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	56.10

2. Data about the subject

2.1	Subject name				Smart Grid Technologies	
2.2	Course responsible/ lecturer				assoc. prof. dr. eng. Silviu Ștefănescu	
2.3	Teachers in charge of Seminars/ Laboratory/ Project				assoc. prof. dr. eng. Aurel Botezan	
2.4 Year of study		IV	2.5 Semester	2	2.6 Type of assessment *(E – exam, C – colloquium, V – verification)*	C
2.7 Subject category		*DF – fundamental, DD – in the field, DS – specialty, DC – complementary*				DS
		DI – compulsory, DO – elective, Dfac – optional				DO

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	
3.4 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	28
(b) Supplementary study in the library, online and in the field	14
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	20
(d) Tutoring	4
(e) Exams and tests	2
(f) Other activities	1

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	Electric power transmission and distribution systems, Power Systems Automation, Power Systems Protection
4.2	Competences	computer operation and programming

5. Requirements (where appropriate)

5.1	For the course	Multimedia support
5.2	For the applications	Computer network

6. Specific competences

Professional competences	• The ability to use software products to monitor and manage processes specific to power systems 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. Discipline objectives (based on specific competencies acquired)

7.1	General objective	The use of the computer in applications specific to power systems engineering.
7.2	Specific objectives	• Modelling and analysis of an power system network. • Calculation of the permanent regime (methods, parameters); automatic voltage control. • Determination of CPT (own technological consumption) on a chosen area. • Determination of the characteristic values of the short-circuit regime. • Aspects of electricity quality; determining power quality indicators. • SCADA.

8. Contents

8.1. Course (Lectures)		Number of hours	Teaching methods	Additional remarks
1	Introduction to the Smart Grid concept	2	Presentation and discussions	…
2	Smart Grid versus conventional electrical networks	2		
3	Smart Grid infrastructure	2		
4	Smart Grid interoperability standards	2		
5	Smart Grid communication system and its cyber security	4		
6	International standard IEC 61850 and its application to Smart Grid	2		

7	Power system protection under Smart Grid environment	4		
8	Application of Smart Grid concept to distribution networks	2		
9	Smart Grid enables the integration of electric vehicles	2		
10	Smart Grid and energy storage systems	2		
11	Smart transmission grid	2		
12	Course review and final conclusions	2		

Bibliography

[1] Salman K. Salman, Introduction to the Smart Grid/ Concepts, Technologies and Evolution, IET ENERGY ENGINEERING SERIES 94, ISBN 978-1-78561-120-9 (PDF)
[2] "Electric Distribution Systems", Abdalhay A. Sallam, OM P. Malik, Wiley
[3] "SmartGrids", Nouredine Hadjsaid and Jean-Claude Sabonnadièr, Wiley
[4] "Smart Grid - Fundamentals of Design and Analysis", James Momoh, Wiley
[5] "Electric Power Distribution Handbook", T. A. Short, CRC Press

8.2. Applications - Seminar /Laboratory/Project		Number of hours	Teaching methods	Additional remarks
1	Laboratory 1. Modeling and Design of Intelligent Networks	4		
2	Laboratory 2. Communication Networks	4		
3	Laboratory 3. Communication Standards and Protocols	4		
4	Monitoring and Control Systems - Supervisory, Control and Data Acquisition (SCADA)	4	…	…
5	Control Standards and Protocols	4		
6	Case Study - Demand Side Management (DSM)	4		
7	Case Study - Operation of Distribution Networks	4		

Bibliography

[1] Salman K. Salman, Introduction to the Smart Grid/ Concepts, Technologies and Evolution, IET ENERGY ENGINEERING SERIES 94, ISBN 978-1-78561-120-9 (PDF)
[2] "Electric Distribution Systems", Abdalhay A. Sallam, OM P. Malik, Wiley
[3] "SmartGrids", Nouredine Hadjsaid and Jean-Claude Sabonnadièr, Wiley
[4] "Smart Grid - Fundamentals of Design and Analysis", James Momoh, Wiley
[5] "Electric Power Distribution Handbook", T. A. Short, CRC Press

9. 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.

10. Assessment

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade (%)
10.4 Course	Knowledge of the taught material, involvement in discussions.	Written exam and interview/ discussions.	0.66
10.5 Laboratory	The method of carrying out the project, the activity within the application hours, the presentation of the results.	Project presentation and test.	0.34
10.5 Project	…	…	…
10.6 Minimum standard of performance: N >= 5 N=(E [%] +P [%])*10			

Date of completion	Lecturers	Title/ Surname/ Name:	Signature
September 2024	Course	assoc. prof. dr. eng. Silviu ŞTEFĂNESCU	…
	Applications Seminar/ Laboratory/ Project	assoc. prof. dr. eng. Aurel BOTEZAN	…
		…	…

Date of approval in the ETHM Department Council September 2024	**Head of Department:** Prof. Eng. MICU Dan Doru, PhD
Date of approval in the Faculty of Electrical Engineering Council September 2024	**Dean:** Assoc. Prof. Eng. CZIKER Andrei, PhD