SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	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	36

2. Data about the subject

2.1 Subject name				Electric Power Generation, Transmission and Distribution	
2.2 Course responsible/lecturer				Prof. Eng. Radu-Adrian TÎRNOVAN, PhD	
2.3 Titular of applications				Lecturer Eng. Maria Cristea, PhD	
2.4 Year of study	3	2.5 Semester	5	2.6 Assessment type	E
2.7 Discipline regime	Subject category				DD
	Optionality				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	-
3.4 Number of hours per semester	56	din care:	3.5 Course	28	3.6 Seminar		3.6 Laboratory	28	3.6 Project	-

3.7 Distribution of time fund (hours per semester) for:	
(a) Study by textbook, course support, bibliography and notes	28
(b) Additional documentation in the library, on specialized electronic platforms and in the field	8
(c) Preparation of seminars / laboratories, homework, reports, portfolios and essays	24
(d) Tutorial	2
(e) Examinations	5
(f) Other activities:	2

3.8 Total of individual study hours (sum of (3.7(a)…3.7(f)))	69
3.9 Total hours per semester (3.4+3.8)	125
3.10 Number of credits	5

4. Prerequisites (where appropriate**)**

4.1. Compulsory	Knowledge of Electrical Engineering Basics, Electrical Equipment
4.2. Recommended	No

5. Requirements (where appropriate)

5.1. For the course (where/when)	• Multimedia equipment
5.2. For the applications	• Laboratory attendance is mandatory. • Knowledge and observance of Labor Safety Standards

6. Specific competences (Learning Outcomes**)**

Professional Competences	• Identification of principles, working parameters and components of industrial manufacturing equipment and logistics specific to power systems. • Use of methods and models for the design and operation of power systems. • Design, testing and exploitation of medium-energy power systems. • Design, documentation, testing and exploitation of power systems using standard concepts, methods and theories. • Elaboration of professional projects for power systems. • Skills in solving specific applications for power systems management. • Developing the ability to use tools and methods of management of power systems
Cross competences	• Responsible execution of professional tasks under conditions of limited autonomy (realization of themes for independent study). • Awareness of the need for continuous training. • Efficient use of learning resources and techniques for personal and professional development - efficient use of communication and training resources (Internet, e-mail, databases, on-line courses, etc.), including using foreign languages.

7. Discipline objectives (according to the Specific competences)

7.1 General objective of the discipline	Developing skills in the field of design, operation and management of power systems (PS)
7.2 Specific objectives	1. Assimilation of knowledge on PS role and composition (structure of a PS) and trends in PS development. 2. Assimilation of basic theoretical knowledge regarding electricity generation: - in large power plants. - distributed electricity generation - generating electricity from renewable sources. - storage of electricity, - knowledge necessary for the analysis of electrical energy sources and their pre-dimensioning. 3. Assimilation of the theoretical knowledge necessary for the dimensioning of PS elements, electrical lines, transformers, generators, etc. 4. Assimilation of the theoretical knowledge necessary for the modeling of the system elements, simulation and analysis of PS (power-flow and short-circuit fault study). 5. Obtaining the necessary skills to design and manage the PS of medium complexity.

8. Contents

8.1 Course (syllabus)	Nr. of hours	Teaching Methods	Notes
1. Power System Concept (PS)	2	Presentation and discussions	
2. Generation of electricity in conventional thermoelectric power plants	2		
3. Generation of electricity in hydropower plants	2		
4. Generation of electricity with wind power installations	2		
5. Solar power plants	2		
6. Fuel cells systems	2		
7. Electrical energy storage systems. Classification, methods of energy storage	2		
8. Classification of electrical networks. Electrical Network Architecture	2		
9. Modeling of power system elements	2		

10. Electrical lines dimensioning	2		
11. Power-flow study of PS	2		
12. Faults in electrical networks. Short-circuit fault I	2		
13. Faults in electrical networks. Short-circuit fault II	2		
14. Protections in the PS. Principles of protection	2		

References (Bibliography)

1. R. Tîrnovan, Electric Power Generation, Transmission and Distribution - Course (in Romanian). Ed. "UT Press" Cluj-Napoca, 2017, ISBN 978-606-737-273-1.
2. Dan Călin Peter, Radu-Adrian Tîrnovan, Electricity Transmission and Distribution (in Romanian), Cluj-Napoca, U.T. Press, 2014 ISBN 978-973-662-960-0
3. Dan Călin Peter, **Radu-Adrian Tîrnovan**, Cristian Barz, Electrical installations (in Romanian), Ed. UT. PRESS, Cluj-Napoca, 2017, ISBN 978-606-737-262-5
4. **Radu-Adrian Tîrnovan**, Digital Protections in Power Systems (in Romanian), Editura U.T.Press, Cluj-Napoca - 2019, ISBN 978-606-737-370-7
5. Gilbert M. Masters, Renewable and Efficient Electric Power Systems, 2004 by John Wiley & Sons, Inc., Hoboken, New Jersey, ISBN 0-471-28060-7

Virtual Learning Materials:

6. Tîrnovan R., Power Generation, Transmission and Distribution, Course (in Romanian), PPT, Word
7. Tîrnovan R., Power Generation, Transmission and Distribution, Laboratory Works (in Romanian), PPT, Word

8.2 Laboratory	Nr. of hours	Teaching Methods	Notes
1. Presentation of lab Applications	2	Presentation, discussions, conclusions	Field conditions, measurements, application of optimal conditions
2. Construction of power steam generation plants	2		
3. Construction of nuclear power plants	2		
4. Hydroelectric Power Plant Installations	2		
5. Overhead power lines: active and protective conductors (guard)	2		
6. Overhead power lines: insulators and supports	2		
7. Construction of power stations and transformation stations	2		
8. Description and technical characteristics of the simulator intended for the study of electrical networks	2		
9. Study of Synchronous Generators	2		
10. Study of the operation of power lines in the absence of load	2		
11. Study of the operation of electricity transmission lines in the presence of the load	2		
12. Study of the operation of electric power transmission lines in the presence of distributed loads (series lines)	2		
13. Overcurrent protection of radial networks	2		
14. Overcurrent directional protection	2		

References

1. Radu-Adrian Tîrnovan, Aurel Botezan, Elena Breaz, Electric Power Generation, Transmission and Distribution - Laboratory (in Romanian). Ed. "UT Press" Cluj-Napoca, 2017 ISBN 978-606-737-272-4

Virtual Learning Materials:

2. Tîrnovan R., Electric Power Generation, Transmission and Distribution - Laboratory, PPT

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

The skills acquired will be necessary for employees working in the field of electrical and energy engineering, the possible occupations being specified in the Official Gazette of Romania, Part I, no. 561/8.VIII.2011

10. Assessment

Type of activity	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade (%)
10.4 Course	Understanding criteria and phenomena, engaging in discussions, formulating questions, participating in consultations, being able to solve concrete applications.	Written exam (E) – grid, applications on aspects from the course.	70%
10.5 Laboratory	Laboratory activity, conspectus, experimental data processing, homework.	Written and oral test	30%
10.6 Minimum standard of performance: E+L ≥ 5.			

Date of completion	**Lecturers**	**Title/ Surname/ Name:**	**Signature**
September 2024	Course	Prof. Eng. Radu-Adrian TÎRNOVAN, PhD	
	Laboratory	Lecturer Eng. Maria Cristea, PhD	

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