*MATHEMATICAL SOFTWARE*
**ANALYTIC SYLLABUS**

**Academic Year 2022-2023**

**Year of study II / Semester I**

## 1. Information on academic programme

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| 1.1. University | **„1 Decembrie 1918" University of Alba Iulia** |
| 1.2. Faculty | **Faculty of Computer Sciences and Engineering** |
| 1.3. Department | **Computer Science, Mathematics and Electronics** |
| 1.4. Field of Study | **Computer Science** |
| 1.5. Cycle of Study | **Undergraduate** |
| 1.6. Academic programme / Qualification | **Computer Science, COR 251201, 251204, 251203** |

## *2.* Information of Course Matter

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| 2.1. **Course** | *Mathematical software* | | | 2.2. **Code** | | CSE206 | |
| 2.3. **Course Leader** | Full Prof. Ph.D., Dr. Habil., Nicoleta Breaz | | | | | | |
| 2.4. **Seminar Tutor** | Asistant PhD student, Daniela Cristea | | | | | | |
| 2.5. Academic Year | **II** | 2.6. Semester | **I** | 2.7. Type of Evaluation (E – final exam/ CE - colloquy examination / CA -continuous assessment) | **CE** | 2.8. Type of course (**C**– Compulsory, **Op** – optional, **F** - Facultative) | **Op** |

**3. Course Structure** (Weekly number of hours)

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| 3.1. Weekly number of hours | **4** | 3.2. course | ***2*** | 3.3. seminar, laboratory | ***2*** |
| 3.4. Total number of hours in the curriculum | **56** | 3.5. course | ***28*** | 3.6. seminar, laboratory | ***28*** |

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| Allocation of time: | Hours |
| Individual study of readers | ***20*** |
| Documentation (library) | ***7*** |
| Home assignments, Essays, Portfolios | ***40*** |
| Tutorials | **-** |
| Assessment (examinations) | ***27*** |
| Other activities……. | **-** |

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| 3.7 Total number of hours for individual study | **150** |
| 3.9 Total number of hours per semester | **94** |
| 3.10 umber of ECTS | **6** |

4.Prerequisites (*where applicable*)

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| 4.1. curriculum-based | **-** |
| 4.2. competence-based | - |

**5.Requisites** (*where applicable*)

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| 5.1. course-related | *The course is hosted in a room equipped with video projector and computers having installed Office (Excel)/Open Office and Matlab/Octave. The tutorial and printed manuals are at the students' disposal (in the library). For online version, the classes will be held on Microsoft Teams (if necessary, other online apps can be also used).*<br>***Note:*** *The students are strongly encouraged to attend the course, in order to gain knowledge for practical applications.* |
| 5.2. seminar/laboratory-based | *The seminar is hosted in a laboratory equipped with video projector and computers having installed Office (Excel)/Open Office and Matlab/Octave. The tutorial and printed manuals are at the students' disposal (in the library). For online version, the classes will be held on Microsoft Teams (if necessary, other online apps can be also used).*<br>***Note:*** *The attendance of the laboratory classes is compulsory, a student who doesn't attend all classes being not allowed at the exam. The missed classes can be recovered by a student, during other classes, before the final examination, by completing a portfolio with all missed homeworks.* |

**6.Specific competences to be acquired (chosen by the course leader from the programme general competences grid)**

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| Professional competences | The course is focused on the development of skills required to use mathematical software and also to project some supplementary components, for a software, dedicated to solve new problems; the graduate will be able to solve various mathematical problems supposing large calculus, based on a software product. Aiming the development of these specific competences, the course assures the knowledge on mathematical software which contributes to the general professional competences given by the study program, regarding ***The use of computer tools in an interdisciplinary context*** **(C3).** These can be clearly described by the level descriptors related to:<br>C3.3. The use of computer and mathematical models and tools to solve specific problems in the application field.<br>C3.4. Data and model analysis<br>C3.5. The development of software components of interdisciplinary projects. |
| Transversal competences | - |

7.Course objectives (as per the programme specific competences grid)

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| 7.1 General objectives of the course | The general aim related to this course consists in getting knowledge which allows to initiate students in the use of mathematical software products, applied in different problems with mathematical component, arising in various fields of science and technique and in general, in the ***use of computer tools in an interdisciplinary context.*** |
| 7.2 Specific objectives of the course | It is aiming the development of some specific competences to use mathematical software, thus the students will get the ability to use software product to solve problems that requires large and hard calculation and also to simplify the way how the results are returned. It is underlined the use of Excel charts and mathematical Excel functions and also the use of MATLAB mathematical functions, such that the students is in the end capable **to use computer and mathematical models and tools to solve specific problems in the application field, to analyses data and models, to develop software components of interdisciplinary projects.** |

8.Course contents

| **8.1 Course (learning units)** | **Teaching methods** | **Remarks** |
|---|---|---|
| **I. Mathematical Software Toolboxes -general issues (2 hours)**<br>1. The use of specific software in the solving of mathematical problems<br>2. Types of mathematical software<br>**(Objectives: learning basics for using of the computer and mathematical models and tools to solve specific problems in the application field)** | ***Lecture, discussion*** | 2 hours onsite<br>Minimal lectures: 1<br>(see the list) |
| **II. Microsoft Excel spreadsheet program (8 hours)**<br>1. Editing Excel formula<br>2. Using of Excel predefined functions<br>3. Mathematical Excel functions<br>3.1. Trigonometrically and mathematical functions<br>3.2. Statistical functions | ***Lecture, discussion, exemplification in Excel*** | 8 hours onsite<br>Minimal lectures: 1<br>(see the list) |

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| 4. Excel statistical charts<br>4.1. Creating charts<br>4.2. Formatting charts<br>4.3. Printing and interpretation of the charts<br>5. Practical applications in Excel<br>**(Objectives: to use computer and mathematical models and tools to solve specific problems in the application field, to analyses data and models, to develop software components of interdisciplinary projects.)** | | |
| **III. Introduction in MATLAB (4 hours)**<br>1. Working with MATLAB session<br>2. Constants, variables, predefined functions, arithmetical, logical and relational operators<br>3. Instructions for reading, editing and assigning<br>4. Commands for 'script' m- file<br>5. Instructions for flow control, branching and efficiency evaluation<br>6. Functions (procedures) in MATLAB<br>**(Objectives: learning basics for using of the computer and mathematical models and tools to solve specific problems in the application field)** | ***Lecture, discussion, exemplification in Matlab*** | 4 hours onsite<br>Minimal lectures: 1 (see the list) |
| **IV. Mathematical functions in MATLAB (14 hours)**<br>1. Basic functions in Matlab<br>1.1. Functions for linear algebra and matriceal calculus<br>1.2. Functions for elementary math and trigonometric<br>1.3. Functions for data analysis<br>1.4. Functions for polynomial calculus<br>1.5. Functions for numerical methods<br>1.6. Functions for graphics<br>2. Applications in Matlab<br>**(Objectives: to use computer and mathematical models and tools to solve specific problems in the application field, to analyses data and models, to develop software components of interdisciplinary projects.)** | ***Lecture, discussion, exemplification in Matlab, materials in digital format*** | 11 hours online<br>3 hours onsite<br>Minimal lectures: 1 (see the list) |

## References


**1. N.Breaz,** Mathematical software, Univ. "1 Decembrie 1918" din Alba Iulia, (electronic version)
**2. D. J. Higham, N. J. Higham,** *MATLAB Guide*, 2nd edition, SIAM, 2005
**3.P. Marchand, O. T. Holand –** *Graphics and GUI with MATLAB*, 3rd edition, Barnes and Noble, 2003
**4. Cleve Moler** – *Numerical Computing in MATLAB*, SIAM, 2005
**5. ***–** *Documentation for MathWorks Products, R2009a-* http://www.mathworks.com/


| **Seminars-laboratories** | **Teaching methods** | |
|---|---|---|
| **1. The use of Excel spreadsheet (4 hours)**<br>-Editing of Excel formula<br>-Using Excel functions<br>**(Objectives: learning basics for using of the computer and mathematical models and tools to solve specific problems in the application field)** | ***Coordination and evaluation of computer-based works*** | 4 hours onsite<br>Minimal lectures: 1 (see the list) |
| **2. The use of Excel as mathematical software (4 hours)**<br>-Mathematical functions<br>-Trigonometrically functions<br>- Statistical functions<br>**(Objectives: to use computer and mathematical models and tools to solve specific problems in the application field)** | ***Coordination and evaluation of computer based works*** | 4 hours onsite<br>Minimal lectures: 1 (see the list) |
| **3. The use of Excel statistical charts (4 hours)**<br>-Creating charts<br>-Formatting charts<br>-Printing and interpretation of the charts<br>**(Objectives: to use computer and mathematical models and tools to solve specific problems in the application field)** | ***Coordination and evaluation of computer based works*** | 4 hours onsite<br>Minimal lectures: 1 (see the list) |
| **4. Basics commends in MATLAB (4 hours)***<br>-Working with MATLAB session<br>-Constants, variables, predefined functions, arithmetical, logical and relational operators<br>-Instructions for reading, editing and assigning<br>-Commends for 'script' m- file<br>**(Objectives: learning basics for using of the computer and mathematical models and tools to solve specific problems in the application field)**<br>***Other similar software as Octave can be used in teaching and assessment as alternative or complementary to Matlab. Also, if time allows, other software as R, can be also used.** | ***Coordination and evaluation of computer based works*** | 4 hours onsite<br>Minimal lectures: 1 (see the list) |
| **5. Programming in Matlab (4 hours)** | ***Coordination and evaluation of computer*** | 4 hours online |

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|---|---|---|
| -Flow control, branching and efficiency evaluation<br>-Functions (procedures) in MATLAB<br>**(Objectives: learning basics for using of the computer and mathematical models and tools to solve specific problems in the application field)** | ***based works, materials in digital format*** | Minimal lectures: 1 (see the list) |
| **6. The use of basic functions in Matlab (8 hours)**<br>-Functions for linear algebra and matriceal calculus<br>-Functions for elementary math and trigonometric<br>-Functions for data analysis<br>-Functions for polynomial calculus<br>-Functions for numerical methods<br>-Functions for graphics<br>**(Objectives: to use computer and mathematical models and tools to solve specific problems in the application field)** | ***Coordination and evaluation of computer based works, materials in digital format*** | 3 hours online<br>5 hours onsite<br>Minimal lectures: 1 (see the list) |

## References


**1. N.Breaz,** Mathematical software, Univ. "1 Decembrie 1918" din Alba Iulia, (electronic version)
**2. D. J. Higham, N. J. Higham,** *MATLAB Guide*, 2nd edition, SIAM, 2005
**3.P. Marchand, O. T. Holand –** *Graphics and GUI with MATLAB*, 3rd edition, Barnes and Noble, 2003
**4. Cleve Moler** – *Numerical Computing in MATLAB*, SIAM, 2005
**5. ***–** *Documentation for MathWorks Products, R2009a*- http://www.mathworks.com/


## 9.Corroboration of course contents with the expectations of the epistemic community's significant representatives, professional associations and employers in the field of the academic programme

The skill's development regarding the use of a mathematical software and the stimulation for the premises to know how to project software products, adequate to different sciences, contribute to the complementarity's warranty required for a software programmer, this being capable to develop various software products having precise specifications (software having a mathematical component), without needing for mathematicians' help, the course answering in this way, to the necessity of the graduate to be adapted at various fields from the labor market, where specialists in computer science are needed.

## 10.Assessment

| Activity | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Percentage of final grade |
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| 10.4 Course | *Final evaluation:*<br>*- correct interpretation of the results of the mathematical problems, solved by using a mathematical software, in the synthesis homework, will be assessed through a test during the final colloquy examination (questions based on applied theory within the synthesis homework);* | ***Final evaluation:***<br>***Final colloquy examination** – test /quiz (online)/presentation and questions (onsite) based on the synthesis homework**.***<br><br>For online activities, Microsoft Teams or alternatives will be used. | 50% |
| 10.5 Seminar/laboratory | *Continuous assessment*<br>*- the students have to solve correctly, by using a mathematical software, all mathematical problems from their practical works required during classes and also the synthesis homework* | ***Continuous assessment:** During the classes, the assessment of practical skills in using a mathematical software will be do done, by evaluate the portfolio containing all required practical works, including a synthesis homework.* | 50% |
| 10.6 Minimum performance standard: | | | |
| Correctly solving of some mathematical problems having a medium level of complexity, using mathematical software (for example, to solve a system of equations in Matlab/Octave).<br>**Note:** ***Please see also the alignment 5 (Requisites), related to compulsory attendance of the practical classes. Also, a student who doesn't attend the Final colloquy examination, can not get a final mark even if he/she has a mark for continuous assessment. The assessment scale is from 1 to 10, and 5 is minimum to pass the exam.*** | | | |

Submission date __25.09.2022__ Course leader signature _____ Seminar tutor signature _____

Date of approval by Department members _____ Department director signature _____