SYLLABUS

1. Data about the program of study

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	3.00

2. Data about the subject

2.1	Subject name				Theory of electric circuits I	
2.2	Course responsible/ lecturer				Conf.dr.ing.ec. Mihaela Crețu – Mihaela.Cretu@ethm.utcluj.ro	
2.3	Teachers in charge of Seminars/ Laboratory/ Project				Conf.dr.ing.ec. Mihaela Crețu – Mihaela.Cretu@ethm.utcluj.ro	
2.4 Year of study	1	2.5 Semester	1	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*				DD	
	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	1	3.3 Laboratory	1	3.3 Project	
3.2 Total hours per semester	125	of which	3.5 Course	28	3.6 Seminar	14	3.6 Laboratory	14	3.6 Project	

3.7 Individual study:	
(a) Manual, lecture material and notes, bibliography	20
(b) Supplementary study in the library, online and in the field	20
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	20
(d) Tutoring	6
(e) Exams and tests	3
(f) Other activities	
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)

4.1	Curriculum	-
4.2	Competences	-

5. Requirements (where appropriate)

5.1	For the course	-
5.2	For the applications	-

6. Specific competences

Professional competences	- The ability to identify, define, and solve engineering problems in a systemic approach -The ability to manage specific applications of general electrical engineering -The ability to solve applications of electrical circuit theory through specific methods and procedures of electrical engineering -The ability to know the particularities of direct current and single-phase alternating current in electrical circuits -The ability to apply the fundamental theorems of electrical circuits in practice -The ability to determine the circulation of currents, voltage drops and to perform power balance in specific applications of electrical circuits.
Cross competences	- Flexibility in approaching and applying the knowledge acquired in practice -Ability to work in a team -Flexibility in using the knowledge acquired in previously studied subjects -Flexibility in applying the knowledge acquired in specialized subjects in the following years

7. Expected learning outcomes

Knowledge	The student/graduate identifies and describes basic concepts, principles, and methods from mathematics, physics and computer science.
Abilities	- The student/graduate operates with basic concepts, principles, and methods from fundamental disciplines. - The student/graduate solves mathematics and physics problems with engineering applicability and validates the obtained solutions. - The student/graduate performs engineering calculations of medium complexity and associates them with textual or Computer-Aided Design (CAD) specific graphical representations. - The student/graduate describes physical phenomena and processes.
Responsibility and autonomy	- The student/graduate applies the values of ethics and professional deontology within the engineering profession. - The student/graduate practices logical reasoning, evaluation, and self-evaluation in decision-making. - The student/graduate communicates effectively regarding engineering activities with a wide range of audiences.

8. Discipline objectives (based on specific competencies acquired)

7.1	General objective	To acquire the fundamental theoretical and applied knowledge regarding the study of electric circuits (direct current and single-phase alternating current)
7.2	Specific objectives	- Ability to address specific problems of direct current - Ability to address specific problems of single-phase alternating current - Ability to use the fundamental theorems of electrical circuits in practical applications

9. Contents

9.1. Course (Lectures)		Number of hours	Teaching methods	Additional remarks
1	*Presentation of the Syllabus of the Theory of Electric Circuits. Introduction in the Theory of Electric Circuits.* *Chapter 1. Introduction to Direct Current (DC) Circuit Theory* 1.1 Quantities, parameters of the linear direct current circuits. 1.2 Laws of the DC electrical circuits. Kirchhoff's current and voltage low. Power conservation law. Maximum power transfer 1.3 Resistor connection. Current divider. Voltage divider. Transformation diagrams of the DC electric circuits	2	The course will be taught both in a classic form (exposition on the blackboard/graphic tablet) and using multimedia methods: the power point presentation on-site or online using Microsoft Teams	On-site or online teaching according to current legislation
2	*Chapter 2. Methods for Analysing Linear DC Circuits* 2.1. Superposition theorem 2.2. Reciprocity theorem 2.3. Method of loop currents 2.4 Method of node voltages 2.5. Transfiguration methods of the DC linear electrical circuits (Equivalent voltage generator method – Thévenin. Equivalent current generator method – Norton) 2.6. Non-linear DC electrical circuits	2		
3	*Chapter 3. Circuit Elements in Quasi-Steady State* 3.1. Operating modes of electrical circuits 3.2. Fundamental relations for the study of the electrical circuits 3.3. Circuit elements	2		
4	*Chapter 4. Quantities, Parameters and Specific Theorems of the Linear Alternating Current (AC) Electrical Circuits* 4.1. Periodic quantities and sinusoidal quantities 4.2. Mathematical operations with sinusoidal quantities 4.3. Alternating current circuit elements	2		
5	*Chapter 4. Quantities, Parameters and Specific Theorems of the Linear Alternating Current (AC) Electrical Circuits* 4.4. Electric power in sinusoidal regime 4.5. Symbolic representation of sinusoidal quantities	2		

6	*Chapter 4. Quantities, Parameters and Specific Theorems of the Linear Alternating Current (AC) Electrical Circuits* 4.6. Complex characterization of linear circuits 4.7. Linear circuit theorems in complex form	2		
7	*Chapter 5. Equivalent impedances* 5.1. Equivalent impedance of circuits without couplings 5.2. Equivalent impedance of circuits with couplings 5.3. Transformer without ferromagnetic core	2		
8	*Chapter 6. Resonance in Sinusoidal Steady State Electrical Circuits* 6.1. Series resonance 6.2 Parallel resonance 6.3 Mixed resonance – series-parallel	2		
9	*Chapter 6. Resonance in Sinusoidal Steady State Electrical Circuits* 6.4. Power factor compensation 6.5. Energy oscillations in alternating current circuits	2		
10	*Chapter 7. Two – Port Network Electrical Circuits* 7.1. Two-port network equations 2 7.2. Equivalent schemes of the two-port network circuits 7.3. Open circuit and short circuit tests of the two-port network electrical circuits	2		
11	*Chapter 7. Two – Port Network Electrical Circuits* 7.4. Two-port network connections 7.5. Characteristic impedance and propagation constant of the symmetric two-port network electrical circuits 7.6. Electrical frequency filters	2		
12	*Chapter 8. Theorems and Methods for Solving Linear AC Electrical Circuits* 8.1. Superposition Method 8.2. Transfiguration methods: The equivalent voltage generator theorem (Thevenin); The equivalent current generator theorem (Norton). Vaschy theorem	2		
13	*Chapter 8. Theorems and Methods for Solving Linear AC Electrical Circuits* 8.3. Method of loop currents 8.4. Method of node voltages	2		
14	*Chapter 8. Theorems and Methods for Solving Linear AC Electrical Circuits*	2		

	8.5. Method of power separation 8.6. Applications			

Bibliography

[1] Mihaela Crețu, Lecture notes, https://users.utcluj.ro/~mihaela/
[2] R.V.Ciupa, V. Topa, The Theory of Electric Circuits, Casa Cartii de Stiinta, 1998
[3] J.A. Edminister, Electric Circuits, Second Edition, Schaum's Outline of Theory and Problems, 1995
[4] S. Franco, Electric circuits fundamentals, Fort WorthPhiladelphia, 1995
[5] N. Balabanian, Electric Circuits, McGraw-Hill Series in Electrical and Computer Engineering, 1994
[6] F.M.G. Tomescu, Fundamentals of electrical engineering : electric circuits, Matrix Rom, 2011
[7] Gh. Mîndru, Teoria circuitelor electrice, Ed. UTPRESS Cluj-Napoca, 2004
[8] M Iordache, L. Dumitriu, Teoria moderna a circuitelor electrice, Ed. All Educational, 2000
[9] E. Simion, T. Maghiar, Electrotehnica, EDP București, 1981

9.2. Applications - Seminar		Number of hours	Teaching methods	Additional remarks
1	*Seminar 1.* Equivalent resistances. Kirchhoff's current and voltage laws. The drop voltage between two nodes.	2	Blackboard based and with the interactive participation of students	On-site or online teaching according to current legislation
2	*Seminar 2.* Power conservation. Maximum power transfer. Methods for solving linear DC electrical circuits	2		
3	*Seminar 3.* Methods for solving linear DC electrical circuits	2		
4	*Seminar 4.* Sinusoidal quantities. Phasor diagrams. Equivalent impedances	2		
5	*Seminar 5*. Methods for solving linear alternating current electrical circuits	2		
6	*Seminar 6.* Solving the two-port network electrical circuits (parameters calculations, two-port network connections)	2		
7	*Seminar 7.* Electrical frequency filters applications	2		

Bibliography

[1] Mihaela Crețu, Lecture notes, https://users.utcluj.ro/~mihaela/
[2] R.V.Ciupa, V. Topa, The Theory of Electric Circuits, Casa Cartii de Stiinta, 1998
[3] J.A. Edminister, Electric Circuits, Second Edition, Schaum's Outline of Theory and Problems, 1995
[4] D.D. Micu, L. Darabant, D. Stet, M. Cretu, A. Ceclan, L. Czumbil, Teoria circuitelor electrice. Probleme, UTPress, Cluj-Napoca, 2016
[5] L. Man, E. Man, Bazele Electrotehnicii. Probleme de circuite, Mediamira, Cluj-Napoca, 2007.

9.3. Applications - Laboratory		Number of hours	Teaching methods	Additional remarks
1	*Laboratory 1.* Training for occupational hazards and safety. Study of the DC electrical circuits	2	Laboratory classes are conducted through the practical implementat	
2	*Laboratory 2.* Study of the power conservation theorem in linear DC electrical circuits	2		
3	*Laboratory 3.* Study of passive dipole in alternating current	2		

4	*Laboratory 4*. Study of a series R, L, C circuit and voltage resonance	2	ion of various circuits for experimental verification of course chapters, with the active involvement of students.	
5	*Laboratory 5.* Study of a parallel R, L, C circuit and current resonance	2		
6	*Laboratory 6.* Study of the power conservation theorem in linear AC electrical circuits	2		
7	*Laboratory 7.* Study of a passive two-port networ	2		

Bibliography

[[1] Mihaela Crețu, Lecture notes, https://users.utcluj.ro/~mihaela/

[2] C. Păcurar, A.N. Giurgiuman, M. Crețu, M.R. Gliga, S.I. Andreica, Bazele electrotehnicii-Îndrumător delaborator, Editura U.T. Press, Cluj-Napoca, 2020

[3] E. Simion, Bazele electrotehnicii- Îndrumător de laborator, Ed. UR Press, 1982

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

The content of the discipline and the acquired skills are consistent with the expectations of professional organizations and employers in the field in which students perform internships and/or occupy a job (in the field of Electrical Engineering:

11. Assessment

Activity type	11.1 Assessment criteria	11.2 Assessment methods	11.3 Weight in the final grade (%)
11.4 Course	The level of theoretical knowledge acquired	Final test from the theoretical part within a given time frame	40%
11.5 Laboratory	The skills of solving electrical circuits	Final test - Solving problems within a given time frame	40%
11.6 Project	The level of practical knowledge acquired	Laboratory test	10%

11.7 Minimum standard of performance:

Quality level

Minimal knowledge

-Understanding the concepts, laws, specific theorems and methods for the analysis of DC and ACelectrical circuits to apply them in solving concrete practical applications (specific problems)

Minimum skills

-Analysis of electrical circuits of medium complexity for design and measurement

-Easily solve problems of electrical circuits of medium complexity

Quantitative level

-Completion of all laboratory work

-Exam and laboratory grades must be at least 5.

Minimum standard of performance

N=(4pC+4pS+1pL+1pO)≥5

Date of completion	Lecturers	Title/ Surname/ Name:	Signature
September 2025	Course	Conf.dr.ing.ec. Mihaela Crețu	
	Seminar	Conf.dr.ing.ec. Mihaela Crețu	
	Laboratory	Conf.dr.ing.ec. Mihaela Crețu	

Date of approval in the ETHM Department Council January 2026	**Head of Department:** Prof. Eng. MICU Dan Doru, PhD
Date of approval in the Faculty of Electrical Engineering Council February 2026	**Dean:** Assoc. Prof. Eng. CZIKER Andrei, PhD