# COURSE DESCRIPTION

*Mathematical Software*

Academic year 2026-2027

**1. Programme-related data**

| | |
|---|---|
| 1.1. Higher Education Institution | Babeş-Bolyai University |
| 1.2. Faculty | Mathematics and Computer Science |
| 1.3. Department | Mathematics |
| 1.4. Field | Mathematics |
| 1.5. Level of study | Bachelor |
| 1.6. Degree programme / Qualification | Mathematics and Computer Science in English |
| 1.7. Form of education | Full-time study |

**2. Course-related data**

| | | | | | |
|---|---|---|---|---|---|
| 2.1. Course title | **Mathematical Software** | | | Course code | **MLE0026** |
| 2.2. Course coordinator | Lect. Dr. Parajdi Lorand Gabriel | | | | |
| 2.3. Seminar coordinator | Lect. Dr. Parajdi Lorand Gabriel | | | | |
| 2.4. Year of study | 3 | 2.5. Semester | 5 | 2.6. Type of assessment | Exam |
| 2.7. Course status | Optional | | | 2.8. Course type | Specialisation subject |

**3. Total estimated time** (hours per semester of teaching activities)

| | | | | | |
|---|---|---|---|---|---|
| 3.1. Number of hours per week | 4 | of which: 3.2. course | 2 | 3.3. seminar/ laboratory/ project | 0/2/0 |
| 3.4. Total of hours in the curriculum | 56 | of which: 3.5. course | 28 | 3.6. seminar/ laboratory | 0/28 |
| **Time allocation for individual study (IS) and self-taught activities (ST)** | | | | | **hours** |
| Learning from textbooks, course materials, bibliography, and notes (IS) | | | | | 20 |
| Additional research in the library, on subject-specific electronic platforms, and on-site | | | | | 20 |
| Preparing seminars/ laboratories/ projects, assignments, reports, portfolios, and essays | | | | | 30 |
| Tutoring (professional guidance) | | | | | 14 |
| Examinations | | | | | 8 |
| Other activities: academic consultations and software-related support | | | | | 2 |
| **3.7. Total hours of individual study (IS) and self-taught activities (ST)** | | | | **94** | |
| **3.8. Total hours per semester** | | | | **150** | |
| **3.9. Number of credits** | | | | **5** | |

**4. Prerequisites** (where applicable)

| | |
|---|---|
| 4.1. curriculum-related | • Programming backgrounds |
| 4.2 skills-related | • Programming skills |

**5. Specific conditions** (where applicable)

| | |
|---|---|
| 5.1. course-related | • Videoprojector (offline), MSTeams or Zoom (online) |
| 5.2. seminar/laboratory-related | • Computer Network, Mathematical Software (Maple, MATLAB, LaTeX) |

**6.1. Competencies resulting from the completion of the degree programme** *(as referred to in the curriculum)*[1]

| Professional competencies | |
|---|---|
| **Competency code** | **Competency** |
| **PC1** | Develop problem-solving strategies |
| **PC2** | Perform analytical mathematical calculations |
| **PC4** | Develop open-source software |
| **PC5** | Synthesize information |
| **PC7** | Communicate mathematical information |
| **PC9** | Use data processing techniques |
| **PC11** | Perform data analysis |
| **Transversal competencies** | |
| **Competency code** | **Competency** |
| **TC2** | Use digital devices and applications |
| **TC3** | Work independently |

**6.2. Learning outcomes relevant to the degree programme** (as referred to in the curriculum)[2]

| Learning outcomes targeted by the subject | | |
|---|---|---|
| **Competency code** | **Knowledge and comprehension** | **Specific academic skills** |
| **PC5** | 8. The student/graduate defines the concepts from basic computer science and/or applied mathematics disciplines. | 8. The student/graduate identifies and applies suitable techniques to solve exercises and problems from the major disciplines of mathematics. |
| **PC5, PC7** | 9. The student/graduate formulates observations and differentiates notions, properties, and assertions from advanced mathematics disciplines through examples and counterexamples. | 9. The student/graduate argues the role of elements found in the hypotheses of mathematical assertions, discusses how they articulate within the proof, and independently constructs correct proofs of mathematical assertions from major mathematical disciplines. The student/graduate translates a practical situation into mathematical language, solves the resulting problem, and interprets the obtained results. |
| **PC9, PC11** | 10. The student/graduate formulates observations and differentiates notions, properties, and assertions from the basic computer science and/or applied mathematics disciplines through examples and counterexamples. | 10. The student/graduate describes real-world problems in mathematical terms, identifies the working hypotheses, constructs suitable mathematical models, and explains the limitations of the resulting models. |

[1] The professional and/or transversal skills targeted by the subject for which the course description is prepared will be copied from the curriculum of the degree programme. For each competency, the complete entry, including the competency code, will be copied with the exact wording that appears in the curriculum, without any changes. If no competency is copied from either of the two categories, the row corresponding to that category is deleted from the table.

[2] The learning outcomes relevant for the degree programme and targeted by the subject for which the course description is prepared will be listed. The entries, copied without any changes from the Curriculum by subject type (Core Subject/Specialisation Subject/Complementary Subject), are listed under the corresponding competency.

**7. Subject-specific learning outcomes**

| **Knowledge and comprehension** |
|---|
| 1. Knows the basic concepts and fundamental principles of using mathematical software in solving mathematical and applied mathematical problems. |
| 2. Knows the functionalities and modes of use of specialized software packages, as well as basic notions of mathematical programming and the automation of computational processes. |
| 3. Knows methods for graphical visualization of functions, data, and numerical solutions, as well as procedures for computer-assisted numerical and symbolic computation. |
| 4. Knows ways of integrating mathematical software into the processes of modelling, analysis and validation of results. |
| **Specific academic skills** |
| 1. Uses mathematical software to perform numerical and symbolic computations, to graph functions, solutions of equations, data, and mathematical models, as well as to solve problems from various fields (linear algebra, numerical analysis, differential equations, etc.). |
| 2. Develops and interprets simple functions or scripts for automating mathematical computations, critically analyses the obtained results and compares numerical solutions with analytical ones. |
| 3. Applies acquired knowledge independently in projects and individual assignments, develops and tests computational solutions, uses advanced software resources, and efficiently manages their activity and learning process. |

**8. Contents**

| **8.1. Course** | **Teaching and learning methods** | **Remarks[3]** |
|---|---|---|
| 1. Introduction to mathematical software. Introduction to Maple | Lectures, demonstrations (including the use of digital teaching tools), problem-solving, individual study and the use of mathematical software in teaching activities. | |
| 2. Differential and integral calculus in Maple | Lectures, demonstrations (including the use of digital teaching tools), problem-solving, individual study and the use of mathematical software in teaching activities. | |
| 3. Functions, procedures and programming in Maple | Lectures, demonstrations (including the use of digital teaching tools), problem-solving, individual study and the use of mathematical software in teaching activities. | |
| 4. Graphical representations and data visualization using Maple | Lectures, demonstrations (including the use of digital teaching tools), problem-solving, individual study and the use of mathematical software in teaching activities. | |
| 5. Matrix operations in MATLAB. Programming in MATLAB | Lectures, demonstrations (including the use of digital teaching tools), problem-solving, individual study and the use of mathematical software in teaching activities. | |
| 6. Graphical representations and data visualization using MATLAB | Lectures, demonstrations (including the use of digital teaching tools), problem-solving, individual study and the use of mathematical software in teaching activities. | |
| 7. Mathematical computations in MATLAB: linear algebra, numerical analysis, data analysis, and solving differential equations | Lectures, demonstrations (including the use of digital teaching tools), problem-solving, individual study and the use of mathematical software in teaching activities. | |

[3] For example, organisational aspects, recommendations for students, specific aspects relating to the course/seminar, such as inviting experts in the field, etc.

**Bibliography**


1. The MathWorks, *Setul de manuale* MATLAB
2. Attaway, S. MATLAB*: a practical introduction to programming and problem solving*, 6th edition, 2022
3. Fox, W. P., Bauldry, W. C. *Advanced problem solving with Maple: a first course*, CRC Press, 2020
4. Thompson, I. *Understanding Maple*, Cambridge University Press, 2016
5. Driscoll, T. A. *Learning* MATLAB, SIAM, 2009
6. Anisiu, V. *Calcul simbolic cu Maple*, Presa Universitară Clujeană, 2006
7. Higham, D. J., Higham, N. J. MATLAB *Guide, 2nd edition*, SIAM, 2005
8. Trîmbiţaş, R. *Analiză numerică: o introducere bazată pe* MATLAB, Presa Universitară Clujeană, 2005
9. Moler, C. B. *Numerical Computing with* MATLAB, SIAM, 2004
10. Marchand, P., Holland, O. T. *Graphics and GUIs with* MATLAB, 3rd edition, Barnes and Noble, 2003
11. Heck, A. *Introduction to Maple*, 3rd edition, Springer, 2003
12. Corless, R. M. *Essential Maple 7: an introduction for scientific programmers*, Springer New York, 2002


| **8.2. Seminar/ laboratory** | **Teaching and learning methods** | **Remarks** |
|---|---|---|
| 1. Introduction to Maple | Demonstrations (including the use of digital teaching tools), individual study and the practical use of mathematical software. | |
| 2. Assignments and unassignment in Maple | Demonstrations (including the use of digital teaching tools), individual study and the practical use of mathematical software. | |
| 3. Symbolic representation and simplification of expressions in Maple; applying the *assume* command | Demonstrations (including the use of digital teaching tools), individual study and the practical use of mathematical software. | |
| 4. Differentiation, integration, and sum computation in Maple | Demonstrations (including the use of digital teaching tools), individual study and the practical use of mathematical software. | |
| 5. Maple: instructions, functions, procedures | Demonstrations (including the use of digital teaching tools), individual study and the practical use of mathematical software. | |
| 6. Two-dimensional and three-dimensional plotting in Maple. Special plots and animations | Demonstrations (including the use of digital teaching tools), individual study and the practical use of mathematical software. | |
| 7. Maple: equations, recurrence relations, and linear algebra | Demonstrations (including the use of digital teaching tools), individual study and the practical use of mathematical software. | |
| 8. Introduction to MATLAB | Demonstrations (including the use of digital teaching tools), individual study and the practical use of mathematical software. | |
| 9. Matrices in MATLAB: generation, indexing, matrix and vector operations | Demonstrations (including the use of digital teaching tools), individual study and the practical use of mathematical software. | |
| 10. Control flow, M-files, data types, and advanced data structures in MATLAB | Demonstrations (including the use of digital teaching tools), individual study and the practical use of mathematical software. | |
| 11. 2D and 3D graphical representations in MATLAB, in Cartesian and other coordinate systems | Demonstrations (including the use of digital teaching tools), individual study and the practical use of mathematical software. | |

| | | |
|---|---|---|
| 12. Advanced graphics in MATLAB: animations, special plots, volume visualization, and GUI development | Demonstrations (including the use of digital teaching tools), individual study and the practical use of mathematical software. | |
| 13. Numerical methods in MATLAB: interpolation, least squares approximation, solving systems of equations, and computing eigenvectors and eigenvalues | Demonstrations (including the use of digital teaching tools), individual study and the practical use of mathematical software. | |
| 14. Numerical methods for solving differential equations in MATLAB | Demonstrations (including the use of digital teaching tools), individual study and the practical use of mathematical software. | |

**Bibliography**


1. Attaway, S. MATLAB*: a practical introduction to programming and problem solving*, 6th edition, 2022
2. Fox, W. P., Bauldry, W. C. *Advanced problem solving with Maple: a first course*, CRC Press, 2020
3. Driscoll, T. A. *Learning* MATLAB, SIAM, 2009
4. Anisiu, V. *Calcul simbolic cu Maple*, Presa Universitară Clujeană, 2006
5. Trîmbiţaş, R. *Analiză numerică: o introducere bazată pe* MATLAB, Presa Universitară Clujeană, 2005
6. Heck, A. *Introduction to Maple*, 3rd edition, Springer, 2003


**9. Evaluation**

| Type of activity | 9.1 Evaluation criteria[4] | 9.2 Evaluation methods[5] | 9.3 Percentage in the final grade |
|---|---|---|---|
| 9.4. Course | The ability to solve mathematical problems using Maple and MATLAB; the correct and well-documented implementation of programs, with explanations written in LaTeX regarding the implementation approach and the underlying theory. | Practical final exam | 70% |
| 9.5. Seminar/ laboratory | Completing mandatory assignments and actively participating in laboratory classes; individual verification of proposed problems during the laboratory test. | Individual evaluation | 30% |
| 9.6 Minimum standard for passing | | | |
| • A minimum grade of 5 is required in the final test as well as in each laboratory test. | | | |

**10. SDG labels (Sustainable Development Goals)[6]**

| | | |
|---|---|---|
|  | | Sustainable Development Generic Label |

[4] The evaluation criteria must directly reflect the learning outcomes targeted at the level of the degree programme respectively at the level of the subject. More specifically, the learning outcomes set out in the expected learning outcomes are assessed.

[5] Both final evaluation methods and ongoing evaluation strategies should be established.

[6] Select a single label which, according to the *Implementation of SDG labels in the academic process*, best matches the subject. If the subject addresses sustainable development in a generic manner (i.e. by presenting/introducing the general framework of sustainable development, etc.), then the Sustainable Development generic label may be applied. If none of the labels describe the subject, select the last option: *"No label applies."*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  |  |  |  |  |
| ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | X |
|  |  |  |  |  |  |  |  | No label applies |
| ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

Date of entry:
10.04.2026

Signature of course coordinator

Lect. Dr. Parajdi Lorand Gabriel

Signature of seminar coordinator

Lect. Dr. Parajdi Lorand Gabriel

Date of approval in the department:
24.04.2026

Signature of the head of department

Prof. dr. Andrei Mărcuș