POLITEHNICA University of Bucharest (**UPB**)
Faculty of Engineering and Management of Technological Systems (**IMST**)
Study Programme: Industrial Engineering (**IE**)
Form of study: Licence (Bachelor)

COURSE SPECIFICATION

Course title:	Mathematics 1	***Semester:***	1
Course code:	UPB.06.F.01.O.003	***Credits (ECTS):***	5

Course structure	**Lecture**	**Seminar**	Laboratory	Project	**Total hours**
Number of hours per week	2	2	-	-	4
Number of hours per semester	28	28	-	-	56

Lecturer	**Lecture**	**Seminar** / Laboratory / Project
Name, academic degree	Vladimir BALAN, Professor	Anda Georgiana OLTEANU, Assitant Professor
Contact (email, location)	vladimir.balan@upb.ro	

Course description:

At its root, linear algebra is the study of systems of linear equations. Systems of linear equations are ubiquitous in the natural and social sciences. One major contribution to the topic was made by Gauss (1777–1855), who was confronted with large systems of linear equations in his work on astronomy and developed the famous method of least squares to cope with measurement errors. Later in the nineteenth century Cauchy, Sylvester, Cayley and others developed the concept of a matrix, which provides the most convenient language for the theory and practice of linear equations. Matrices are intricate algebraic objects with many fascinating properties, but they also provide a bridge between linear equations and vectors, so infusing the subject of linear algebra with a strong geometric flavor. We will delve into all these topics, as well as the notions of determinant and eigenvalues, which are important numbers associated with any square matrix.
This course includes the study of vectors in the plane and space, systems of linear equations, matrices, determinants, real and abstract vector spaces, subspaces and linear transformations, basis and change of basis, inner products and orthogonality, eigenvalues and eigenvectors, similarity, diagonalization, quadratic forms, and algebraic varieties of first two orders (straight lines, planes, conics and quadrics).
The covered topics are useful in other disciplines such as physics, economics and social sciences, natural sciences, and engineering.It parallels the combination of theory and applications, and the subjects are presented with an applicative emphasis, and are addressing the basic theorems.

Seminar / Laboratory / Project description:

The text and class discussion will introduce the concepts, methods, applications, and logical arguments; students will practice them and solve problems on daily assignments, and they will be tested on quizzes, midterms, and the final exam. The main addressed subjects are vectors in the plane and space, systems of linear equations, matrices, determinants, real and abstract vector spaces, subspaces and linear transformations, basis and change of basis, inner products and orthogonality, eigenvalues and eigenvectors, similarity, diagonalization, quadratic forms, and straight lines, planes, conics and quadrics.

Intended learning outcomes:

The present course aims to fulfill the following learning outcomes:

- To provide students with a good understanding of the concepts and methods of linear algebra, described in detail in the syllabus.
- To help the students develop the ability to solve problems using linear algebra.

- To connect linear algebra to other fields both within and without mathematics.
- To develop abstract and critical reasoning by studying logical proofs and the axiomatic method as applied to linear algebra.

Students will be able to apply the concepts and methods described in the syllabus, they will be able to solve problems using linear algebra, they will know a number of applications of linear algebra, and they will be able to follow complex logical arguments and develop modest logical arguments.

Assessment method:	% of the final grade	Minimal requirements for award of credits
Written exam	40%	20%
Report / project	-	-
Homework	20%	10%
Seminar	40%	20%
Other	-	-

References:

Compulsory reading

[1] C. Udriste, *V. Balan*, *Linear Algebra and Analysis* (in English), Ed. Geometry Balkan Press, Bucureşti 2001.

[2] C. Udriste, *V. Balan*, *Analytic and Differential Geometry* (in English), Geometry Balkan Press, Bucureşti, 1999.

[3] *V. Balan*, I.R. Nicola, *Linear Algebra, Applications of linear algebra, analytic & differential geometry, differential equations. Solved problems and software programs* (in English), Ed. Printech, Bucureşti 2011.

[4] L.Smith, Linear Algebra, Springer Verlag, 1978.

[5] *V. Balan*, *Algebră liniară, geometrie analitică*, Ed. Fair Partners, Bucureşti, 1999.

[6] M.V.Sweet, *Algebra, Geometry and Trigonometry in Science, Engineering and Mathematics*, Ellis Horwood, 1984.

Optional reading

[1] *V. Balan*, A. Suciu, *Algebră liniară. Culegere de probleme*, Ed. Printech, 2001.

[2] C.Radu, *Algebră liniară, geometrie analitică*, Editura Fair Partners, Bucureşti, 2004.

[3] C.Radu, *Algebră liniară, geometrie analitică şi diferenţială*, Editura All, Bucureşti, 1996.

[4] C.Radu, C.Drăguşin, L.Drăguşin, *Aplicaţii de algebră, geometrie şi matematici speciale*, E.D.P. 1991.

[5] C.Radu, L.Drăguşin, C.Drăguşin, *Algebră liniară, analiză matematică. Geometrie analitică şi diferenţială*, Ed. Fair Partners, Bucureşti, 2000.

[6] C.Udrişte, *Algebră liniară, geometrie analitică*, Geometry Balkan Press, Bucureşti, 2005.

[7] C.Udrişte, *Aplicaţii de algebră, geometrie şi ecuaţii diferenţiale*, Ed. Did. Ped., Bucureşti, 1993.

[8] P.V.O'Neill, *Advanced Engineering Mathematics*, Wadsworth Eds., 1991.

[9] A.V.Pogorelov, *Analytic Geometry*, Mir Publishers, Moscow, 1961.

[10] P.H.Selby*, Practical Algebra*, John Wiley & Sons, 1974.

Prerequisites:	***Co-requisites*** ***(courses to be taken in parallel as a condition for enrolment):***
High-school Algebra, Analytic Geometry and Analysis	

Additional relevant information:

Good knowledge of high-school matrix theory and linear systems is required.

Date: 7/6/2016

Prof.dr. Vladimir BALAN