# SYLLABUS

## 1. Data about the program of study

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| 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 | 54.20 |

## 2. Data about the subject

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|---|---|---|---|---|---|---|
| 2.1 | Subject name | | | | Power Substations | |
| 2.2 | Course responsible/ lecturer | | | | Lecturer Corina Martineac Ph.D | |
| 2.3 | Teachers in charge of Seminars/ Laboratory/ Project | | | | Lecturer Corina Martineac Ph.D | |
| 2.4 Year of study | | 4 | 2.5 Semester | 1 | 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* | | | | 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 | 1 | 3.3 Project | 1 |
| 3.4 Number of hours per semester | 56 | din care: | 3.5 Course | 28 | 3.6 Seminar | | 3.6 Laboratory | 14 | 3.6 Project | 14 |

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| 3.7 Distribution of time fund (hours per semester) for: | |
| (a) Study by textbook, course support, bibliography and notes | 20 |
| (b) Additional documentation in the library, on specialized electronic platforms and in the field | 10 |
| (c) Preparation of seminars / laboratories, homework, reports, portfolios and essays | 10 |
| (d) Tutorial | |
| (e) Examinations | 4 |
| (f) Other activities: study visit. | |

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| 3.8 Total of individual study hours (sum of (3.7(a)…3.7(f))) | 44 |
| 3.9 Total hours per semester (3.4+3.8) | 100 |
| 3.10 Number of credits | 4 |

## 4. **Prerequisites** (where appropriate)

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| 4.1 Curriculum | Knowledge of electrical circuit theory, in the field of producers and use of electricity, of electrical machines (transformers), of electrical appliances: their construction, role, operation and graphic and alphanumeric symbolization and also knowledge of low voltage power installations. |
| 4.2 Competences | |

**5. Requirements (where appropriate)**

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| 5.1. For the course | Multimedia equipment, Power Substations companies presentations |
| 5.2. For the applications | Laboratory and project attendance is mandatory.<br>Knowledge and observance of Labor Safety Standards |

**6. Specific competences**

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| Professional Competences | • Ability to design, exploit, develop and optimize energy transmission and distribution systems, as well as power supplies for end-users of all types.<br>• Ability to apply acquired knowledge about power systems, electrical equipment, operation and maintenance.<br>• The design of medium complexity electric power systems, using modern principles for the power systems management.<br>• The ability to use the latest technical solutions and equipment.<br>• Exploitation of technological knowledge for the purpose of designing and exploiting medium complexity power systems. |
| Related Competences | • Applying the values and ethics of the engineer profession and the responsible execution of professional tasks under conditions of limited autonomy and qualified assistance. Promoting logical, convergent and divergent reasoning, practical applicability, assessment and self-assessment in decision-making.<br>• Performing activities and exercising the roles specific to teamwork on different hierarchical levels. Promoting the spirit of initiative, dialogue, cooperation, positive attitude and respect for others, diversity and multiculturalism and continually improving their own activities. |

**7. Discipline objectives (based on specific competencies acquired)**

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| 7.1 General objective of the discipline | Knowing the structure and operation for substations. |
| 7.2 Specific objectives | Decision-making in case of failures in substations. |

**8. Contents**

| **8.1 Course (syllabus)** | Nr. of hours | Teaching Methods | Notes |
|---|---|---|---|
| 1. Energetic System: structure; energy quality indicators; terminology | 2 | Multimedia equipment, presentation and discussions | |
| 2. Substations wiring diagrams classification. | 2 | | |
| 3. Wiring diagrams for medium voltage transforming and evacuation substations that discharge energy at medium voltage; wiring diagrams for substations with sectioned and non sectioned single and double busbars. | 2 | | |
| 4. Wiring diagrams for medium voltage transforming and evacuation substations that discharge energy at high voltage | 2 | | |
| 5. Wiring diagrams of evacuation substations with high voltage busbars. | 2 | | |
| 6. Wiring diagrams of high voltage exhaust substations without busbars. | 2 | | |
| 7. Wiring diagrams of step-down substations. | 2 | | |
| 8. Wiring diagrams of transformer substations. | 2 | | |
| 9. Substation components. | 2 | | |
| 10. Practical solutions for outdoor and indoor substations and transformer substations. | 2 | | |

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|---|---|---|---|
| 11. Gas Insulated Substations GIS | 2 | | |
| 12. Internal services and auxiliary installations in substations. | 2 | | |
| 13. Lightning protection systems. | 2 | | |
| 14. Grounding installations. | 2 | | |

References (Bibliography)


1. Vădan, I., Maier, V., Cziker, A., - *Staţii şi Posturi de Transformare*, Editura Mediamira, Cluj-Napoca, 2003, ISBN 973-9357-45-8.
2. Duşa, V., Vaida, V., - *Comanda şi controlul funcţionării reţelelor electrice*. Editura Tehnică, Bucureşti, 2001, ISBN 973-31-2048-0.
3. Gheju,P., Duşa, P., - *Staţii şi Posturi Electrice de Transformare, vol.1 şi 2,* Institutul Politehnic Traian Vuia, Timişoara, 1978
4. Darie, S., Vădan, I., - *Producerea Transportul şi Distribuţia Energiei Electrice, Instalaţii pentru Transportul şi Distribuţia Energiei Electrice, vol.1*, Editura UT PRES, Cluj-Napoca, 2003, ISBN 973-662-036-0.
5. Guzun, B., Gal, Al. S., Darie, G., Olovinaru, D. *Centrale, Statii şi Retele Electrice Csre; Elemente de bază.* Editura Academiei Române, Bucureşti, 2005.


| **8.2 Laboratory** | Nr. of hours | Teaching Methods | Notes |
|---|---|---|---|
| 1. Presentation of laboratory topics and initial data for synthesis materials. | 1 | Presentation, discussions, conclusions | |
| 2. Substations electrical equipment - power transformers. | 1 | | |
| 3. Operating regimes of power transformers and equivalent schemes. | 1 | | |
| 4. Substations current and voltage transformers - constructive types, wiring diagram. | 1 | | |
| 5.Medium and high voltage switchgear | 2 | | |
| 6. Study visit to Cluj-Est Substation, - „Transelectrica" SA. | 2 | | |
| 7. Grounding installation system design for an outdoor substation - design principles and guide presentation. | 7 | | |
| 8. Lightning protection systems design for an outdoor substation - design principles and guide presentation. | 7 | | |
| 9. Study visit to Cluj-Floresti Substation, - „Transelectrica" SA. | 1 | | |
| 10. Study visit to Gadalin Substation, - „Transelectrica" SA. | 1 | | |
| 11. Discutions about the wiring diagrams for the visited substations. | 1 | | |
| 12. Synthesis material/project presentation. | 1 | | |
| 13. Synthesis material/project presentation. | 1 | | |
| 14. Recovery session. | 1 | | |

Bibliografie

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

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

**10. Assessment**

| Activity type | 10.1 Assessment criteria | 10.2 Assessment methods | 10.3 Share of final mark (%) |
|---|---|---|---|
| 10.4 Course | Understanding criteria and phenomena, engaging in discussions, formulating questions, participating in consultations, being able to solve concrete applications. | Written paper (E) – applications on aspects from the course.<br>M1 - Quiz<br>M2 - Quiz<br>S1 and S2 explaining wiring diagrams for substations | M1 – 10%<br>M2 – 10%<br>(S1/2 + S2/2) – 50% |
| 10.5 Laboratory /Project | Laboratory activity, questions and discussions during the study visits.<br>Activity during project implementation, technical solutions chosen, drawings, knowledge of methodology and norms. | Project verification, knowledge and different stages presentations<br>Mark - P | 20% |
| 10.6 Minimum performance standard Final Mark ≥ 5 M1 ≥ 5 M2 ≥ 5 S1 ≥ 5 S2 ≥ 5 P ≥ 5<br>Mark calculation formula: Final Mark = 1+ 0,2· P + 0,1·M1 + 0,1·M2 + 0,5·(S1/2 + S2/2) | | | |

| **Date:** | **Titulari** | **Titlu Prenume NUME** | **Semnătura** |
|---|---|---|---|
| 08.09.2024 | Course | Lecturer Corina Gloria Martineac Ph.D. | |
| | Applications | Lecturer Corina Gloria Martineac Ph. D. | |
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**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