face	
USE OF INFORMATION ANDCOMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Communication with students through the platform with emails & announcements on the course's website (e-class). Powerpoint display with projector and laptop. Demonstration of modern mathematical software (Matlab, Mathematica, Wolfram Alpha) on the taught subjects. Announcement of course notes in electronic form on the course's website (e-class). Referral to websites with related applications (Desmos, Maxima, Geogebra). Utilization of the computer laboratory of the Department. Possibility of examinations through the tool of Exercises in e-class.	
TEACHING METHODS	***Activity***	***Semester workload***
	Lectures	39
	Exercises	46
	Individual study	65
	Course Total (30h/ECTS)	**150**

STUDENT PERFORMANCE EVALUATION	**Language of assessment:** Greek (English for ERASMUS students upon request). Students are assessed through a written examination, which includes short-answer questions and problem solving. There is a possibility for an intermediate examination in the middle of the semester. Ability to deliver work (20%). Students with learning difficulties are examined in accordance with article 37 of the Internal Regulations of the UNIWA. The evaluation criteria have been presented to the students before the final examination and the individual grade of the subjects is written in them. Students can see their writing and their individual grades in the topics, as well as receive clarifications about them after pointing out any mistakes.

(5) **ATTACHED BIBLIOGRAPHY**

***- Suggested bibliography**:*

1. Νικόλαος Χαλιδιάς, Εφαρμοσμένα Μαθηματικά για Οικονομολόγους και Μηχανικούς, Broken Hill Publishers, 2021.
2. A.O.Morris, Μια Εισαγωγή στη Γραμμική Άλγεβρα, ΕΠΙΣΤΗΜΟΝΙΚΕΣ ΚΑΙ ΤΕΧΝΟΛΟΓΙΚΕΣ ΕΚΔΟΣΕΙΣ Α.Γ.ΠΝΕΥΜΑΤΙΚΟΣ, 1980.
3. Γεωργίου Δημήτριος, Κούγιας Ιωάννης, Μεγαρίτης Αθανάσιος, Γραμμική Άλγεβρα, 2η Έκδοση, Εκδόσεις Τζιόλα, 2017.
4. Θανάσης Χρυσάκης, Γραμμική Άλγεβρα και Αναλυτική Γεωμετρία, Εκδόσεις Τσότρας, 2013.
5. Strang Gilbert, Γραμμική Άλγεβρα και Εφαρμογές, ΙΔΡΥΜΑ ΤΕΧΝΟΛΟΓΙΑΣ & ΕΡΕΥΝΑΣ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ, 2009.
6. Βάρσος Δημήτρης, Δεριζιώτης Δημήτρης, Εμμανουήλ Γιάννης, Μαλιάκας Μιχάλης, Μελάς Αντώνης, Ταλέλλη Ολυμπία, Μια Εισαγωγή στη Γραμμική Άλγεβρα, "σοφία" Ανώνυμη Εκδοτική & Εμπορική Εταιρεία, 2012.
7. Δονάτος Γεώργιος Σ., Αδάμ Μαρία Χ., Γραμμική Άλγεβρα, Γ. ΔΑΡΔΑΝΟΣ - Κ. ΔΑΡΔΑΝΟΣ Ο.Ε., 2008.