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	21.00

2. Data about the subject

2.1	Subject name				**Electrotechnical Materials**	
2.2	Course responsible/ lecturer				*Turcu Antoniu-Claudiu, antoniu.turcu@enm.utcluj.ro*	
2.3	Teachers in charge of Seminars/ Laboratory/ Project				*Turcu Antoniu-Claudiu, antoniu.turcu@enm.utcluj.ro*	
2.4 Year of study		2	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 Curs	2	3.3 Seminar		3.3 Laboratory	2	3.3 Project	
3.4 Total hours in the curriculum	56	of which:	3.5 Curs	28	3.6 Seminar		3.6 Laboratory	28	3.6 Project	
3.7 Individual study:										
(a) Manual, lecture material and notes, bibliography										12
(b) Supplementary study in the library, online and in the field										12
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays										20
(d) Tutoring										-
(e) Exams and tests										2
(f) Other activities										-

3.8 Total hours of individual study (summ (3.7(a)…3.7(f)))	44
3.9 Total hours per semester (3.4+3.8)	100
3.10 Number of credit points	4

4. Pre-requisites (where appropriate)

4.1 Curriculum	
4.2 Competence	Physics, Chemistry, Electrical Circuit Theory, Special Mathematics

5. Requirements (where appropriate)

5.1. For the course	Cluj-Napoca, Active involvement
5.2. For the applications Laboratory	Cluj-Napoca, Mandatory

6. Specific competences

Professional skills	- To be able to understand the behavior of materials under different operating conditions; - To know the phenomena that occur when electrotechnical materials are introduced into electromagnetic fields; - To know the main properties and areas of use of electrotechnical materials; - To know how to correctly choose materials for specific technical applications; - To know the methodology for measuring and evaluating material parameters; - To know the factors that influence material properties.
Transversal skills	

7. Expected learning outcomes

Knowledge	The student/graduate identifies, formulates, analyzes the principles of electricity circuits and the risks associated with them.
Abilities	The student/graduate adjusts product designs or product parts so that they meet the requirements. The student/graduate creates and/or executes a plan or specification for the design of industrial systems, materials, products or a production plan, based on aesthetic and/or functional design concepts.
Responsibility and autonomy	The student/graduate selects and uses bibliographic sources specific to the field. The student/graduate demonstrates autonomy in learning specific engineering issues.

8. Discipline objectives (as results from the *key competences gained*)

8.1 General objective	To be able to know and understand various aspects related to electrotechnical materials, their properties, fields of applicability
8.2 Specific objectives	The student can demonstrate that he/she has acquired sufficient knowledge to understand the concepts that have been studied.

9. Contents

9.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
Elementary notions of body structure: Bonding forces, Crystalline structure of bodies.	2	Participatory lecture, debate, presentation, online	**56 hours**
Dielectric materials: electrical characteristics, polarization mechanisms, functions of dielectric materials, study of temporary polarizations.	2		
Temporary polarization: permittivity in harmonic electric fields, losses in dielectrics.	2		
Permanent polarization: ferroelectrics, piezoelectrics.	2		
Electrets. Liquid crystals.	2		
Conduction of electrically insulating materials.	2		
Breakdown of electrically insulating materials.	2		
Presentation of dielectrics with temporary polarization.	2		
Semiconductor materials: conduction, galvanometric effects.	2		

Semiconductor materials: properties and fields of use.	2		
Conductor materials: conduction, superconductivity, functions, properties and uses	2		
Magnetic materials: definitions, classifications, functions;	2		
Properties of magnetic materials	2		
Presentation of magnetic materials	2		

Bibliography

1. Micu, R., Creţ, R. Materiale electrotehnice. U.T. Pres, Cluj – Napoca, 2002
2. Cătuneanu V.M. Micu, R. ş.a. Materiale pentru electronică, E.D.P., Bucureşti, 1982
3. Creţ, R. Materiale pentru electronică. U.T. Pres, Cluj – Napoca, 2004
4. Ifrim, A., Noţingher, P. Materiale electrotehnice. E.D.P, Bucureşti, 1990.
5. Helerea, E. Materiale electrotehnice. Dielectrici. Editura Universităţii Transilvania, Braşov, 1998

9.2 Laboratory activity	Nr. ore	Metode de predare	Observaţii
Determination of volume and surface resistivities of	2	**Discussions,**	**420 ore**
insulating materials.		**debate, onsite**	
Variation of dielectric characteristics with frequency.	2		
Temperature dependence of dielectric characteristics	2		
Testing transformer oil	2		
Determination of magnetic characteristics of electrical sheet metal using the 25 cm Epstein apparatus	2		
Study of ferrimagnetic materials	2		
Influence of the continuous component of the magnetic field on the magnetic characteristics of materials temperature	2		
Determination of magnetic properties by the method of visualizing the dynamic hysteresis cycle on the cathode oscilloscope	2		
Determination of characteristics of hard magnetic materials	2		
Determination of characteristics of varistors and thermistors	2		
Temperature dependence of the static characteristic of the pn junction	2		
Temperature dependence of the resistivity of metallic conductors	2		
Determination of the main electrical parameters of semiconductors	2		
Study of the behavior of semiconductors in magnetic and electric fields	2		

Bibliografie

1. Antoniu TURCU, Rodica CRET. Materiale electrotehnice. Îndrumător de laborator. Ed. Mediamira, 2012
2. Antoniu TURCU, Cosmin DARAB, Materiale Electrotehnice, Indrumator de laborator, Ed. Mediamira, 2017

10. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

In developing the content of the discipline, the requirements and expectations of representatives of the epistemic community, professional associations and representative employers in the fields related to the discipline were taken into account.

11. Evaluare

Activity type	11.1 Assessment criteria	11.2 Assessment methods	11.3 Weight in the final grade

11.4 Course	Involvement in solving the written exercises	EXAM	80%
11.5 Laboratory	Involvement in solving developing the laboratory setup and tests	Validation of the laboratory activity.	20%
10.6 Minimum standard of performance: 5			

Data completării:	**Titulari**	**Titlu Prenume NUME**	**Semnătura**
17.11.2025	Lecturer	Assoc. Prof. Antoniu-Claudiu TURCU, Ph.D, Eng., Ec. Ref.	
	Applications	Assoc. Prof. Antoniu-Claudiu TURCU, Ph.D, Eng., Ec. Ref.	

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