DISCIPLINE ACADEMIC SHEET

ACADEMIC YEAR 2020 – 2021

1. PROGRAMME DATA

1.1 Higher Education Institution	*UNIVERSITY OF CRAIOVA*
1.2 School	*Automation, Computers and Electronics*
1.3 Department	*Computers and Information Technology*
1.4 Field of Study	*Computers and Information Technology*
1.5 Study Level[1]	*L (licence/ undergraduate)*
1.6 Study Program (name/code)[2] /Calification	*Computers D27CEL102 /* L206010101010

2. DISCIPLINE DATA

2.1 Discipline Name				**LINEAR ALGEBRA, ANALYTICAL AND DIFFERENTIAL GEOMETRY**					
2.2 Course Activities Holder				**Florian MUNTEANU**					
2.3 Practical Activities Holder				**Florian MUNTEANU**					
2.4 Study Year	**1**	2.5 Semester	**I**	2.6 Discipline Type (content)[3]	**DF**	2.7 Discipline Conditions (mandatory)[4]	**DI**	2.8Evaluation Type	E

3. ESTIMATED TOTAL TIME (hours per semester of teaching activities)

3.1 Number of hours per week	**5**	in which: 3.2 course	**3**	3.3 seminar	**2**
3.4 Total hours of curriculum	**70**	in which: 3.5 course	**42**	3.6 seminar	**28**

3.7 Time distribution	hours
▪ Study after manual, course support, bibliography and notes	**23**
▪ Additional documentation in library, on specialized electronic platforms and field	**14**
▪ Training seminars / labs, homework, portfolios and essays	**14**
▪ Tutoring	**-**
▪ Examinations	**2**
▪ Other activities: consultations, student meetings	**2**

Total hours per individual activities	**25**
3.8 Total hours per semester[5]	**125**
3.9 Number of credits[6]	**5**

4. PRECONDITIONS (where appropiate)

4.1 of curriculum	Students must have acquired specialized knowledge in the following subjects: Elementary algebra and geometry, Calculus, Physics.
4.2 of competence	Working with matrices, determinants computation, solving algebraic equations and solving linear equations systems, derivation of one variable real function.

5. CONDITION (where appropiate)

5.1. of the course	Teaching the course is done using Google Classroom platform and Google Meet video chat by slides and using blackboard via Google Meet. Also, to answer certain questions from students and for explanations, examples, demonstrations is used blackboard and oral presentation via Google Meet. It provides ongoing support in print and in electronic format with free access. Teaching is as follows: ▪ 80% theoretical presentation based on slides using blackboard via Google Meet ▪ 20% interactive activity (discussions with students)
5.2. of seminar/ laboratory/project	The seminar takes place on Google Classroom platform and Google Meet. Together with students give explanations, guidance and solve practical applications to blackboard via Google Meet, exercises and problems that illustrate the theoretical concepts. Students receive homework.

6. SPECIFIC LEARNED SKILLS [7]

Professional competences	Given the theoretical knowledge taught on the course and examples and practical applications presented at the seminar, the course "Linear Algebra and Geometry" contribute to professional competences: C1. *Working with fundamentals of mathematics, engineering and informatics.* C1.1. Proper use in professional communication of the eigen concepts of calculability, complexity, programming paradigms and modelling of computer and communications systems. C1.2. Using theories and specific tools (algorithms, charts, models, protocols, etc.) to explain the operation and structure of hardware, software and communication systems . C1.3. Building models for different components of computer systems. C1.4. Formal assessment of the functional and non-functional features of computer systems. C1.5. Theoretical foundation of the features for the designed systems. C3. *Solving problems using computer science and engineering tools.* C3.1. Identification of a class of problems and solving methods specific for computer systems. C3.2. Using interdisciplinary knowledge, solution patterns and tools to conduct experiments and interpret their results. C3.3. Applying solution by means of engineering tools and methods. C3.4. Benchmarking, including experimental evaluation of solving alternatives for performance optimization. C3.5. Developing and implementing computer-based solutions for specific problems. C4. *Improving the performance of hardware, software and communication systems.* C4.1. Identifying and describing defining elements of the performance of hardware, software and communication systems. C4.2.Explaining the interaction of factors determining the performance of hardware, software and communication systems. C4.3. Application of methods and underlying principles for increasing the performance of hardware, software and communication systems. C4.4. Choosing criteria and performance evaluation methods of hardware, software and communication systems. C4.5. Developing professional solutions for hardware, software and communication systems based on increasing of performance.
Transversal Competence	

7. DISCIPLINE OBJECTIVES (based on the specific learned competences)

7.1 General objective of the discipline	It is one of the fundamental subjects of the curriculum for this license area. Contribute to train future software and hardware engineers, specialists in applied informatics, providing them with knowledge of algebra and geometry math strictly necessary for their skills training.
7.2 Specific objectives	The aim of the course is the introduction of the fundamental notions of linear algebra, analytic and differential geometry: vector spaces, linear mappings, quadratic forms, Euclidian spaces, geometric vectors, the straight line, the plane, conics and quadric surfaces, curves and surfaces. Tutorial classes allow to fix theoretical knowledge and to create calculus control by applications.

8. CONTENT

8.1 COURSE (content units)	No hours	Teaching methods
Chapter 1. Vector Spaces 1.1 Definition, examples 1.2 Linear dependence. Generating systems 1.3 Basis and dimension. Coordinates of a vector with respect to a basis 1.4 Vector subspaces: definition, examples, operations with subspaces	**4**	Teaching the course is done using Google Classroom platform and Google Meet video chat. - 80% theoretical presentation based on slides and using blackboard via Google Meet. - 20% interactive activity (explanations and
Chapter 2. Linear Mappings 2.1 Definition, examples 2.2 Kernel and image: definition, Theorem of rank 2.3 Associated matrix of a liniar mapping 2.4 Invariant subspaces. Eigenvalues and eigenvectors 2.5 Diagonalizable operators	**6**	

Chapter 3. Bilinear Forms. Quadratic Forms 3.1 Bilinear forms: definition, examples, matrix, analytic expression 3.2 Symmetric bilinear forms and quadratic forms 3.3 Reduction of a quadratic form to a canonical form by Jacobi and Gauss methods 3.4 Quadratic form defined on a real vector space. The signature of a quadratic form	**3**	discussions with students). The necessary materials are available to students in electronic and printed form.
Chapter 4. Euclidian Spaces 4.1 Definition, examples 4.2 Norm, inequality of Cauchy 4.3 Orthonormal basis. Gram-Schmidt procedure 4.4 Orthogonal complement of a subspace of a Euclidian space 4.5 Symmetric operators. Method of orthogonal transformations	**5**	
Chapter 5. Geometric Vectors 5.1 Geometric (free) vectors. Real vector space of geometric vectors 5.2 Scalar product, vector product, mixed product 5.3 Orthonormal Cartesian frames	**2**	
Chapter 6. Straight Line and Plane 6.1 Straight line: geometrical determination, equations 6.2 Distance from a point to a line. Angle of two lines 6.3 Plane: geometrical determination, equations 6.4 Distance from a point to a plane. Angle of two planes 6.5 Common orthogonal line of two no coplanar lines	**3**	
Chapter 7. Conics and Quadric Surfaces 7.1 Cartesian general equation of a quadric surface (conic). Center 7.2 Intersection of a quadric surface (conic) with a straight line. The tangent plane 7.3 Reduction of the equation of a quadric surface (conic) to the canonical equation 7.4 The study of the quadric surfaces (conics) on the canonical equation 7.5 Rules surfaces. Rotational surfaces	**7**	
Chapter 8. Curves in Plane and Curves in Space 8.1 Parameterized curves. Natural parameterization 8.2 Definition of the curve. Representations modes 8.3 The tangent and the normal. The normal plane 8.4 Curvature. Torsion. Frenet's frame. Formulae of Frenet	**7**	
Chapter 9. Surfaces 9.1 Parameterized surfaces. Surface 9.2 Curves on a surface. Coordinates curves. Singular and regular points 9.3 The tangent plan. The normal 9.4 First fundamental form of a surface. The length of a curve on a surface 9.5 Second fundamental form of a surface. Curvatures. Geodesics	**5**	
Total	**42**	

Bibliography [8]

1. Berger, M., Geometry I, II, Springer Verlag, Berlin-Heidelberg, 1987
2. Radu, C., Algebră liniară, geometrie analitică şi diferenţială, Ed. ALL, Bucureşti, 1998
3. Silov, G.E., Mathematical analysis. Finite dimensional spaces, Ed. St. Encicl., Bucureşti, 1983
4. Stănăşilă, O., Analiză liniară şi geometrie, Ed. ALL, Bucureşti, 2000
5. Vladimirescu, I., Matematici aplicate, Repr. Univ. Craiova, 1987
6. Vladimirescu, I., Munteanu, F., Algebră liniară, geometrie analitică şi geometrie diferenţială, Ed. Universitaria, Craiova, 2007
7. Munteanu, F. ş.a., Probleme de algebră liniară, geometrie analitică şi geometrie diferenţială, Ed. Sitech, Craiova, 2010
8. Munteanu, F., Linear algebra, analytic geometry and differential geometry, online course http://www.ucv.ro/pdf/departamente_academice/dma/suporturi_curs/Munteanu_Florian_Alg_lin_geom.pdf

8.2 Practical activities (topics/homework)	No hours	Teaching methods
1. Examples of vector spaces. Linear dependence. Generating systems. Basis and dimension	**2**	Conducting seminars with students is made by Google Classroom platform and Google Meet video chat. Explanations,
2. Coordinates of a vector with respect to a basis. Vector subspaces. Operations with subspaces	**2**	
3. Examples of linear mappings. Kernel and image. Associated matrix	**2**	
4. Eigenvalues and eigenvectors. Diagonalizable operators	**2**	

5. Bilinear forms, quadratic forms, canonical form of a quadratic form, method of Gauss, method of Jacobi	**2**	instructions and solutions of the practical applications will be done by slides and on the blackboard via Google Meet. They are available to students sample applications and a breviary resolved theoretically both electronically and in print. Activities: -80% effective deployment of seminar - 20% interpreting the results and discussions with students
6. Examples of Euclidian spaces. Gram-Schmidt procedure	**2**	
7. Symmetric operators. Method of orthogonal transformations	**2**	
8. Operations with geometric vectors. Changing of orthonormal frames	**2**	
9. Problems about line and plane in space: equations, angles, distances	**2**	
10. Examples of conics and quadric surfaces. Problems about center, tangent plan, sphere	**2**	
11. Reduction to the canonical form of quadric surfaces and conics	**2**	
12. Examples of curves in plane and in space. Tangent, normal plan	**2**	
13. Determination of Frenet's frame, curvature and torsion for a curve	**2**	
14. Examples of surfaces. Tangent plan, normal. Problems	**2**	
Total	**28**	

Bibliography [8]

1. Belage, A. et autres, Exercices resolus d'algebre lineaire, Masson, Paris, 1983
2. Munteanu, F. ş.a., Culegere de probleme de alg. liniară, geom. analitică, difer., Ed. Universitaria, Craiova, 2009
3. Udrişte, C. ş.a., Probleme de algebră, geometrie şi ecuaţii diferenţiale, EDP, Bucureşti, 1981
4. Vladimirescu, I., Matematici aplicate, Repr. Univ. Craiova, 1987
5. Vladimirescu, I., Munteanu, F., Algebră liniară, geometrie analitică şi geometrie diferenţială, Ed. Universitaria, Craiova, 2007
6. Vladislav, T., Raşa, I., Matematici financiare şi inginereşti, Ed. Fair Partners, Bucureşti, 2001
7. Munteanu, F. ş.a., Probleme de algebră liniară, geometrie analitică şi geometrie diferenţială, Ed. Sitech, Craiova, 2010
8. Munteanu, F., Linear algebra, analytic geometry and differential geometry, online course http://www.ucv.ro/pdf/departamente_academice/dma/suporturi_curs/Munteanu_Florian_Alg_lin_geom.pdf

9. COURSE CONTENT CONJUNCTION WITH EXPECTATIONS OF THE EPISTEMIC COMMUNITY REPRESENTATIVES, PROFESSIONAL ASSOCIATIONS AND EMPLOYEE REPRESENTATIVES IN THE PROGRAM DOMAIN

Course content was discussed with representatives of
- Department of Computer Science and Information Technology, Faculty of Automation, Computers and Electronics
- Faculty of Automation, Computers and Electronics, University of Craiova
- Department of Applied Mathematics, University of Craiova

10. EVALUATION

Activity Type	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Final mark weight
10.4 Course	- Understanding the proper theoretical foundations. - The ability to make connections between the concepts taught. - Ability to analyze and synthesize a concrete situation	- Written partial exam on Google Classroom - Final written exam on Google Classroom with two on-line examiners	40% 35%
10.5 Practical activities	- Interpretation of results; - Application solutions are presented and discussed within the group - Solving practical applications left at each seminar topic	Continuous assessment and final examination	25%
10.6 Minimum standard of performance (the minimum knowledge necessary to promote discipline and how to check the knowledge acquiring)			
▪ Achieve a minimum of 50% of the score assessment, examination and final examination. ▪ Final scoring is done by rounding up.			

Date of completion: 01.10.2020

Course Holder
Lecturer Florian MUNTEANU, Ph. D.

Applicative activities holder
Lecturer Florian MUNTEANU, Ph. D.

Date of approval: 01.10.2020
Director of Department
Prof. Marius BREZOVAN, Ph. D.