# SYLLABUS [1]

## 1. Information about the program

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|---|---|
| **1.1** Higher education institution | Politehnica University Timisoara |
| **1.2** Faculty[2]/ Department [3] | Civil Engineering Faculty/ Department of Mathematics |
| **1.3** Chair | — |
| **1.4** Field of study (name/code[4]) | Civil Engineering/80 |
| **1.5** Study cycle | Bachelor |
| **1.6** Study program (name/code/qualification) | Civil Engineering (in English)/10/Engineer |

## 2. Information about the discipline

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|---|---|---|---|---|---|---|---|
| **2.1** Name of discipline/ formative category[5] | MATHEMATICS II/ DF | | | | | | |
| **2.2** Coordinator (holder) of course activities | PhD. Assoc. Prof. Camelia ARIESANU | | | | | | |
| **2.3** Coordinator (holder) of applied activities[6] | Madalina Sofia PASCA | | | | | | |
| **2.4** Year of study[7] | I | **2.5** Semester | 1 | **2.6** Type of evaluation | E | **2.7** Type of discipline[8] | DI |

## 3. Total estimated time – hours / semester: direct teaching activities (fully assisted or partly assisted) and individual training activities (unassisted) [9]

| | | | | | |
|---|---|---|---|---|---|
| **3.1** Number of fully assisted hours / week | 4 of which: | **3.2** course | 2 | **3.3** seminar / laboratory / project | 2 |
| **3.1*** Total number of fully assisted hours / semester | 56 of which: | **3.2*** course | 28 | **3.3*** seminar / laboratory / project | 28 |
| **3.4** Number of hours partially assisted / week | of which: | **3.5** training | | **3.6** hours for diploma project elaboration | |
| **3.4*** Total number of hours partially assisted / semester | of which: | **3.5*** training | | **3.6*** hours for diploma project elaboration | |
| **3.7** Number of hours of unassisted activities / week | 2 of which: | additional documentary hours in the library, on the specialized electronic platforms and on the field | | | 0.5 |
| | | hours of individual study after manual, course support, bibliography and notes | | | 1 |
| | | training seminars / laboratories, homework and papers, portfolios and essays | | | 0.5 |
| **3.7*** Number of hours of unassisted activities / semester | 28 of which: | additional documentary hours in the library, on the specialized electronic platforms and on the field | | | 7 |
| | | hours of individual study after manual, course support, bibliography and notes | | | 14 |
| | | training seminars / laboratories, homework and papers, portfolios and essays | | | 7 |
| **3.8 Total hours / week** [10] | 6 | | | | |
| **3.8* Total hours /semester** | 84 | | | | |
| **3.9 Number of credits** | 4 | | | | |

## 4. **Prerequisites** (where applicable)

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[1] The form corresponds to the Discipline File promoted by OMECTS 5703 / 18.12.2011 and to the requirements of the ARACIS Specific Standards valid from 01.10.2017.

[2] The name of the faculty which manages the educational curriculum to which the discipline belongs

[3] The name of the department entrusted with the discipline, and to which the course coordinator/holder belongs.

[4] The code provided in HG no.140 / 16.03.2017 or similar HGs updated annually shall be entered.

[5] Discipline falls under the educational curriculum in one of the following formative disciplines: Basic Discipline (DF), Domain Discipline (DD), Specialist Discipline (DS) or Complementary Discipline (DC).

[6] Application activities refer to: seminar (S) / laboratory (L) / project (P) / practice/training (Pr).

[7] Year of studies in which the discipline is provided in the curriculum.

[8] Discipline may have one of the following regimes: imposed discipline (DI), optional discipline (DO) or optional discipline (Df).

[9] The number of hours in the headings 3.1 *, 3.2 *, ..., 3.8 * is obtained by multiplying by 14 (weeks) the number of hours in headings 3.1, 3.2, ..., 3.8. The information in sections 3.1, 3.4 and 3.7 is the verification keys used by ARACIS as: (3.1) + (3.4) ≥ 28 hours / wk. and (3.8) ≤ 40 hours / wk.

[10] The total number of hours / week is obtained by summing up the number of hours in points 3.1, 3.4 and 3.7.

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|---|---|
| **4.1** Curriculum | • College-level Mathematics; Calculus, Linear Algebra and Coordinate Geometry |
| **4.2** Competencies | • |

**5. Conditions** (where applicable)

| | |
|---|---|
| **5.1** of the course | • |
| **5.2** to conduct practical activities | • |

**6. Specific competencies** acquired through this discipline

| | |
|---|---|
| Specific competencies | • Master the fundamentals of linear algebra and the basic concepts and skills to use later in the career |
| Professional competencies ascribed to the specific competencies | • Design of structural elements in civil engineering, specific to graduated study programme<br>• Technological and economical design for the erection, operation and maintenance works in civil engineering, specific to graduated study programme<br>• Organization and management of the execution, operation and maintenance procedures for civil, industrial and agricultural constructions |
| Transversal competencies ascribed to the specific competencies | • Documentation in Romanian and foreign language, in view of professional and personal development, via continuous learning and efficient adaptation to the new technical specifications |

**7. Objectives of the discipline** (based on the grid of specific competencies acquired - pct.6)

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|---|---|
| **7.1** The general objective of the discipline | • The goal of this course is to master the fundamentals of linear algebra, mainly the arithmetic vector space and its linear transformations |
| **7.2** Specific objectives | • The main goal of the course is to help students master the basic concepts and skills they use later in their careers |

**8. Content** [11]

| **8.1** Course | Number of hours | Teaching methods [12] |
|---|---|---|
| **Linear equations** : Consistency of linear equations; Cramer's rule; least square solution of a system of linear equations; homogeneous linear systems | 2 | Disquisition, lecture, dialog, explanation, example |
| **Vector spaces:** Linear dependence and independence; bases and dimension; linear subspaces | 4 | |
| **Linear maps:** Linear maps and its matrices; the kernel and image of a linear map | 4 | |
| **Eigenvalues and eigenvectors:** Characteristic polynomial, | 2 | |

[11] It details all the didactic activities foreseen in the curriculum (lectures and seminar themes, the list of laboratory works, the content of the stages of project preparation, the theme of each practice stage). The titles of the laboratory work carried out on the stands shall be accompanied by the notation "(*)".
[12] Presentation of the teaching methods will include the use of new technologies (e-mail, personalized web page, electronic resources etc.).

| | | |
|---|---|---|
| eigenvalues and eigenvectors of a squared matrix; diagonalization | | |
| **Inner product vector spaces:** The inner product and the associated norm; unit vectors, angles, orthogonal vectors; Orthonormal bases; orthogonal matrices; Gramm-Schmidt Process; Linear transformations of inner product vector spaces. Orthogonal diagonalization of symmetric matrice | 6 | |
| **Three dimensional geometry:** The three dimensional space; geometric vectors; the dot product and cross product of two geometric vectors; orientation of three dimensional space; orthonormal frames; translation, rotation about a point in the plane, rotation about an axis in space; lines and planes in the three dimensional space; projections and distances | 2 | |
| **Differential Geometry of curves and surfaces**: the tangent and normals to a 3D curve. The curvature and torsion of a 3D curve. The tangent plan and the normal to a surface | 4 | |
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Bibliography [13] 1. C. Arieşanu, I. Iosif, Linear Algebra and Geometry for Electrical Engineering, Ed. Politehnica, 2017, ISBN 978-606-35-0172-2

2. 2 David C. Lay, Linear Algebra and its Applications, Addison-Wesley, 2012

3. V. A. Topogonov, Differential Geometry of Curves and Surfaces, Birkhauser, 2006

| **8.2** Applied activities [14] | Number of hours | Teaching methods |
|---|---|---|
| *Systems of linear equations. Cramer's rule, least square solution of a system of linear equations; homogeneous linear systems* | 2 | Solving problems, explanation, example, conversation, homework |
| *Linear dependence and independence of vectors in $R^n$. Bases and dimension, linear subspaces* | 4 | |
| *Linear maps, the matrix associated to fixed bases, kernel and image* | 2 | |
| *The algorithm for computation of eigenvalues and eigenspaces of a squared matrix. Algebraic and geometric multiplicity. Application: power matrix, systems of linear differential equations of first order* | 4 | |
| *Problems involving computation of the inner product of two vectors in R^n, the norm and the unit vector* | 2 | |
| *Orthonormal bases. Application of the Gramm-Schmidt orthogonalization method. Symmetric transformations* | 2 | |
| *Of $R^n$ and orthogonal diagonalization. Problems involving operations with geometric vectors in the three dimensional space* | 4 | |
| *The straight line and the plane in 3D* | 2 | |

[13] At least one title must belong to the discipline team and at least one title should refer to a reference work for discipline, national and international circulation, existing in the UPT library.

[14] Types of application activities are those specified in footnote 5. If the discipline contains several types of applicative activities then they are sequentially in the lines of the table below. The type of activity will be in a distinct line as: "Seminar:", "Laboratory:", "Project:" and / or "Practice/training".

| | | |
|---|---|---|
| *Problems related to the differential geometry of 3D curves and surfaces* | 4 | |

Bibliography [15] 1. C. Arieşanu, I. Iosif, Linear Algebra and Geometry for Electrical Engineering, Ed. Politehnica, 2017, ISBN 978-606-35-0172-2

2. 2 David C. Lay, Linear Algebra and its Applications, Addison-Wesley, 2012

3. V. A. Topogonov, Differential Geometry of Curves and Surfaces, Birkhauser, 2006

**9. Corroboration of the content of the discipline with the expectations of the main representatives of the epistemic community, professional associations and employers in the field afferent to the program**

- Understanding the correct use of mathematical and engineering sciences is essential.
- Discipline creates special mathematical skills of students on which they will be able to meet the requirements of the labor market in various areas or to continue research in the higher stages of study

**10. Evaluation**

| Type of activity | **10.1** Evaluation criteria [16] | **10.2** Evaluation methods | **10.3** Share of the final grade |
|---|---|---|---|
| **10.4** Course | Four problems | Written Exam | 67% |
| **10.5** Applied activities | **S:** Three problems for each test | Written tests and oral examination | 33% |
| | **L:** - - | | |
| | **P**[17]**:** -- | | |
| | **Pr:** -- | | |
| **10.6** Minimum performance standard (minimum amount of knowledge necessary to pass the discipline and the way in which this knowledge is verified [18]) | | | |
| • 60% | | | |

| | | |
|---|---|---|
| **Date of completion** | **Course coordinator (signature)** | **Coordinator of applied activities (signature)** |
| 22.01.2018 | …… | …… |
| **Head of Department (signature)** | **Date of approval in the Faculty Council [19]** | **Dean (signature)** |
| …… | | …… |

[15] At least one title must belong to the discipline team.
[16] Syllabus must contain the procedure for assessing the discipline, specifying the criteria, methods and forms of assessment, as well as specifying the weightings assigned to them in the final grade. The evaluation criteria shall be formulated separately for each activity foreseen in the curriculum (course, seminar, laboratory, project). They will also refer to the forms of verification (homework, papers, etc.)
[17] In the case where the project is not a distinct discipline, this section also specifies how the outcome of the project evaluation makes the admission of the student conditional on the final assessment within the discipline.
[18] It will not explain how the promotion mark is awarded.
[19] The endorsement is preceded by the discussion of the board's view of the study program on the discipline record.