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	55.00

2. Data about the subject

2.1	Subject name			Electrical Drives		
2.2	Course responsible/ lecturer			Prof. eng Iulian Birou, Phd. (birou@edr.utcluj.ro),		
2.3	Teachers in charge of Seminars/ Laboratory/ Project			Asist. Eng. Mihai Suciu, Phd. (Mihai.Suciu@emd.utcluj.ro)		
2.4 Year of study	IV	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*				DS	
	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	56	of which	3.5 Course	28	3.6 Seminar		3.6 Laboratory	28	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	23
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	20
(d) Tutoring	3
(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	General knowledge on System Theory, Electrotechnics, Electrical Machines, Power Electronics
4.2	Competences	Specific competences related to System Theory, Electrical Machines, Power Electronics

5. Requirements (where appropriate)

5.1	For the course	

5.2	For the applications	Mandatory presence

6. Specific competences

Professional competences	C6. Design and control of electrical drive systems C6.1. Identification of fundamental aspects specific related to system theory and automated control, and of the investigation methods of an electrical drive system. C6.3. Application of control principles and specific procedures used for optimization of working parameters of a control system, for evaluation of the working limits of an electrical drive system. C6.4. Development of digital control based electrical drives fed by power electronic converters controlled by dedicated microprocessor or DSP based systems. C6.5. Development of a control system of reduced complexity of an industrial process using specific techniques and procedures.
Cross competences	CT1 Identification of the main objectives, available resources, completion conditions, work steps, work times, terms and related risks. CT3 Efficient use of documentation and communication resources and assisted professional training (on-line database, specific software and hardware solutions.

7. Expected learning outcomes

Knowledge	The student/graduate describes, identifies, and analyzes electromagnetic and mechanical phenomena specific to electromechanical converters, electrical equipment, and electromechanical drives.
Abilities	The student/graduate explains and interprets the operating regimes of electrical equipment and electromechanical systems. The student/graduate identifies electromechanical systems based on their components, including their mathematical modeling, as well as their kinematic and dynamic description. The student/graduate designs electromechanical or electrical installations.
Responsibility and autonomy	The student/graduate applies this advanced knowledge to efficiently design and size electromechanical and electrical installations in compliance with applicable standards.

8. Discipline objectives (based on specific competencies acquired)

8.1	General objective	To know the electrical drive systems with DC and AC machine fed by power converters. To know the scalar control, vector control and direct torque control of induction and synchronous machines, both in motor and generator regime.
8.2	Specific objectives	After the completion of this course, students will be able: □ To chose and to control an electrical drive system for a specific application;

		To integrate the electrical drive system in a motion control process or in a power generating process. To identify, to design and to assembly the components of an adjustable speed electrical driving system (electrical machine, power converter, mechanical process, control system, digital computer); To measure the parameters of an electrical drive system

9. Contents

9.1. Course (Lectures)		Number of hours	Teaching methods	Additional remarks
1	The structure of a performant electreical drive system. Power flow componets and information Flow components.	2	Multimedia presentation, group projects, case studies	
2	Basic principals of electrical drives. Mechanical elements and power efficiency of electrical drives, stability criteria and applications of electrical drives	2		
3	Electrical drive systems with DC machines feded by rectifiers nd choppers; control functions	2		
4	Control diagram of DC drive system	2		
5	Basic principals of three-phase AC electrical machines (IM and SM); rotating field, equations, characteristics	2		
6	Scalar control (U/f =ct) of AC drives	2		
7	Vector control of AC drives. Principals, equivalence with DC drive control, power converters for AC drives, control strategies.	2		
8	Direct torque control of AC drives	2		
9	Electrical drive systems with AC machines used for producing electrical energy. Constant speed generating systems and variable speed generating systems (renewable energy generating systems)	2		
10	Transducers and digital computing systems used for performant electrical drive systems. Modern control strategies	2		
11	The structure of a performant electreical drive system. Power flow componets and information Flow components.	2		
12	Basic principals of electrical drives. Mechanical elements and power efficiency of electrical drives, stability criteria and applications of electrical drives	2		

13	Electrical drive systems with DC machines feded by rectifiers nd choppers; control functions	2		
14	Control diagram of DC drive system	2		

Bibliography

1. Kelemen, A.: Acţionări electrice. Ed. Didactică şi Pedagogică, Bucureşti, 1979.
2. Iulian Birou - Metode performante de control in actionari electrice de curent alternativ. Editura Casa cartii de stiinta, 1999.
3. Kelemen, A., Imecs, M.: Sisteme de reglare cu orientare după câmp ale maşinilor de curent alternativ. Lito I.P.C.N. 1987 sau Editura Academiei Române, Bucureşti, 1989.
4. Iulian Birou – Actionari electrice; Sisteme de reglare si control. Editura Mediamira, 2003
5. Kelemen, A., Imecs, M.: Electronică de putere. Ed. Didactică şi Pedagogică, Bucureşti, 1983.

9.2. Applications - Seminar /Laboratory/Project		Number of hours	Teaching methods	Additional remarks
1	1.a. DC drive system with PM excitation, fed by power converter	2		
	1.b. Drive system with DC machine fed in both in rotor and stator by power converters	2		
2	2a. Drive system with DC machines for elevators (2 quadrant)	2		
	2b. Drive system with DC machines for 4 quadrant applications	2		
3	3a Control of a DC drive system fed by 4 quadrant rectifier	2		
	3b. Control of a DC drive system fed by 4 quadrant chopper	2		
4	4a. Electrical drive system with three-phase rotor winding induction machine.	2		
	4b. Scalar control of three-phase squirel-cage induction machine (DSP based open loop U/f=ct.)	2		
5	5a. AC drive system with induction machine fed by a current convertor 5b. Scalar control of three-phase induction machine (DSP based close-loop control U/f=ct. With initial boost voltage).	2		
6	6a. Vector control of an induction machine based on rotor field orientation fed by PWM voltage converter. 6b. Vector control of a permanent-magnet synchronous fed by PWM voltage converter.	2		
7	Final presentation and evaluation	4		

Bibliography

[1] *Acţionări electrice - Îndrumător pentru lucrări de laborator*, versiune electronica, 2019

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

11. Assessment

Activity type	11.1 Assessment criteria	11.2 Assessment methods	11.3 Weight in the final grade (%)
11.4 Course	Evaluation of the acquired knowledge during the course activities: theoretical and application-based exam	Written and oral exam (3h)	65%
11.5 Laboratory	Evaluation of the acquired competences based on: - Activity during lab - theoretical and practical tests - portfolio	- portfolio presentation - tests	35%
11.6 Minimum standard of performance: N>5			

Date of completion	**Lecturers**	**Title/ Surname/ Name:**	**Signature**
January 2026	Course	Prof. eng Iulian Birou, Phd.	
	Applications Seminar/ Laboratory/ Project	Asist. Eng. Mihai Suciu, Phd. (	

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