

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	Power Engineering and Management
1.4	Field of study	Energy Engineering
1.5	Cycle of study	Master of Science
1.6	Program of study/ Qualification	Modern Power Systems
1.7	Form of education	Full time
1.8	Subject code	10.00

2. Data about the subject

2.1	Subject name	Smart Grid		
2.2	Course responsible/ lecturer	Conf.dr.ing. Silviu Ștefănescu		
2.3	Teachers in charge of Laboratory	Conf.dr.ing. Silviu Ștefănescu		
2.4 Year of study	1	2.5 Semester	2	2.6 Type of assessment (<i>E – exam, C – colloquium, V – verification</i>)
2.7 Subject category	<i>DF – fundamental, DD – in the field, DS – specialty, DC – complementary</i>			E
	<i>DI – compulsory, DO – elective, Dfac – optional</i>			DA

3. Estimated total time

3.1 Number of hours per week:	3	of which	3.2 Course	2	3.3 Seminar	-	3.3 Laboratory	1	3.3 Project	
3.4 Total hours per semester	42	of which	3.5 Course	28	3.6 Seminar	-	3.6 Laboratory	14	3.6 Project	
3.7 Individual study:										
(a) Manual, lecture material and notes, bibliography										28
(b) Supplementary study in the library, online and in the field										14
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays										7
(d) Tutoring										4
(e) Exams and tests										4
(f) Other activities										1
3.8 Total hours of individual study [<i>sum (3.7(a) to 3.7(f))</i>]					58					
3.9 Total hours per semester [<i>sum of 3.4 and 3.8</i>]					100					
3.10 Number of credit points					4					

4. Prerequisites (where applicable)

4.1	Curriculum	Electric power production, transport and distribution, Electrical networks.
4.2	Competences	Computer skills

5. Requirements (where appropriate)

5.1	For the course	Multimedia means
5.2	For the applications	PC network

6. Specific competences

Professional competences	• The ability to use software products to monitor and manage processes specific to energy engineering while ensuring the safety of personnel in electrical installations of any level. • Application of basic principles and methods from software programs and digital technologies to solve well-defined problems related to programming, databases, aided graphics, modeling, computer-aided design of power systems and technologies, investigation and computerized data processing specific to electrical and energy engineering. • Elaboration of projects of medium complexity using computer-aided design. • Development of the ability to use tools and methods of management of power systems. • Skills in solving specific applications for electricity management using the computer.
Cross competences	• Applying the values and ethics of the engineering profession and the responsible execution of professional tasks under conditions of limited autonomy and qualified assistance. Promoting logical, convergent and divergent reasoning, practical applicability, evaluation and self-evaluation in decision-making. • The objective self-assessment of the need for continuous professional training for the purpose of insertion on the labor market and adaptation to the dynamics of its requirements and for personal and professional development. Effective use of language skills and knowledge of information and communication technology.

7. Expected learning outcomes

On completion of the discipline, the student will be able to demonstrate:

Knowledge	Has in-depth knowledge of the architectures, functions and current trends of modern power systems and smart grids. Critically understands the integration of distributed resources, operational flexibility and the impact of digital technologies on the energy system. Correlates advanced domain knowledge with sustainability, resilience and energy efficiency objectives.
Skills	Analyses operating regimes and formulates technically substantiated solutions for the configuration and operation of power systems. Integrates technical, operational and economic data for evaluating system development alternatives. Applies interdisciplinary approaches for optimising operation and modernising energy infrastructure.
Responsibility and autonomy	Manages complex and unpredictable work or study situations requiring strategic decisions. Autonomously grounds professional solutions and assumes their technical and organisational implications. Contributes responsibly to the development of professional practices and to the coordination of activities within technical teams.

8. Discipline objectives (based on specific competencies acquired)

8.1 General objective	The use of the computer in applications specific to electrical engineering.
8.2 Specific objectives	• Realization of the model of an electrical network. • Calculation of the permanent regime (methods, parameters); automatic voltage control. • Determination of OTC (own technological consumption) on a chosen area. • Determination of the characteristic values of the short-circuit regime. • Aspects of power quality; determining indicators. • SCADA.

9. Contents

9.1. Course (Lectures)		Number of hours	Teaching methods	Additional remarks
1	Introduction to Smart Grids (SG)	2	Presentation and discussions	...
2	Power System Operation.	2		
3	Distributed Generation Using Renewable Energy Sources - Distributed Generation (DG).	2		

4	Optimizing the operation of the power system by optimizing consumption - Demand Side Management (DSM).	2		
5	Virtual Power Plants - (VPP).	2		
6	Electric Energy Storage.	2		
7	Electric Vehicle (EV)	2		
8	Information and Communications Technology (ICT)	2		
9	Power System Stability	2		
10	Protections through Relays and Control of Intelligent Networks.	2		
11	Smart Metering	2		
12	Modern Technologies for Transport and Distribution of Electric Energy.	2		
13	Interoperability and Cyber Security.	2		
14	Socio-Economic Aspects of the Use of Intelligent Networks.	2		
Bibliography				
[1]. Electric Distribution Systems", Abdalhay A. Sallam, OM P. Malik, Wiley				
[2]."SmartGrids", Nouredine Hadjsaid and Jean-Claude Sabonnadière, Wiley				
[3]."Smart Grid - Fundamentals of Design and Analysis", James Momoh, Wiley				
[4]."Electric Power Distribution Handbook", T. A. Short, CRC Press.				
9.2. Applications - Laboratory		Number of hours	Teaching methods	Additional remarks
1	Modeling and Design of Intelligent Networks.	2	Computer operation, modeling, calculations, discussions.	Video Projector, PC, Paladin software
2	Communication Networks.	2		
3	Communication Standards and Protocols.	2		
4	Supervisory, Control and Data Acquisition (SCADA).	2		
5	Control Standards and Protocols.	2		
6	Case study - Demand Side Management (DSM).	2		
7	Case study - Operation of Distribution Networks.	2		
Bibliography				
[1]. Electric Distribution Systems", Abdalhay A. Sallam, OM P. Malik, Wiley				
[2]."SmartGrids", Nouredine Hadjsaid and Jean-Claude Sabonnadière, Wiley				
[3]."Smart Grid - Fundamentals of Design and Analysis", James Momoh, Wiley				
[4]."Electric Power Distribution Handbook", T. A. Short, CRC Press.				

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

The courses and applications take into account the requirements and expectations of the business environment: well-known companies in the field, collaborators from the industrial and economic environments, colleagues from other university centers.

11. Assessment

Activity type	10.1 Assessment criteria	10.2 Assessment methods	11.3 Weight in the final grade (%)
11.4 Course	Knowledge of the taught material, involvement in discussions.	Written exam and practical test (E).	66%
11.5 Laboratory	The method of carrying out the project, the activity within the application hours, the presentation of the results.	Project verification made on the computer (P).	34%
11.6 Minimum standard of performance: $E, P \geq 5$ The formula for calculating the mark $N = (2 \cdot E + P) / 3$			

Date of completion	Lecturers	Title/ Surname/ Name:	Signature
September 2024	Course	Conf. Eng. Silviu Ștefănescu PhD	
	Applications Laboratory	Conf. Eng. Silviu Ștefănescu PhD	

Date of approval in the council of the Department of Power Engineering and Management September 2024	Head of Department: Assoc. Prof. Eng. Horia G. BELEIU, PhD
Date of approval in the Faculty of Electrical Engineering Council September 2024	Dean: Assoc. Prof. Eng. Andrei C. CZIKER, PhD