COURSE DESCRIPTION

Electrotechnics

Academic year 2026-2027

1. Programme-related data

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

2. Course-related data

2.1. Course title	**Analysis and synthesis of circuits**			Course code	**MLE7027**
2.2. Course coordinator	Prof. dr. ing. Octavian Creţ				
2.3. Seminar coordinator	Prof. dr. ing. Octavian Creţ				
2.4. Year of study	1	2.5. Semester	2	2.6. Type of assessment	Exam
2.7. Course status	Compulsory			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	3	3.3. ~~seminar~~/ laboratory/ ~~project~~	1
3.4. Total of hours in the curriculum	56	of which: 3.5. course	42	3.6. ~~seminar~~/ laboratory/ ~~project~~	14
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					10
Preparing seminars/ laboratories/ projects, assignments, reports, portfolios, and essays					6
Tutoring (professional guidance)					5
Examinations					3
Other activities					
3.7. Total hours of individual study (IS) and self-taught activities (ST)				44	
3.8. Total hours per semester				100	
3.9. Number of credits				4	

4. Prerequisites (where applicable)

4.1. curriculum-related	
4.2 skills-related	

5. Specific conditions (where applicable)

5.1. course-related	Class room with projector
5.2. seminar/laboratory-related	Laboratory with computers

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

Professional competencies	
Competency code	**Competency**
PC16	Interpret electronic design specifications

PC19	Design prototypes
PC21	Assembly hardware components
PC24	Model and simulate sensors
Transversal competencies	
Competency code	**Competency**
TC1	Work independently
TC2	Solve problems
TC3	Think analytically

6.2. Learning outcomes relevant to the degree programme (as referred to in the curriculum)

Learning outcomes targeted by the subject		
Competency code	**Knowledge and comprehension**	**Specific academic skills**
PC18 **PC19**	The student/graduate describes, identifies, and summarizes basic concepts and methods related to the modeling, analysis, design, and testing of computer systems—including those with microcontrollers or processors—operating systems, graphics processing systems, and data acquisition systems.	The student/graduate designs models for various components of computer systems, including hardware and software, and evaluates their functional and nonfunctional characteristics.
PC20 **PC21**	The graduate has the necessary knowledge to use electronic tools in order to characterize and evaluate the performance of electronic circuits.	The student/graduate uses specific methods and tools to analyze, design, and implement systems for data acquisition, graphics processing, and data pro cessing and display. The student/graduate designs and implements functional systems of low to medium complexity using microprocessors.

7. Subject-specific learning outcomes

Knowledge and comprehension
1. Understanding the basic laws of Electrostatics, Electrodynamics, and Magnetism
2. Understanding the fundamentals of electrical circuits
3. Mastering and applying methods for calculating the parameters of direct current electrical circuits
4. Mastering and applying methods for calculating the parameters of alternating current electrical circuits
Specific academic skills
1. Acquiring practical skills in the field of electrical circuits.
2. Graduates will be able to solve problems related to direct and alternating current circuits.

1. Statics and Dynamics in Electromagnetism. Electric Charge. Coulomb's Law
2. Electric fields. Electric fields from Particular Charge Distributions
3. Gauss's Law
4. Electric potential
5. Dielectrics
6. Capacitance
7. Applications of Electrostatics
8. Electrokinetic fields
9. Power density and Joule's law. Direct-current circuits. Electrical Measuring Instruments. RC Circuits. Household Wiring and Electrical Safety

10. Magnetic forces and fields
11. Sources of magnetic fields. Electromagnetic induction
12. Inductance
13. Sinusoidal quantities. Definitions. Characteristic values. Alternating-Current Circuits
14. Maxwell's equations. Source conversions. Superposition Theorem. Thévenin's and Norton's Theorems. Maximum power transfer theorem. Delta-Y (Pi-T) Conversions. Nodal and Mesh Analysis. Comparison of nodal and mesh

8. Contents

8.1. Course	**Teaching and learning methods**	**Remarks**
1. Statics and Dynamics in Electromagnetism. Electric Charge. Coulomb's Law	Presentations, discussions	N/A
2. Electric fields. Electric fields from Particular Charge Distributions		
3. Gauss's Law		
4. Electric potential		
5. Dielectrics		
6. Capacitance		
7. Applications of Electrostatics		
8. Electrokinetic fields		
9. Power density and Joule's law. Direct-current circuits. Electrical Measuring Instruments. RC Circuits. Household Wiring and Electrical Safety		
10. Magnetic forces and fields		
11. Sources of magnetic fields. Electromagnetic induction		
12. Inductance		
13. Sinusoidal quantities. Definitions. Characteristic values. Alternating-Current Circuits		
14. Maxwell's equations. Source conversions. Superposition Theorem. Thévenin's and Norton's Theorems. Maximum power transfer theorem. Delta-Y (Pi-T) Conversions. Nodal and Mesh Analysis. Comparison of nodal and mesh		

Bibliography
1. Micu, D., Ţopa, V. Bazele electrotehnicii. Probleme de circuite electrice. Lito IPC-N, 1987
2. Răduleţ, R. Bazele electrotehnicii. Probleme. Vol. I,II EDP Bucureşti, 1970, 1975
3. Simion, E., ş.a. Bazele electrotehnicii. Îndrumător de laborator. Lito IPC-N, 1987
4. Dan Doru Micu, Laura Darabant, Denisa Ştеţ, Mihaela Creţu, Andrei Ceclan, Levente Czumbil, Teoria circuitelor electrice. Probleme, UT Press, Cluj-Napoca, 978-606-737-140-6, 2016.
5. Samuel J. Ling, William Moebs, Jeff Sanny. University Physics, Volume 2, Oct 6, 2016. https://openstax.org/books/university-physics-volume-2/pages/1-introduction

8.2. Seminar/ laboratory	**Teaching and learning methods**	**Remarks**
1. Electrostatics and Electrodynamics. Coulomb's Law	Hands-on exercises, blackboard presentations, additional explanations, and discussions	N/A
2. Gauss's Law. Electric Potential		
3. Electric capacitance. Applications of electrostatics		
4. Direct current circuits. Electrical measuring instruments.		
5. Magnetic forces and fields		
6. Inductance. Alternating current circuits.		
7. Thevenin's and Norton's theorems. The maximum power transfer theorem.		

Bibliography
1. Micu, D., Ţopa, V. Bazele electrotehnicii. Probleme de circuite electrice. Lito IPC-N, 1987
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9. Evaluation

Type of activity	9.1 Evaluation criteria	9.2 Evaluation methods	9.3 Percentage in the final grade
9.4. Course	Problem-solving skills. Presence, (inter)activity	Written exam	80%
9.5. Seminar/ laboratory	Problem-solving skills.	In-person and/or written exam, or via the TEAMS platform, if necessary	20%
9.6 Minimum standard for passing			
• Requirements for passing the exam: grade on practical assignments + grade on the written exam ≥ 5; • Formulating and solving typical logic design problems using the formal tools specific to the field.			

10. SDG labels (Sustainable Development Goals)

	○	Sustainable Development Generic Label						
								
○	○	○	○	○	○	○	○	◉
								No label applies
○	○	○	○	○	○	○	○	○

Date of entry:
May 9, 2026

Signature of course coordinator

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Signature of seminar coordinator

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Date of approval in the department:
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Signature of the head of department

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