Course Title	Linear Algebra				
Course Code	AMAT 181				
Course Type	Required				
Level	BSc (Level 1)				
Year / Semester	1^{st} /1^{st} or 2^{nd}				
Teacher's Name	Dr Savvas Pericleous				
ECTS	5	Lectures / week	3	Laboratories/week	
Course Purpose	The purpose of the course is to introduce students with two new mathematical concepts that are considered essential for engineering studies. We begin the class by defining the notion of a matrix and explain how this new tool will eliminate limitations of the past and enable us tackle large scale applications with the help of computer software. The students are then introduced to the concept of a vector, having the opportunity to visualize the notion in two and three dimensions. The two concepts of Matrices and vectors both arise in the study of linear transformations and their applications.				
Learning Outcomes	1. Explain the notion of a matrix, including its transpose, identify the properties of special types of matrices and perform different matrix operations. 2. Generate determinants of any order using minors, compute 2x2, 3x3 determinants directly and find the inverse of a matrix by employing its determinant and the transpose of the matrix of cofactors. 3. Use Cramer's Rule for solving square linear systems with the aid of determinants, employ Gaussian Elimination for solving systems of linear equations, perform elementary row matrix reduction to echelon form and back substitution to obtain the solution of the system, apply Gauss-Jordan Elimination to find the inverse of a square matrix using augmentation, and implement a readily available inverse of the matrix of coefficients to solve a square linear system. 4. Explain the notion of multiplicity of roots of the characteristic equation and compute eigenvalues and corresponding eigenvectors of square matrices. 5. Define the notion of vectors in two, three and higher dimensions, perform operations with vectors including dot and cross vector products, determine linear independence of vectors, explain the				

	notion of vector spaces and subspaces, and outline the concept of an orthogonal basis of the Euclidean space. 6. Define linear transformations, perform elementary transformations available, and apply these concepts to real-life examples identifying their geometric implications. 7. Employ the computer programming language Matlab to solve different matrix operations and systems of linear equations, to compute eigenvalues and eigenvectors, to execute elementary vector manipulation, and determining linear dependence between vectors.		
Prerequisites	None	Corequisites	None
Course Content	• Matrices and Determinants. Matrix concept, operations with matrices, Special matrices, definition of a determinant and its properties, determinant of a product, inverse matrix, properties and computation. • Simultaneous Linear Equations. Cramer's rule, Gaussian elimination, Gauss-Jordan elimination, geometric interpretation. • Vectors and Linear spaces. Vector concept, operations with vectors, vector products, generalization to higher dimensions, vector spaces and subspaces, Euclidean space, basis, linear dependence. • Linear Transformations. Definition of linear transformations, properties, elementary transformations. • Eigenvalue Problem. Eigenvalue problem, characteristic equation, eigenvalues and eigenvectors. • MATLAB Applications: Basic matrix algebra, computing determinants, solving systems of linear equations with a number of different techniques, finding eigenvalues and eigenvector, elementary vector manipulation, and determining linear dependence of vectors.		
Teaching Methodology	The course is delivered to the students by means of lectures, conducted with use of the board. The students are also engaged in the course through questions by the lecturer which are discussed in class. Several examples are solved on the white board, with the participation of students. Students are encouraged to leave their seats and solve examples on the board as well. Students are asked to work on their own during class hours on practice problems, and they are encouraged to ask questions. Students are able to visualize how theory becomes practice in a computer lab demonstration using the software *matlab*.		

	Many additional exercise sheets and material is available to students through the e-learning platform. Students are encouraged to attend office hours for extra help. Students are encouraged to attend the peer tutoring center for extra help.
Bibliography	(a) Textbooks: • Gareth W., *Linear Algebra with Applications*, 9th edition, Jones & Bartlett Learning, 2017. (b) References: • Anton H., *Elementary Linear Algebra with Applications*, John Wiley, 2000. • Anton H., *Contemporary Linear Algebra MATLAB Technology Resource Manual*, John Wiley, 2002.
Assessment	(a) Methods: Students will be assessed with coursework that involves two in class written tests and a final exam. (b) Criteria: Assessment criteria are available in each test or in the final exam (c) Weights: • Tests 40% • Final Exam 60%
Language	English language