University of Craiova
Faculty of Automation, Computers and Electronics
Software Engineering Department

**COURSE SYLLABUS**

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| **A. Subject Matter:** | Linear Algebra, Analytic and Differential Geometry |
| **B. Person in charge:** | Dr. Florian MUNTEANU, Lecturer |
| **C. To whom it addresses** (study program: university, license domain, specialization): | This is a course for the first year students, first semester, in the license domains COMPUTERS AND INFORMATION TECHNOLOGY (specializations Computers in Romanian and Computers in English) and ELECTRONICAL ENGINEERING AND TELECOMUNICATION (specialization Applied Electronics) |
| **D. Subject's schedule** (course hours, seminary, laboratory, project, number of weeks) | 14 weeks; weekly 2 hours courses and 2 hours tutorial classes |
| **E. Course outcomes** (expressed in the form of cognitive, technical and professional competencies) | This is a fundamental discipline of the curriculum from these license domains. 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, symmetric operators, geometric vectors, the straight line and the plane, conics and quadric surfaces, curves and surfaces. Tutorial classes allows to fix theoretical knowledge and to create calculus control by applications, exercises and problems. |
| **F. Assesment and evaluation** | Written exam: time 2 h, 4 items (one theoretical item and three practical items; each item will appreciated from 1 to 10 points. An arithmetical average of the items will be done.<br>- Partially written exam (optional), with 50% contribution at the final note.<br>- The activity from the tutorial classes will be appreciated by 25% contribution at the final note. |
| **G. Prerequisites** | Mathematics from high school and Mathematical Analysis from first year. |
| **H. Courses from study program that benefit from the course outcomes** | Mathematical Analysis, Special Mathematics, Numerical Calculus, Physics, Mechanics, Technical Design, AutoCAD and Technical Courses. |
| **I. Course syllabus (28 h)** | Chapter 1 Vector Spaces 3 h<br>1.1 Definition, examples<br>1.2 Linear dependence. Generating systems<br>1.3 Basis and dimension. Coordinates of a vector with respect to a basis<br>1.4 Vector subspaces: definition, examples, operations with subspaces<br>Chapter 2 Linear Mappings 4 h<br>2.1 Definition, examples<br>2.2 Kernel and image: definition, Theorem of rank<br>2.3 Associated matrix of a liniar mapping<br>2.4 Invariant subspaces. Eigenvalues and eigenvectors<br>2.5 Diagonalizable operators<br>Chapter 3 Bilinear Forms. Quadratic Forms 2 h<br>3.1 Bilinear forms: definition, examples, matrix, analytic expression<br>3.2 Symmetric bilinear forms and quadratic forms<br>3.3 Reduction of a quadratic form to a canonical form by Jacobi and Gauss methods<br>3.4 Quadratic form defined on a real vector space. The signature of a quadratic form<br>Chapter 4 Euclidian Spaces 3 h<br>4.1 Definition, examples |

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| | 4.2 Norm, inequality of Cauchy<br>4.3 Orthonormal basis. Gram-Schmidt procedure<br>4.4 Orthogonal complement of a subspace of a Euclidian space<br>4.5 Symmetric operators. Method of orthogonal transformations<br>Chapter 5 Geometric Vectors 2 h<br>5.1 Geometric (free) vectors. Real vector space of geometric vectors<br>5.2 Scalar product, vector product, mixed product<br>5.3 Orthonormal Cartesian frames<br>Chapter 6 Straight Line and Plane 2 h<br>6.1 Straight line: geometrical determination, equations<br>6.2 Distance from a point to a line. Angle of two lines<br>6.3 Plane: geometrical determination, equations<br>6.4 Distance from a point to a plane. Angle of two planes<br>6.5 Common orthogonal line of two no coplanar lines<br>Chapter 7 Conics and Quadric Surfaces 4 h<br>7.1 Cartesian general equation of a quadric surface (conic). Center<br>7.2 Intersection of a quadric surface (conic) with a straight line. The tangent plane<br>7.3 Reduction of the equation of a quadric surface (conic) to the canonical equation<br>7.4 The study of the quadric surfaces (conics) on the canonical equation<br>Chapter 8 Curves in Plane and in Space 5 h<br>8.1 Parameterized curves. Natural parameterization<br>8.2 Definition of the curve. Representations modes<br>8.3 The tangent and the normal. The normal plane<br>8.4 Curvature. Torsion. Frenet's frame. Formulae of Frenet<br>Chapter 9 Surfaces 3 h<br>9.1 Parameterized surfaces. Surface<br>9.2 Curves on a surface. Coordinates curves. Singular and regular points<br>9.3 The tangent plan. The normal<br>9.4 First and second fundamental form of a surface |
| **J. Contain of tutorial classes (28 h)** | 1. Examples of vector spaces. Linear dependence. Generating systems. Basis and dimension<br>2. Coordinates of a vector with respect to a basis. Vector subspaces. Operations with subspaces<br>3. Examples of linear mappings. Kernel and image. Associated matrix<br>4. Eigenvalues and eigenvectors. Diagonalizable operators<br>5. Bilinear forms, quadratic forms, canonical form of a quadratic form, method of Gauss, method of Jacobi<br>6. Examples of Euclidian spaces. Gram-Schmidt procedure<br>7. Symmetric operators. Method of orthogonal transformations<br>8. Operations with geometric vectors. Changing of orthonormal frames<br>9. Problems about line and plane in space: equations, angles, distances<br>10. Examples of conics and quadric surfaces. Problems about center, tangent plan, sphere<br>11. Reduction to the canonical form of quadric surfaces and conics<br>12. Examples of curves in plane and in space. Tangent, normal plan<br>13. Determination of Frenet's frame, curvature and torsion for a curve<br>14. Examples of surfaces. Tangent plan, normal. Problems |

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| **K. References** | 1. Vladimirescu, I., Munteanu, F., Algebră liniară, geometrie analitică şi geometrie diferențială, Ed. Universitaria, Craiova, 2007<br>2. Vladimirescu, I., Matematici aplicate, Repr. Univ. Craiova, 1987.<br>3. Vladimirescu, I., Popescu, M., Algebră liniară şi geometrie analitică, Ed. Univ. Craiova 1994<br>4. Vladimirescu, I., Popescu, M., Alg. liniară, geom. n-dimensională, Ed. Radical, Craiova 1996<br>5. Radu, C., Algebră liniară, geometrie analitică şi diferențială, Ed. ALL, Bucureşti, 1998<br>6. Vladislav, T., Raşa, I., Matematici financiare şi inginereşti, Ed. Fair Partners, Bucureşti, 2001<br>7. Udrişte, C. ş.a., Probleme de algebră, geometrie şi ecuații diferențiale, EDP, Bucureşti, 1981<br>8. Stănăşilă, O., Analiză liniară şi geometrie, Ed. ALL, Bucureşti, 2000<br>9. Munteanu, F. ş.a., Probleme de alg. liniară, geom. analitică, difer., Ed. Sitech, Craiova, 2008<br>10. Murărescu, Gh., Curs de algebră liniară şi geometrie analitică, Repr. Univ. Craiova, 1991<br>11. Vraciu, G., Elemente de algebră liniară cu aplicații, Ed. Radical, Craiova, 2000<br>12. Belage, A. et autres, Exercices resolus d'algebre lineaire, Masson, Paris, 1983<br>13. Berger, M., Geometry I, II, Springer Verlag, Berlin-Heidelberg, 1987<br>14. Silov, G.E., Mathematical analysis. Finite dimensional spaces, Ed. St. Encicl., Bucureşti, 1983<br>15. Brânzănescu, V., Stănăşilă, O., Matematici Speciale, Ed. ALL, Bucureşti 1994 |

Date: 02.10.2008 Signature: