**SYLLABUS**

## 1. Data about the program of study

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|---|---|---|
| 1.1 | Institution | Technical University of Cluj-Napoca |
| 1.2 | Faculty | Faculty of Electrical Engineering |
| 1.3 | Department | Electrotechnics and Measurements |
| 1.4 | Field of study | Electrical Engineering |
| 1.5 | Cycle of study | Bachelor of Science |
| 1.6 | Program of study/ Qualification | Electrical System Cluj-Napoca in English language |
| 1.7 | Form of education | Full time |
| 1.8 | Subject code | **12** |

## 2. Data about the subject

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|---|---|---|---|---|---|---|
| 2.1 | Subject name | | | | Computer programming and programming languages II | |
| 2.2 | Course responsible/ lecturer | | | | Conf.dr.eng. Grindei Violeta Laura | |
| 2.3 | Teachers in charge of Seminars/ Laboratory/ Project | | | | Lect. dr.eng. Constantinescu Claudia | |
| 2.4 Year of study | | 1 | 2.5 Semester | 2 | 2.6 Type of assessment *(E – exam, C – colloquium, V – verification)* | E |
| 2.7 Subject category | | *DF – fundamental, DD – in the field, DS – specialty, DC – complementary* | | | | DF |
| | | *DI – compulsory, DO – elective, Dfac – optional* | | | | DI |

## 3. Estimated total time

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 3.1 Number of hours per week: | 4 | of which | 3.2 Course | 2 | 3.3 Seminar | | 3.3 Laboratory | 2 | 3.3 Project | |
| 3.2 Total hours per semester | 125 | of which | 3.5 Course | 28 | 3.6 Seminar | | 3.6 Laboratory | 28 | 3.6 Project | |

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| 3.7 Individual study: | |
| (a) Manual, lecture material and notes, bibliography | 24 |
| (b) Supplementary study in the library, online and in the field | 17 |
| (c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays | 18 |
| (d) Tutoring | 6 |
| (e) Exams and tests | 4 |
| (f) Other activities | 0 |
| 3.8 Total hours of individual study *[sum (3.7(a) to 3.7(f))]* | 69 |
| 3.9 Total hours per semester *[sum of 3.4 and 3.8]* | 125 |
| 3.10 Number of credit points | 5 |

## 4. Prerequisites (where applicable)

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| 4.1 | Curriculum | Completing PCLP I |
| 4.2 | Competences | Competences from PCLP I |

## 5. Requirements (where appropriate)

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| 5.1 | For the course | Projector |
| 5.2 | For the applications | Computers room |

**6. Specific competences**

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| Professional competences | • ability to identify, formulate and solve engineering problems in a system approach<br>• ability to apply engineering knowledge, engineering sciences, and applied computer science.<br>• ability to use software products for monitoring and controlling processes specific to energy engineering while ensuring the safety of personnel in electrical installations of any level. |
| Cross competences | • Flexibility in approaching and practically applying the latest technologies in the areas of expertise undertaken.<br>• ability to work in interdisciplinary and multidisciplinary teams, to communicate effectively, and to understand professional and ethical responsibilities. |

**7. Discipline objectives (based on specific competencies acquired)**

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| 7.1 | General objective | The use of advanced programming languages and the acquisition of basic skills in designing and implementing programs in C/C++/Python in Electrical Engineering field. |
| 7.2 | Specific objectives | The student must be able to design and implement complex applications to solve problems in the field of energy engineering using C/C++/Python programming languages. |

**8. Contents**

| **8.1. Course (Lectures)** | | Number of hours | Teaching methods | Additional remarks |
|---|---|---|---|---|
| 1 | Pointers. Pointers to arrays. Arrays of pointers. Pointers to pointers. Pointers to functions. Functions with pointer arguments. | 2 | ppt tutorials | Quiz evaluation tests |
| 2 | Dynamic memory allocation. Dynamic allocation functions. | 2 | | |
| 3 | Command line. Arguments of the main() function. | 2 | | |
| 4 | Defining, declaring, and accessing elements of structures. Structures and functions. Pointers to structures. Arrays of structures.Sorting algorithms. | 2 | | |
| 5 | Defining, declaring, and accessing elements of unions, enumerations, bit fields, lists (implementation of specific list types). | 2 | | |
| 6 | Defining and using file operations in C. | 2 | | |
| 7 | Streams cin and cout. | 2 | | |
| 8 | Structuring C/C++ programs into modules. | | | |
| 9 | Differences between C/C++. C++ Libraries. Standard Template Library in C++: algorithms (for sorting, selection, and binary search of data stored in containers), containers: vector, list, map, set, and stack, iterators: forward_iterator, | 2 | | |

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|---|---|---|---|---|
| | bidirectional_iterator, and random_access_iterator, functors-function objects, adaptors. | | | |
| 10 | OOP: Defining objects, classes, and methods used in object-oriented programming. The concept of inheritance. Classes and friend functions. Common class functions (constructor, destructor). | 2 | | |
| 11 | File operations in C++. | 2 | | |
| 12 | Mathematical applications implemented in C/C++ in the field of electrical engineering: polynomials, polynomial differentiation, Taylor series expansions of trigonometric functions, applications with mean values, effective values, mean absolute deviation values, error calculation, integral applications. | 2 | | |
| 13 | Applications in C/C++ for solving electrical circuit problems. | 2 | | |
| 14 | Introduction to Python. Python applications in electrical engineering: graphical representation of 2D and 3D numerical data, animated graphs, waveforms. | 2 | | |

Bibliography

[1] Aplicaţii C/C++/C# şi Arduino în Inginerie Electrică, Laura Grindei, Claudia Constantinescu, Marius Purcar, manual on line: https://biblioteca.utcluj.ro/files/carti-online-cu-coperta/435-3.pdf

| **8.2. Applications - Seminar /Laboratory/Project** | | Number of hours | Teaching methods | Additional remarks |
|---|---|---|---|---|
| 1 | Implementing C/C++ programs to solve problems using pointers and pointer operations. | 2 | Implementation and testing of programs on the computer in Code::Blocks<br><br>Completion of 9 online tests in Teams | |
| 2 | Implementing C/C++ programs to solve problems using pointers to arrays. | 2 | | |
| 3 | Implementing C/C++ programs to solve problems using arrays of pointers. | 2 | | |
| 4 | Implementing C/C++ programs to solve problems using pointers to pointers and pointers to functions. | 2 | | |
| 5 | Implementing C/C++ programs to solve problems using dynamic memory allocation. | 2 | | |
| 6 | Implementing C/C++ programs to use the command line and arguments of the main() function. | 2 | | |
| 7 | Implementing C/C++ programs to solve problems using structures, structures as function arguments, and pointers to structures. | 2 | | |
| 8 | Implementing C/C++ programs to solve problems using arrays of structures and sorting algorithms for them. | 2 | | |
| 9 | Implementing C/C++ programs to solve problems using unions, enumerations, bit fields, lists (implementation of specific list types). | 2 | | |

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|---|---|---|---|---|
| 10 | Implementing C++ programs using C++ I/O: cin, cout. | 2 | | |
| 11 | Implementing C++ programs with classes and methods. | 2 | | |
| 12 | Implementing practical applications in electrical engineering: polynomials, polynomial differentiation, Taylor series of trigonometric functions, applications with mean values, effective values, mean absolute deviation values, error calculation, integral applications. | 2 | | |
| 13 | Applications in C/C++ in electrical engineering: solving problems with electrical circuits: equivalent resistance calculation, voltage divider, matrix solution of a system of equations that simplifies the solution of an electrical circuit. | 2 | | |
| 14 | Implementing Python applications. 2D and 3D graphical representations using Python. | 2 | | |

Bibliography

[1] Aplicaţii C/C++/C# şi Arduino în Inginerie Electrică, Laura Grindei, Claudia Constantinescu, Marius Purcar, manual on line: https://biblioteca.utcluj.ro/files/carti-online-cu-coperta/435-3.pdf

**9. Alignment of course content with expectations of the epistemic community, professional associations, and representative employers in the field**

The content of the course is in line with what is taught in other Electrical Engineering faculties, both within the other university centres in the country and abroad.

**10. Assessment**

| Activity type | 10.1 Assessment criteria | 10.2 Assessment methods | 10.3 Weight in the final grade (%) |
|---|---|---|---|
| 10.4 Course | The level of theoretical knowledge accumulation is tested through a written test with questions regarding the interpretation of C/C++ code sequences and the writing of a C/C++ program to solve an electrical engineering problem. | Multiple-choice test + one C/C++ code to solve an electrical engineering problem. | 50% |
| 10.5 Laboratory | The level of practical knowledge accumulated during labotatories is tested through on line tests | 9 multiple choice on line tests in Teams | 50% |
| 10.5 Project | | | |

| 10.6 Minimum standard of performance:<br>Final mark =(theoretical test mark +average of 9 laboratory tests)/2=minimum 5 |
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| Date of completion | Lecturers | Title/ Surname/ Name: | Signature |
|---|---|---|---|
| September 2024 | Course | Conf. dr. ing. Violeta Laura GRINDEI | |
| | Applications Seminar/ Laboratory/ Project | Conf. dr. ing. Violeta Laura GRINDEI | |
| | | s.l.dr. ing.Claudia Constantinescu | |

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| **Date of approval in the ETHM Department Council**<br><br>September 2024 | **Head of Department:**<br>Prof. Eng. MICU Dan Doru, PhD |
| **Date of approval in the Faculty of Electrical Engineering Council**<br><br>September 2024 | **Dean:**<br>Assoc. Prof. Eng. CZIKER Andrei, PhD |