# COURSE OUTLINE

**1. Data about the study programme**

| | |
|---|---|
| 1.1 Higher education institution | Transylvania University of Brasov |
| 1.2 Faculty | Electrical Engineering and Computer Science |
| 1.3 Department | Electrical Engineering and Applied Physics |
| 1.4 Field of study[1)] | Electrical Engineering |
| 1.5 Study level[2)] | MA |
| 1.6 Study programme | Advanced Electrical Systems |

**2. Data about the course**

| | |
|---|---|
| 2.1 Name of course | Analysis and signal processing (SEA101) |
| 2.2 Course convenor | Şef.lucr.dr.ing. Laura - Mihaela Leluțiu |
| 2.3 Seminar/ laboratory/ project convenor | Şef.lucr.dr.ing. Laura - Mihaela Leluțiu |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2.4 Study year | I | 2.5 Semester | 1 | 2.6 Evaluation type | E | 2.7 Course status | Content[3)] | DAP |
| | | | | | | | Attendance type[4)] | DI |

**3. Total estimated time (hours of teaching activities per semester)**

| | | | | | |
|---|---|---|---|---|---|
| 3.1 Number of hours per week | 3 | out of which: 3.2 lecture | 2 | 3.3 ~~seminar~~/ laboratory/ ~~project~~ | 0/2/0 |
| 3.4 Total number of hours in the curriculum | 56 | out of which: 3.5 lecture | 28 | 3.6 seminar/ laboratory/ project | 0/28/0 |

| Time allocation | hours |
|---|---|
| Study of textbooks, course support, bibliography and notes | 20 |
| Additional documentation in libraries, specialized electronic platforms, and field research | 20 |
| Preparation of seminars/ laboratories/ projects, homework, papers, portfolios, and essays | 15 |
| Tutorial | 6 |
| Examinations | 8 |
| Other activities.................................... | |

| | |
|---|---|
| **3.7 Total number of hours of student activity** | 69 |
| **3.8 Total number per semester** | 125 |
| **3.9 Number of credits[5)]** | 5 |

**4. Prerequisites (if applicable)**

| | |
|---|---|
| 4.1 curriculum-related | • Electrical measurements |
| 4.2 competences-related | • Measuring, data acquisition and processing systems. |

**5. Conditions (if applicable)**

| | |
|---|---|
| 5.1 for course development | Class room equipped with multimedia equipment. Capacity: 60 seats |
| 5.2 for seminar/ laboratory/ project development | Room endowed with microcomputers (PC); OS: Win 32/64; Capacity: 25 seats |

6. Specific competences

| | |
|---|---|
| Professional competences | Cp1<br>L.O.1.1. The graduate exhibits an in-depth knowledge of the programming language, environments and technologies and tools specific to electrical engineering applications.<br>L.O.1.2. Graduate in the use of specific computational tools for the design and optimization of advanced electrical systems.<br>L.O.1.3. The graduate of the integrated use of concepts in solving the problem in the field of electrical engineering the use of methods based on the use of dedicated software and appropriate CAD means.<br>Cp2<br>L.O.2.1. The graduate knows the methods of physical and mathematical description of the structures and operation of electrical systems.<br>L.O.2.2. Advanced theory graduate for justifying the operation, command and control processes of advanced electrical systems.<br>L.O.2.3. The graduate is capable of nuanced use of assessment methods and fundamentals of electrical system-specific applications, taking into account the principles of energy conversion and electromagnetic compatibility. |
| Transversal competences | CT1.<br>L.O.1.1. The graduate has the ability to perform professional tasks responsibly, taking into account moral and ethical values.<br>L.O.1.2. The graduate knows how to work in conditions of professional autonomy, with the practical application of the acquired knowledge.<br>CT2<br>L.O.2.1. The graduate has the ability to perform specific work roles in a multidisciplinary team, contributing to the achievement of common objectives.<br>L.O.2.2. The graduate shows an entrepreneurial spirit, highlighted by innovation and active involvement in the performance of team tasks.<br>L.O.2.3. The graduate can lead and coordinate the activities of a team, ensuring cohesion and efficiency in achieving objectives. |

**7. Course objectives (resulting from the specific competences to be acquired)**

| | |
|---|---|
| 7.1 General course objective | The materials aim to provide students' knowledge of measurement and processing of sizes using appropriate measuring instruments, recording and interpreting them according to the study and design skills training on concepts and methods in the field of measurement. Explaining the operation of measuring instruments. |
| 7.2 Specific objectives | Interpretation of the measurement results, evaluation of errors in the measurement process. Measuring skills training, data processing and experimental design electrical measurements using specific computer. Acquiring skills and abilities to perform the measurement assemblies. |

**8. Content**

| 8.1 Course | Teaching methods | Number of hours | Remarks |
|---|---|---|---|
| 1. General problems of acquisition and processing of data. SAPD functions. Fields of use. | Lecture, interactive course | 2 | |
| 2. Circuits for signal conditioning<br>2.1. Converting the signal output voltage of the | Lecture, interactive course | 2 | |

| | | | |
|---|---|---|---|
| electrical transduction<br>2.2. Adaptation-level signals | | | |
| 3. SAPD galvanic separation of the source signal | Lecture, interactive course | 2 | |
| 4. Analog signal filters | Lecture, interactive course | 2 | |
| 5. Analog signals preprocessing. Analog to digital signals conversion<br>5.1. Sampling of an analog signals. Sampling Circuits<br>5.2. Digital Signal processing. Encode analog signals | Lecture, interactive course | 2 | |
| 6. Quantization and encoding of signals<br>6.1. Encoding of signals<br>6.2. Sample and Hold circuits | Lecture, interactive course | 2 | |
| 7. Analog-digital converters | Lecture, interactive course | 2 | |
| 8. A-D Converters<br>8.1. Parallel - serial Converters<br>8.2. Sigma-delta Converters | Lecture, interactive course | 2 | |
| 9. Analog-to-digital converter command<br>9.1 Sample/ Hold and analog-to-digital converter Assembly | Lecture, interactive course | 2 | |
| 10. Extension board. Bridges and ports<br>10.1. Extension boards<br>10.2 Types of motherboards<br>10.3. Types of extension boards<br>10.4. Extension buses | Lecture, interactive course | 2 | |
| 11. ISA/EISA Standard<br>11.1. PCI Standard<br>11.2. Parallel and serial ports of computers<br>11.3. DMA channels. Interrupt system | Lecture, interactive course | 2 | |
| 12 Data acquisition techniques<br>12.1 Mono-channel and multi-channel.<br>12.2. Double-buffered data acquisition / generation mode<br>12.3. Controlling data purchases with trigger signals<br>12.4. Controlling the data acquisition speed | Lecture, interactive course | 2 | |
| 13. Analog Outputs<br>13.1. Configuring analog outputs<br>13.2. Generating data on analog outputs<br>13.3. Numerical inputs / outputs<br>13.4. Examples | Lecture, interactive course | 2 | |
| 14. Virtual instrumentation notions | Lecture, interactive course | 2 | |

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2. Lelutiu L.M., Measuring, data acquisition and processing systems, Editura Universitatii "Transilvania" din Brasov, ISBN 978-606-19-0304-7, 2013
3. Lelutiu L.M., Măsurări electrice şi electronice, Editura Universitatii "Transilvania" din Brasov, ISBN 978-606-19-0519- 5, 2014

4. Lelutiu L.M., Electrical measurements, Editura Universitatii "Transilvania" din Brasov, ISBN 978-606-19-0713- 7, 2015
5. Lelutiu L.M., Senzori utilizați în măsurarea şi controlul mărimilor specifice calității mediului, 2010, Editura Universitatea Transilvania din Brasov, ISBN 978-973-598-820-3
6. John Park, Steve Mackay, Practical Data Acquisition for Instrumentation and Control Systems, An imprint of Elsevier Linacre House, Jordan Hill, Oxford OX2 8DP , IDC Technologies, ISBN 07506 57960, 2003
7. Szekely,I., Szabo,W., Gerigan,C., Sisteme de achiziție şi prelucrare a datelor, Editura Universitatii Transilvania din Braşov, 1996
8. Romanca M., "Arhitectura microprocesoarelor", ISBN 973-635-314-1, Editura Universitatii "Transilvania" din Brasov, 2004.
9. Szekely, I.: Szabo, W., Munteanu, R., Sisteme pentru achiziție şi prelucrare a datelor. Editura Mediamira, Cluj-Napoca, 1997
10. Golovanov C., Albu M., Golovanov N., Todos P., Probleme moderne de măsurare în electroeneregică, Editura Tehnică, Bucureşti, 2001
11. Millea, A., Măsurări electrice. Principii şi metode. Editura Tehnică, Bucureşti, 1980
12. Helerea E. Munteanu A., Rab (Lelutiu)L.M L.:Energy and Environmental Engineering. Editura Universitatii Transilvania din Brasov, 2007
13. D. Stoiciu – Metrologie, calitate şi fiabilitate, Universitatea Politehnica Timişoara, 1993


| 8.2 ~~Seminar~~/ laboratory/ ~~project~~ | Teaching-learning methods | Number of hours | Remarks |
|---|---|---|---|
| 1. Technical Security Rules and Labour Protection | Group work, problem/project-based learning, Presentations of reports | 2 | |
| 2. Study of signal conditioning circuits. Hardware.<br>3. Linearization of Analog Signals | Group work, problem/project-based learning, Presentations of reports | 4 | |
| 4. The study of sample& hold circuit | Group work, problem/project-based learning, Presentations of reports | 4 | |
| 5. Studying analog-digital and digital analog converters | Group work, problem/project-based learning, Presentations of reports | 2 | |
| 6. Analog multipliers | Group work, problem/project-based learning, Presentations of reports | 2 | |
| 7. Studying digital- analog converters | Group work, problem/project-based learning, Presentations of reports | 2 | |
| 8. Basic principles using a development board | Group work, problem/project-based learning, Presentations of | 2 | |

| | | | |
|---|---|---|---|
| | reports | | |
| 9. Applications with Arduino_ LED controlled by a button | Group work, problem/project-based learning, Presentations of reports | 2 | |
| 10. Measurement of environmental parameters using analog sensors and Arduino | Group work, problem/project-based learning, Presentations of reports | 2 | |
| 11. Measurement of environmental parameters using digital sensors and Arduino | Group work, problem/project-based learning, Presentations of reports | 2 | |
| 12.Measuring Distance and Proximity with Arduino | Group work, problem/project-based learning, Presentations of reports | 2 | |
| 13. Laboratory examination | Presentations of reports | 2 | |

Bibliography


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2. Masurari electrice si electronice - Indrumar de laborator, Editura Universitații Transilvania din Braşov, ISBN 978-606-19-0304-7, 2018
3. Sisteme pentru achiziția şi prelucrarea datelor –Indrumar de laborator, Editura Universitații Transilvania din Braşov, ISBN 978-606-19-0304- 17, 2018
4. Szekely, I., Morariu, Gh., Hazy, P., Măsurări şi achizitii de date - Indrumar de laborator, Brasov, Reprografia Universitatii Transilvania din Brasov, 1994
5. Szekely Gyula, Tudor Marian, Marchis Alin, Aparatura electronica de masurare - Indrumar de laborator, Brasov: ''Transilvania'' din Brasov, 2002
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8. http://vega.unitbv.ro/~romanca/EmbSys/
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10. http://www.unitbv.ro/faculties/biblio/interfete_specializate/curs.pdf
11. http://vega.unitbv.ro/~romanca/EmbSys/
12. D. Ursuțiu, Inițiere în LabVIEW, Ed. Lux Libris, ISBN 973-9428- 60-6, 2001


**9. Correlation of course content with the demands of the labour market (epistemic communities, professional associations, potential employers in the field of study)**

| |
|---|
| Course content is underpinned by expectations epistemic community representatives, professional associations and employers' representatives in the field for the program. Discipline offers a modern synthetic material and current with the latest information on the concepts and methods of data acquisition and processing, an interdisciplinary field involving knowledge and techniques of measurement, electronics, computers, data communication, signal processing |

**10. Evaluation**

| Activity type | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Percentage of the final grade |
|---|---|---|---|
| 10.4 Course | The originality of the deductive reasoning required in knowledge of methods, measurement acquisition and data processing systems, monitoring and control of nonelectrical quantities. | Written examination | 60% |
| 10.5 ~~Seminar~~/ laboratory/ ~~project~~ | Reports. Accuracy of implementation of applications. | Development of applications. Oral and written examination | 40% |
| 10.6 Minimal performance standard | | | |
| Final grade – a minimum of 5. The final grade is computed only in case when the marks obtained by treating the subjects from written exam and the laboratory activity are greater than or equal to5.<br>N=0,60E+0,40L | | | |

This course outline was certified in the Department Board meeting on 23.09.2024 and approved in the Faculty Board meeting on 24.09.2024.

| | |
|---|---|
| **Assoc. Prof. Titus Constantin BĂLAN,**<br>**Dean** | **Assoc. Prof. Lia ACIU,**<br>**Head of Department** |
| **Sef lucr. Dr. Ing. Laura-Mihaela LELUȚIU,**<br>**Course holder** | **Sef lucr. Dr. Ing. Laura-Mihaela LELUȚIU,**<br>**Holder of seminar/ laboratory/ project** |

Note:

1) Field of study – select one of the following options: BA/MA/PhD. (to be filled in according to the forceful classification list for study programmes);

2) Study level – choose from among: BA/MA/PhD;

3) Course status (content) – for the BA level, select one of the following options: **FC** (fundamental course) / **DC** (course in the study domain)/ **SC** (speciality course)/ **CC** (complementary course); for the MA level, select one of the following options: **PC** (proficiency course)/ SC (synthesis course)/ **AC** (advanced course);

4) Course status (attendance type) – select one of the following options: **CPC** (compulsory course)/ **EC** (elective course)/ **NCPC** (non-compulsory course);

5) One credit is the equivalent of 25 study hours (teaching activities and individual study).

# COURSE OUTLINE

**1. Data about the study programme**

| | |
|---|---|
| 1.1 Higher education institution | Transilvania University of Brașov |
| 1.2 Faculty | Electrical Engineering and Computer Science |
| 1.3 Department | Electrical Engineering and Applied Physics |
| 1.4 Field of study[1)] | Electrical Engineering |
| 1.5 Study level[2)] | MA |
| 1.6 Study programme | Advanced Electrical Systems |

**2. Data about the course**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2.1 Name of course | | | Environmental policy and electromagnetic compatibility (SEA102) | | | | | |
| 2.2 Course convenor | | | Aciu Lia Elena | | | | | |
| 2.3 Laboratory/ project convenor | | | Călin Marius Daniel | | | | | |
| 2.4 Study year | 1 | 2.5 Semester | 1 | 2.6 Evaluation type | E | 2.7 Course status | Content[3)] | PC |
| | | | | | | | Attendance type[4)] | CPC |

**3. Total estimated time (hours of teaching activities per semester)**

| | | | | | |
|---|---|---|---|---|---|
| 3.1 Number of hours per week | **3** | out of which: 3.2 lecture | **2** | 3.3 laboratory | **1** |
| 3.4 Total number of hours in the curriculum | **42** | out of which: 3.5 lecture | **28** | 3.6 laboratory | **14** |
| Time allocation | | | | | hours |
| Study of textbooks, course support, bibliography and notes | | | | | 15 |
| Additional documentation in libraries, specialized electronic platforms, and field research | | | | | 20 |
| Preparation of seminars/ laboratories/ projects, homework, papers, portfolios, and essays | | | | | 40 |
| Tutorial | | | | | 5 |
| Examinations | | | | | 3 |
| Other activities...................................... | | | | | |

| | |
|---|---|
| **3.7 Total number of hours of student activity** | 83 |
| **3.8 Total number per semester** | 125 |
| **3.9 Number of credits[5)]** | 5 |

**4. Prerequisites (if applicable)**

| | |
|---|---|
| 4.1 curriculum-related | - electromagnetic compatibility |
| 4.2 competences-related | • Basic knowledge of electromagnetic compatibility. Knowing the coupling mechanism of disturbances and quantities that characterize the impact of advanced electrical systems on the environment. |

**5. Conditions (if applicable)**

| | |
|---|---|
| 5.1 for course development | • Room equipped with projector. Capacity 40 seats. |
| 5.2 for laboratory | • Capacity laboratory room with 15 seats, equipped with computers and equipment specific to electromagnetic environment parameters determination, advanced equipment for electromagnetic pollution testing, existing at the Research Institute of Transilvania University of Brasov. |

**6. Specific competences**

| | |
|---|---|
| Professional competences | Cp 2.The use of modern knowledge in the analysis, evaluation and operation of electrical subsystems<br>C2.3. The graduate is capable of nuanced use of evaluation methods and substantiation of specific applications of electrical systems, taking into account the principles of energy conversion and electromagnetic compatibility Use and application of measurement, analysis, evaluation and interpretation techniques in the field of electrical systems for energy production, distribution and use.<br>• C2.3.The graduate is capable of nuanced use of evaluation methods and substantiation of specific applications of electrical systems, taking into account the principles of energy conversion and electromagnetic compatibility<br>Cp 3. Use and application of measurement, analysis, evaluation and interpretation techniques in the field of electrical systems for energy production, distribution and use.<br>• C3.2.The graduate adequately uses measuring equipment and testing techniques for electrical systems<br>Cp.5 The development of new solutions for the realization of applications with advanced electrical systems, in the perspective of socio-economic sustainability.<br>• C 5.4 The graduate evaluates methods of analysis and quality improvement, with the elaboration of specific corrective/preventive measures. |
| Transversal competences | Ct.1 Responsible management of tasks and resources, considering professional ethics and social responsibility<br>• 1.3. The graduate assumes responsibility in the activities undertaken, in the spirit of integrating advanced electrical systems into the environment, under the conditions of sustainable development. |

**7. Course objectives (resulting from the specific competences to be acquired)**

| | |
|---|---|
| 7.1 General course objective | • Knowledge of environmental policy theories and the existing connection to ensuring electromagnetic compatibility between advanced electrical systems in the design phase or already built and the environment in which they operate. |
| 7.2 Specific objectives | • Using advanced theories for justifying the operation processes and control of advanced electrical systems.<br>• Evaluating the efficiency of systems for measuring, acquisition, data processing and testing of electrical systems parameters, by using analysis and diagnosis techniques.<br>• Using modern theories for designing and optimization of advanced electrical systems applications.<br>• Integrated use of the concepts for the development of energy-efficient applications, for controlling the energy production and management, environmental monitoring and control<br>• Evaluating and validating the analysis and quality improvement methods, with the development of corrective/preventive specific measures. |

**8. Content**

| 8.1 Course | Teaching methods | Number of hours | Remarks |
|---|---|---|---|
| 1. European Union Environmental Policy - Issues. Environmental policy - a component of the European model of sustainable development. Principles that fundament the SD concept | Interactive course with teaching materials and examples presented with video-projector | 2 | |
| 2. The System of European Environmental Policy Instruments. Organization of environmental | Interactive course with teaching materials and | 2 | |

| | | | |
|---|---|---|---|
| information - types of indicators | examples presented with video-projector | | |
| 3. How the environmental indicators are used by the European Environment Agency. SD indicators with reference to the energy environment. Current indicators and information on the European energy environment. The objectives of the European Environment Agency | Interactive course with teaching materials and examples presented with video-projector | 2 | |
| 4. Reporting on the environment in Europe in 2020 | Interactive course with teaching materials and examples presented with video-projector | 2 | |
| 5. Integrated National Energy and Climate Change Plan for 2021 – 2030 | Interactive course with teaching materials and examples presented with video-projector | 6 | |
| 6. Types of pollution due to electrical installations | Interactive course with teaching materials and examples presented with video-projector | 2 | |
| 7. Europe's long-term sustainability goals | Interactive course with teaching materials and examples presented with video-projector | 6 | |
| 8. A new perspective on electromagnetic compatibility | Interactive course with teaching materials and examples presented with video-projector | 2 | |
| 9. Interaction between the biological environment and the electromagnetic environment | Interactive course with teaching materials and examples presented with video-projector | 2 | |
| 10. The effects of the electromagnetic pollution | Interactive course with teaching materials and examples presented with video-projector | 2 | |

Bibliography

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2. Helerea E., Munteanu A., Aciu L.: Energy and Environmental Engineering. Editura Universității Transilvania din Brașov, 2007.
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5. Salzman J., Thompson B. Jr.: Environmental Law and Policy, Foundation Press, 2013.
6. Vig N., Kraft M.: Environmental Policy: New Directions for the 21 century, 2012.
7. Junginger M., Lako P., Lensink S., W. van Sark, Weiss M.: Climate change scientific assessment and policy analysis: Technological learning in the energy sector.

| 8.2 Laboratory | Teaching-learning methods | Number of hours | Remarks |
|---|---|---|---|
| 1. Electro-safety rules specific to EMC testing. Laboratory rules. Testing stands presentation. | Conversation and case studies | 2 | |
| 2. Comparative measurement of environmental parameters with spectral analyzer in different urban areas (measurements and validation by calculation). | Team work | 2 | |
| 3. The study of electromagnetic pollution due to electric arc discharge in the operation of advanced electrical switching systems. | Team work | 2 | |
| 4. Immunity testing of electrical equipment at disturbances generated by magnetic impulse field due to atmospheric discharge. | Team work | 4 | |
| 5. The study of the flicker phenomenon due to voltage fluctuations in the operation of modern lighting systems. | Team work | 2 | |
| 6. Tracing of CBEMA sensitivity curves at electromagnetic contactors for immunity evaluation at power failure and voltage interruptions | Team work | 2 | |
| 7. Laboratory colloquium. Final assessment of student work and portfolios | Interactive activity | 2 | |

Bibliography

1. Călin M.D., Helerea.E, Aciu.L, Ghiță.M, Ursachi.C - EMC testing of technical systems. Laboratory guide, elearning platform, http://elearning.unitbv.ro/
2. Ogruțan P., Aciu L.:Compatibilitate electromagnetică. Aplicații, Editura Universității Transilvania din Braşov, 2006.
3. 3. Aciu L. E., Ogruțan P., Ursachi C.: Aplicații de compatibilitate electromagnetică, Editura Universității Transilvania din Braşov, 2017.

**9. Correlation of course content with the demands of the labour market (epistemic communities, professional associations, potential employers in the field of study)**

The course provides the necessary knowledge to understand how to apply energy policies to the design and operation of electrical systems. Also, knowing about the impact of advanced electrical systems on the environment is the premise of sustainable development that all employers are considering. The European regulations and those recommended by the IEEE Professional Association (www.ieee.org) and the European Environment Agency are considered.

**10. Evaluation**

| Activity type | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Percentage of the final grade |
|---|---|---|---|
| 10.4 Course | Knowledge of the latest environmental strategies | Novel presentation of a specific subject from the course | 90 % |
| | Applying electromagnetic compatibility methods to reduce environmental pollution | | |

| | | | |
|---|---|---|---|
| 10.5 Laboratory | Evaluation of electromagnetic environment parameters and effectiveness of antidisturbances measures | The laboratory completed | 10% |
| 10.6 Minimal performance standard | | | |
| • Develop a study on how to implement environmental policies for an electrical system.<br>• Justify the solutions in the design of advanced electrical systems to reduce electromagnetic emissions and environmental pollution. | | | |

This course outline was certified in the Department Board meeting on 23/09/2024 and approved in the Faculty Board meeting on 24/09/2024.

| | |
|---|---|
| Assoc prof eng .Titus BĂLAN<br>**Dean** | Assoc prof eng Lia Elena Aciu<br>**Head of Department** |
| Assoc prof eng Lia Elena Aciu<br>**Course holder** | Lecturer eng Marius Daniel Călin<br>**Holder of laboratory** |

Note:

1) Field of study – select one of the following options: Bachelor / Master / Doctorat (to be filled in according to the forceful classification list for study programmes);

2) Study level – choose from among: Bachelor / Master / Doctorat;

3) Course status (content) – for the Bachelor level, select one of the following options: **FC** (fundamental course) / **DC** (course in the study domain)/ **SC** (speciality course)/ **CC** (complementary course); for the Master level, select one of the following options: **PC** (proficiency course)/ SC (synthesis course)/ **AC** (advanced course);

4) Course status (attendance type) – select one of the following options: **CPC** (compulsory course)/ **EC** (elective course)/ **NCPC** (non-compulsory course);

5) One credit is the equivalent of 25 study hours (teaching activities and individual study).

# COURSE OUTLINE

**1. Data about the study programme**

| | |
|---|---|
| 1.1 Higher education institution | Transilvania University of Brasov |
| 1.2 Faculty | Electrical Engineering and Computer Science |
| 1.3 Department | Electrical Engineering and Applied Physics |
| 1.4 Field of study[1)] | Electrical Engineering |
| 1.5 Study level[2)] | MA |
| 1.6 Study programme | Advanced Electrical Systems |

**2. Data about the course**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2.1 Name of course | Utility-scale energy storage systems (SEA 103) | | | | | | | |
| 2.2 Course convenor | Assoc. Prof. Luminița BAROTE | | | | | | | |
| 2.3 Seminar/ laboratory/ project convenor | Assoc. Prof. Luminița BAROTE | | | | | | | |
| 2.4 Study year | 1 | 2.5 Semester | 1 | 2.6 Evaluation type | E | 2.7 Course status | Content[3)] | PC |
| | | | | | | | Attendance type[4)] | CPC |

**3. Total estimated time (hours of teaching activities per semester)**

| | | | | | |
|---|---|---|---|---|---|
| 3.1 Number of hours per week | 4 | out of which: 3.2 lecture | 2 | 3.3 seminar/ laboratory/ project | **1L/1P** |
| 3.4 Total number of hours in the curriculum | 56 | out of which: 3.5 lecture | 28 | 3.6 seminar/ laboratory/ project | 28 |

| Time allocation | hours |
|---|---|
| Study of textbooks, course support, bibliography and notes | 25 |
| Additional documentation in libraries, specialized electronic platforms, and field research | 10 |
| Preparation of seminars/ laboratories/ projects, homework, papers, portfolios, and essays | 30 |
| Tutorial | - |
| Examinations | 4 |
| Other activities.................................... | - |

| | |
|---|---|
| **3.7 Total number of hours of student activity** | 69 |
| **3.8 Total number per semester** | 125 |
| **3.9 Number of credits[5)]** | 5 |

**4. Prerequisites (if applicable)**

| | |
|---|---|
| 4.1 curriculum-related | • Knowledge of the basic concepts of the *Power Supplies*, *Power Electronics*, *Electromechanical Converters*, *Electrical Equipment* and *Physics*. |
| 4.2 competences-related | • Knowledge of the power supplies (including renewables): structure, working principles, based measurements;<br>• Knowledge of Matlab-Simulink software package. |

**5. Conditions (if applicable)**

| | |
|---|---|
| 5.1 for course development | • Classroom with video projector and whiteboard |
| 5.2 for seminar/ laboratory/ project development | • Laboratory room with whiteboard, projector and 15 network computers. |

**6. Specific competences and learning outcomes**

| | |
|---|---|
| Professional competences | **Cp.2 Using modern knowledge in the analysis, evaluation, and operation of electrical subsystems.**<br>• L.O.2.1 The graduate knows methods of physical and mathematical description of the structure and operation of electrical systems.<br>• L.O.2.2 The graduate uses advanced theories to justify the processes of operation, command, and control of advanced electrical systems.<br>**Cp.4 Modeling and optimizing electrical and electronic systems for efficient energy use.**<br>• L.O.4.1 The graduate applies modern methods of modeling and optimizing electrical and power electronic systems for efficient energy use.<br>• L.O.4.4 The graduate designs projects in the field of renewable energy sources, energy storage, and distribution systems.<br>• L.O.4.5 The graduate is capable of modeling and implementing renewable energy systems integrated into intelligent distributed electrical networks. |
| Transversal competences | **Ct.1 Responsible management of tasks and resources, considering professional ethics and social responsibility**<br>• L.O.1.2 The graduate is able to work with professional autonomy, applying the knowledge acquired in practical situations.<br>• L.O.1.3 The graduate assumes responsibility in undertaking activities, integrating advanced electrical systems into the environment in a spirit of sustainable development.<br>**Ct.2 Efficiency and responsibility in managing teamwork**<br>• L.O.2.1 The graduate can perform specific roles within a multidisciplinary team, contributing to the achievement of common objectives.<br>**Ct.3 Continuous professional development and lifelong learning**<br>• L.O.2.3 The graduate can effectively use language skills and information technology knowledge for personal and professional development. |

**7. Course objectives (resulting from the specific competences to be acquired)**

| | |
|---|---|
| 7.1 General course objective | • Developing theoretical and practical knowledge (modelling/programming) relating to the operation, connecting and using electrical energy storage systems (EESS) based on renewable energies (Wind, PV and Micro-hydro). The master students would be able to carry out further research activities/design/development in accordance with the new concepts of smart micro grid and sustainable development. |
| 7.2 Specific objectives | • The use of advanced theories to justify operating processes;<br>• Integrated concepts to solve complex problems regarding the quality and functionality of SSEE;<br>• Learning techniques, methods and algorithms to describe modelling and optimization of SSEE;<br>• Efficient SSEE utilization to optimize the efficient use of energy;<br>• Using modern methods in order to obtain energy-efficient applications. |

**8. Content**

| 8.1 Course | Teaching methods | Number of hours | Remarks **28h** |
|---|---|---|---|
| C1. General presentation of the course (course outline), discussions on the examination method, etc. | Interactive course with teaching materials and | 2h | |
| C2. Electrical energy storage systems. General issues: the main | | 2h | |

| | | | |
|---|---|---|---|
| parameters of storage batteries | examples presented online by videoconference. | | |
| C3. Classification of electrical energy storage systems. Presentation of electrical models for different storage systems (LAB, VRB, Li-ion, PEMFC). | | 2h | |
| C4. Presentation of different types of storage systems, focusing on the fields of application, their advantages and disadvantages, cost, future development prospects: Lead batteries (LAB); NiCd batteries; Li-ion batteries. | | 2h | |
| C5. Presentation of different types of storage systems, focusing on the fields of application, their advantages and disadvantages, cost, future development prospect: Inertial electrical energy storage systems; Supercapacitor storage systems; Superconducting coil storage systems; Hydroelectric energy storage with pumped storage. | | 2h | |
| C6. Presentation of different types of storage systems, focusing on the fields of application, their advantages and disadvantages, cost, future development prospects: Energy storage using compressed air; Storage systems with redox-flow batteries; VRB batteries; ZnBr batteries; Hydrogen storage systems (HES). | Interactive course with teaching materials and examples presented online by videoconference. | 2h | |
| C7. Applications of electrical energy storage systems within renewable energy systems: Modeling and testing the operation of a low power wind turbine with storage system - LAB | | 2h | |
| C8. Applications of electrical energy storage systems within renewable energy systems: Wind turbine operating autonomously with VRB storage system | | 2h | |
| C9. Applications of electrical energy storage systems within renewable energy systems: WT-PV hybrid system operating autonomously with storage system | | 2h | |
| C10. Applications of electrical energy storage systems within renewable energy systems: Modeling and testing of a wind system connected to the grid. | | 2h | |
| C11. Applications of electrical energy storage systems within renewable energy systems: Calculation method for the assessment of harmonic content (THD) in network converters. | | 2h | |
| C12. Applications of electrical energy storage systems within renewable energy systems: Residential system with RES for electric vehicle charging stations. | | 2h | |
| C13. Applications of electrical energy storage systems within renewable energy systems: State of charge estimation for a Li-Ion battery in electric vehicle applications | | 2h | |
| C14. Final discussions, exam topics, etc. | | 2h | |

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alternative generation techniques, University of Limerick Raport, 2007.
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6. Xing Luo , Jihong Wang, Mark Dooner, Jonathan Clarke, Overview of current development in electrical energy storage technologies and the application potential in power system operation, Applied Energy, Volume 137, 1 January 2015, pages 511–536.

| 8.2 Seminar/ **laboratory/ project** | Teaching-learning methods | Number of hours | Remarks **28h** |
|---|---|---|---|
| **Laboratory – 14 h** | | | |
| 1. Technical rules for security and safety. Overview of works proposed for laboratory study. | The method of oral-visual communication; Presentation/application Deployment; Running programs on computers | 2h | |
| 2. Modelling and simulation lead accumulator battery (LAB); | | 2h | |
| 3. Modelling and simulation of VRB | | 2h | |
| 4. Modelling and simulation of Li-Ion battery | | 2h | |
| 5. Modelling and simulation of a fuel cell with changeable membrane (PEMFC); | | 2h | |
| 6. Applications of storage systems analysed in distributed systems to generate (case studies) | | 2h | |
| 7. Laboratory examination | Evaluation | 2h | |
| Laboratory Bibliography<br>[1]. L. Barote, Electrical energy storage systems, Laboratory Handbook, Editura Universitatii Transilvania din Brasov, 2013. | | | |
| **Project– 14 h** | | | |
| Examples of project themes:<br>1. Autonomous PV-storage system intended to power a house;<br>2. Electric energy storage systems in an autonomous microgrid;<br>3. Techniques for determining the state of charge for batteries;<br>4. Autonomous system with RES-storage for residential applications;<br>5. Electric energy storage systems in the field of electric transport. | Learning by project; Team work; Synthetic presentation of the project; | 14h | |
| Project stages:<br>1) Documentation on the topic of the project (4 hours);<br>2) Identification of the solution to be developed and division of work tasks within the team (4 hours);<br>3) Development, modeling, simulation and optimization of the studied system (8 hours);<br>4) Checks and preparation of the project (8 hours);<br>5) Supporting the project in the team, during the last meeting (4 hours). | | | |
| Project Bibliography<br>[1] L. Barote, Electrical energy storage systems, Laboratory Handbook, Editura Universitatii Transilvania din Brasov, 2013.<br>[2] L. Barote, Stocarea energiei electrice in sisteme distribuite de generare, Editura Universitatii Transilvania din Brasov, ISBN 978-606-19-0616-1, 2015.<br>[3] H. Farhangi, Smart Microgrids – Lesson from Campus Microgrid, Design and Implementation, CRC Press, 2017;<br>[4] I. Serban, Microretele hibride cu surse regenerabile de energie, Ed. Universitatii Transilvania, Brasov, 2008.<br>[5] C. Marinescu, I. Serban, L. Clotea, D. Marinescu, C.P. Ion, M. Georgescu, L. Barote, A. Forcos, Retele hibride cu surse regenerabile de energie. Evolutii moderne, Ed. Universitatii Transilvania Brasov, 2011. | | | |

| |
|---|
| [6] C. Marinescu, M. Georgescu, L. Clotea, C.P. Ion, I. Serban, L. Barote, D.M. Valcan, Surse Regenerabile de Energie. Abordari Actuale, Ed. Universitatii Transilvania, Brasov, 2009. |

**9. Correlation of course content with the demands of the labour market (epistemic communities, professional associations, potential employers in the field of study)**

| |
|---|
| The course provides the knowledge necessary to understand the structure, function, method of interconnection and the modelling of EESS. Theoretical and practical knowledge acquired through regulations are consistent with national and international standards which are confirmed by the fact that many graduate students come from firms and companies (Electrica, Transelectrica). Are considered European standards and those recommended by the IEEE Professional Association (www.ieee.org). |

**10. Evaluation**

| Activity type | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Percentage of the final grade |
|---|---|---|---|
| 10.4 Course | -Knowledge of theoretical aspects (schemes of principle, operation and use of MESS); | Written exam | 50% |
| | -Correct application of the principles of mathematics and modelling | | |
| 10.5 Seminar/ **laboratory/ project** | Laboratory: The level of development/testing of the required applications | Computer evaluation in the last laboratory session | 25% |
| | Project: Degree of fulfillment of project requirements | Project support and discussions throughout the semester. | 25% |
| 10.6 Minimal performance standard | | | |
| • For admission to the final exam, students must pass with minimum qualification (mark 5) undergo compulsory work the laboratory tests. The final exam, deals with two topics of minimum qualification of mark 5 each. For these subjects students receive scales of proofreading. Note that you get in the end is a medium between the examination work and notes obtained from the laboratory according to the percentages in paragraphs 10.4 and 10.5. | | | |

This course outline was certified in the Department Board meeting on 23/09/2024 and approved in the Faculty Board meeting on 24/09/2024.

| | |
|---|---|
| **Assoc. Prof. Titus Constantin BĂLAN**<br>**Dean** | **Assoc. Prof. Lia Elena ACIU,**<br>**Head of Department** |
| **Assoc. Prof. Luminița BAROTE,**<br>**Course holder** | **Assoc. Prof. Luminița BAROTE,**<br>**Holder of laboratory** |

| | |
|---|---|
| | |

Note:

[1)] Field of study – select one of the following options: Bachelor / Master / Doctorat (to be filled in according to the forceful classification list for study programmes);

[2)] Study level – choose from among: Bachelor / Master / Doctorat;

[3)] Course status (content) – for the Bachelor level, select one of the following options: **FC** (fundamental course) / **DC** (course in the study domain)/ **SC** (speciality course)/ **CC** (complementary course); for the Master level, select one of the following options: **PC** (proficiency course)/ SC (synthesis course)/ **AC** (advanced course);

[4)] Course status (attendance type) – select one of the following options: **CPC** (compulsory course)/ **EC** (elective course)/ **NCPC** (non-compulsory course);

[5)] One credit is the equivalent of 25 study hours (teaching activities and individual study).

# COURSE OUTLINE

## 1. Data about the study programme

| | |
|---|---|
| 1.1 Higher education institution | Transilvania University of Brasov |
| 1.2 Faculty | Electrical Engineering and Computer Science |
| 1.3 Department | Electrical Engineering and Applied Physics |
| 1.4 Field of study[1)] | Electrical Engineering |
| 1.5 Study level[2)] | MA |
| 1.6 Study programme | Advanced Electrical Systems |

## 2. Data about the course

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2.1 Name of course | Control of power electronic converters (SEA104) | | | | | | | |
| 2.2 Course convenor | Luminița Roxana CLOȚEA | | | | | | | |
| 2.3 Seminar/ laboratory/ project convenor | Luminița Roxana CLOȚEA | | | | | | | |
| 2.4 Study year | 1 | 2.5 Semester | 1 | 2.6 Evaluation type | E | 2.7 Course status | Content[3)] | PC |
| | | | | | | | Attendance type[4)] | CPC |

## 3. Total estimated time (hours of teaching activities per semester)

| | | | | | |
|---|---|---|---|---|---|
| 3.1 Number of hours per week | **4** | out of which: 3.2 lecture | **2** | 3.3 seminar/ laboratory/ project | **0/1/1** |
| 3.4 Total number of hours in the curriculum | 56 | out of which: 3.5 lecture | 28 | 3.6 seminar/ laboratory/ project | 0/14/14 |

| Time allocation | hours |
|---|---|
| Study of textbooks, course support, bibliography and notes | 28 |
| Additional documentation in libraries, specialized electronic platforms, and field research | 7 |
| Preparation of seminars/ laboratories/ projects, homework, papers, portfolios, and essays | 28 |
| Tutorial | 3 |
| Examinations | 3 |
| Other activities…………………………… | |

| | |
|---|---|
| **3.7 Total number of hours of student activity** | 69 |
| **3.8 Total number per semester** | 125 |
| **3.9 Number of credits[5)]** | 5 |

## 4. Prerequisites (if applicable)

| | |
|---|---|
| 4.1 curriculum-related | • |
| 4.2 competences-related | • Basic knowledge related to the structure and operation of the main classes of power electronic converters.<br>• Basic knowledge related to the operation of the AC machines. |

## 5. Conditions (if applicable)

| | |
|---|---|
| 5.1 for course development | • Multimedia lecture room. Capacity of the room: 50 places. |
| 5.2 for seminar/ laboratory/ project development | • Special laboratory room, including 15 PCs. |

**6. Specific competences and learning outcomes**

| | |
|---|---|
| Professional competences | Cp1. To know modern concepts and computing methods for computer-aided design of electrical systems<br>L.O.1.1. The graduate demonstrates a thorough knowledge of programming languages, environments and technologies and specific tools for electrical engineering applications.<br>L.O.1.2 The graduate uses specific calculation tools for the design and optimization of advanced electrical systems.<br>Cp2. Use of modern knowledge in the analysis, evaluation and operation of electrical subsystems.<br>L.O.2.1 The graduate knows methods of physical and mathematical description of the structure and operation of electrical systems.<br>Cp4. Modeling and optimization of electrical and electronic systems for efficient energy use.<br>L.O..4.3. The graduate performs a quantitative and qualitative assessment of the performance of electrical and electronic power systems for the efficient use of energy.<br>Cp.5 The development of new solutions for the realization of applications with advanced electrical systems, in the perspective of socio-economic sustainability.<br>L.O.5.3. The graduate uses concepts for the realization of applications with low energy consumption, for the control of energy production and management, monitoring and control of the environment. |
| Transversal competences | CT1.Responsible management of tasks and resources, considering professional ethics and social responsibility.<br>L.O.1.2 The graduate knows how to work in conditions of professional autonomy, with the practical application of the acquired knowledge.<br>CT3. Continuous professional development and lifelong learning.<br>L.O.3.1 The graduate is capable of objective self-assessment regarding the need for continuous professional training. |

**7. Course objectives (resulting from the specific competences to be acquired)**

| | |
|---|---|
| 7.1 General course objective | • Advanced knowledge and theory related to the modeling and optimisation of power electronic converter control system, so that the graduated student to be able to develop research activities in the field, in order to improve the quality of the power and increasing the energy efficiency. |
| 7.2 Specific objectives | • Knowing the methods for physical and mathematical description of the electrical systems structure and operation.<br>• Using advanced theories for justifying the operation processes and control of advanced electrical systems.<br>• Assimilating the techniques and description of the methods and algorithms for modelling and optimization of advanced electrical systems.<br>• Using and applying advanced theories for energy monitoring and management.<br>• Developing research projects by means of innovative quantitative and qualitative methods for energy management, and establishing solutions according to the technical, economic and environmental requirements. |

**8. Content**

| 8.1 Course | Teaching methods | Number of hours | Remarks |
|---|---|---|---|
| Course 1 – Introduction<br>1.1. Types of power electronic converters.<br>1.2 Efficiency and losses.<br>1.3 Characteristics of power semiconductor | White and blackbord,<br>PC and videoprojector | 2 | |

| | | | |
|---|---|---|---|
| devices, power electronic converters and electrical machines.<br>1.4 Control techniques, digital control circuits. | | | |
| Course 2 – Switching techniques of the power semiconductor devices<br>2.1 Semiconductor devices in commutation.<br>2.2 Hard commutation.<br>2.3 Snubber circuits.<br>2.4 Characteristics of soft commtation. | White and blackbord, PC and videoprojector | 2 | |
| Course 3 – Principals of soft commutation. Analysing the soft commutation.<br>3.1 ZCS commutation. | White and blackbord, PC and videoprojector | 2 | |
| Course 4 – Principals of soft commutation. Analysing the soft commutation.<br>4.1 ZVS commutation. | White and blackbord, PC and videoprojector | 2 | |
| Course 5 – Principals of soft commutation.<br>Application reffered to ZCS and ZVS, | White and blackbord, PC and videoprojector | 2 | |
| Course 6 – Gate drive circuits.<br>6.1 Characteristics of MOSFET transistors.<br>6.2 Characteristics of IGBT transistors.<br>6.3 Voltage control gate drive circuits.<br>6.4 Aplications. | White and blackbord, PC and videoprojector | 2 | |
| Course 7 – Two level three phase inverters. Control techniques.<br>7.1 Main components of an electric drive system.<br>7.2 Six-step control technique..<br>7.3 Sinusoidal PWM. Control techniques. | White and blackbord, PC and videoprojector | 2 | |
| Course 8 – Two level three phase inverters.<br>8.1 Space Vector PWM Control Technique..<br>8.2 Space vector representation of the inverter, the switching times of the inverter.<br>8.3 Comparison between sinusoidal PWM and SVPWM.<br>8.3 Characteristic waveforms. | White and blackbord, PC and videoprojector | 2 | |
| Course 9 – Three level NPC type inverter.<br>9.1 Inverter topology and operation.<br>9.2 Space vector PWM technique for the NPC inverter.<br>9.3 States of the inverter, the switching times.<br>9.4 Comparison between two lvel and three level NPC inverters. | White and blackbord, PC and videoprojector | 2 | |
| Coursel 10 – Control of the three phase rectifiers using PWM technique.<br>10.1 Rectifier topology and operation.<br>10.2. Space vector PWM technique for the rectifier.<br>10.3 States of the rectifier, the switching times, the waveforms. | White and blackbord, PC and videoprojector | 2 | |
| Course 11– Vector control of the induction | White and blackbord , | 2 | |

| | | | |
|---|---|---|---|
| machine.<br>11.1 Vectorial model of the induction machine.<br>11.2 The equations in an arbitrary system.<br>11.3 Relations for the electromagnetic torque.<br>11.4 Control strategies.<br>11.5 Scalar control. Open loop control. | PC and videoprojector | | |
| Course 12 – Vector control of the induction machine.<br>12.1 Rotor flux orientation, direct and indirect orientation.<br>12.3 Stator flux orientation.<br>12.4 Direct torque control DTC.<br>12.5 Natural torque control NTC, sensorless control. | White and blackbord, PC and videoprojector | 2 | |
| Course 13 – Permanent magnet synchronous machine control.<br>13.1 Control of the synchronous generators.<br>13.2 MTPA type control.<br>13.3 Unity power factor control.<br>13.4 Examples. | White and blackbord, PC and videoprojector | 2 | |
| Course 14 – Artificial inteligence.<br>14.1 Expert systems.<br>14.2 Fuzzy logic systems.<br>14.3 Neuronal networks systems. | White and blackbord, PC and videoprojector | 2 | |

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3. Monmasson, E., *Power Electronic Converters:PWM Strategies and Current Control Techniques*, Wiley and Sons, 2011.
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6. Kazymierkovski, M., *Control in Power Electronics-Selected problems*, Academic Press Series in Engineering, 2002.
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| 8.2 Seminar/ laboratory/ project | Teaching-learning methods | Number of hours | Remarks |
|---|---|---|---|
| Laboratory | | | |
| 1. ZVT DC-DC boost converter soft with auxiliary transistor and optimized gate drive circuit. | Team work | 2 | Practical work |
| 2. DC-DC inverleaved converter. | Team work | 2 | Practical work |
| 3.PFC Converter | Team work | 2 | Practical work |
| 4.Optimized gate drive circuit for IGBT halfbridge.. | Team work | 2 | Practical work |
| 5. ZCS DC-DC converter . | Individual work | 2 | Simulatin |
| 6. Simulation of the three phase inverters. | Individual work | 2 | Simulation |
| 7. Evaluation of the laboratory activity. | | 2 | |

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Project

Project 1

Designing and simulation the control circuit of a two level inverter, using space vector PWM (14 hours).

Stages:

1. The theme (2 hours).
2. Documentation, choosing the converter topology, computing currents, voltages at the input and output (2 hours).
3. Switching times computation, function of the switching frequency, output frequency and the modulation index (2 hours).
4. Control circuit design and switching times importing in Matlab/Simulink (2 hours) .
5. Simulation and şi analysing the waveforms forme de undă. Fourier analyse (2 hours).
6. Editing the project (2 hours).
7. Presentation and evaluation of the project (2 hours).

Project 2

DC-DC convertor with extended soft commutation for electric vehicle charging (14 hours).

Stages:

1. The theme (2 hours).
2. Choosing the topology of the converter (2 hours).
3. Power stage circuit (2 hours).
4. Operation principle of the converter (2 hours).
5. Choosing the semiconductor devices (2 hours).
6. Passive components design (2 hours).

Presentation and evaluation of the project (2 hours).

Bibliography

1. Cloțea L. R., *Electrical power converters control*. Suport de curs, 2019 (disponibil pe e-platforma Universitatii Transilvania din Brasov).
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5. Kazymierkovski, M., *Control in Power Electronics-Selected problems*, Academic Press Series in Engineering, 2002.
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9. D. Simoneti, J.L. Vieira "A ZVS Full-Bridge 0-50V/0-10A DC-DC Power Supply" in ISIE'97 Guimaraes, Portugal.
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12. N. Pavan Kumar, " PV Based ZVZCS Current Control DC/DC Bridge Converter for Battery Charging", in IJMTST, vol. 3, No4, pp 6-10.

**9. Correlation of course content with the demands of the labour market (epistemic communities, professional associations, potential employers in the field of study)**

| |
|---|
| The European and the IEEE directives are considered. |

**10. Evaluation**

| Activity type | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Percentage of the final grade |
|---|---|---|---|
| 10.4 Course | - knowing the switching techniques and the optimisation methods. | Written examination | 50% |
| | - knowing the control techniques of the inverters,<br>- knowing the control techniques of the electrical drives,<br>- capacity of solving specific applications. | | |
| 10.5 Seminar/ laboratory/ project | - evaluation of the practical activity. | Oral examination | 10% |
| | - evaluation of the project. | Oral examination | 40% |
| 10.6 Minimal performance standard | | | |
| • Compulsory graduation of the laboratory activity and project evaluation, minimum mark 5.<br>• Graduation of the exam, minimum mark 5. | | | |

This course outline was certified in the Department Board meeting on 23/09/2024 and approved in the Faculty Board meeting on 24/09/2024.

| | |
|---|---|
| **Assoc. Prof. Titus Constantin BĂLAN,**<br>**Dean** | **Assoc. Prof. Lia Elena ACIU,**<br>**Head of Department** |
| **Assoc. Prof. Luminița Roxana CLOȚEA,**<br>**Course holder** | **Assoc. Prof. Luminița Roxana CLOȚEA,**<br>**Holder of laboratory/project** |

Note:

1) Field of study – select one of the following options: Bachelor / Master / Doctorat (to be filled in according to the forceful classification list for study programmes);

2) Study level – choose from among: Bachelor / Master / Doctorat;

[3] Course status (content) – for the Bachelor level, select one of the following options: **FC** (fundamental course) / **DC** (course in the study domain)/ **SC** (speciality course)/ **CC** (complementary course); for the Master level, select one of the following options: **PC** (proficiency course)/ SC (synthesis course)/ **AC** (advanced course);

[4] Course status (attendance type) – select one of the following options: **CPC** (compulsory course)/ **EC** (elective course)/ **NCPC** (non-compulsory course);

[5] One credit is the equivalent of 25 study hours (teaching activities and individual study).

# COURSE OUTLINE

**1. Data about the study programme**

| | |
|---|---|
| 1.1 Higher education institution | Transilvania University of Brașov |
| 1.2 Faculty | Electrical Engineering and Computer Science |
| 1.3 Department | Electrical Engineering and Applied Physics |
| 1.4 Field of study[1)] | Electrical Engineering |
| 1.5 Study level[2)] | MA |
| 1.6 Study programme | Advanced Electrical Systems |

**2. Data about the course**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2.1 Name of course | Ethics and academic integrity (SEA105) | | | | | | | |
| 2.2 Course convenor | Assoc. Prof. Dr. Eng. Catalin Petrea ION | | | | | | | |
| 2.3 Seminar/ laboratory/ project convenor | | | | | | | | |
| 2.4 Study year | I | 2.5 Semester | 1 | 2.6 Evaluation type | C | 2.7 Course status | Content[3)] | PC |
| | | | | | | | Attendance type[4)] | CPC |

**3. Total estimated time (hours of teaching activities per semester)**

| | | | | | |
|---|---|---|---|---|---|
| 3.1 Number of hours per week | 1 | out of which: 3.2 lecture | 1 | 3.3 seminar/ laboratory/ project | 0 |
| 3.4 Total number of hours in the curriculum | 14 | out of which: 3.5 lecture | 14 | 3.6 seminar/ laboratory/ project | 0 |

| Time allocation | hours |
|---|---|
| Study of textbooks, course support, bibliography and notes | 16 |
| Additional documentation in libraries, specialized electronic platforms, and field research | 16 |
| Preparation of seminars/ laboratories/ projects, homework, papers, portfolios, and essays | 0 |
| Tutorial | 2 |
| Examinations | 2 |
| Other activities.................................... | 0 |

| | |
|---|---|
| **3.7 Total number of hours of student activity** | 36 |
| **3.8 Total number per semester** | 50 |
| **3.9 Number of credits[5)]** | 2 |

**4. Prerequisites (if applicable)**

| | |
|---|---|
| 4.1 curriculum-related | • |
| 4.2 competences-related | • |

**5. Conditions (if applicable)**

| | |
|---|---|
| 5.1 for course development | • Class room equipped with multimedia equipment. Capacity: 30 seats<br>• Video projector |
| 5.2 for seminar/ laboratory/ project development | • |

### 6. Specific competences

| | |
|---|---|
| Professional competences | |
| Transversal competenc | • CT1. To carry out responsibly the professional tasks and resources, respecting professional ethics and social responsibility<br>• The graduate has the capacity to accomplish professional tasks in a responsible manner, based on moral and ethical value |

### 7. Course objectives (resulting from the specific competences to be acquired)

| | |
|---|---|
| 7.1 General course objective | • Developing knowledge about ethics and integrity within the scientific activity |
| 7.2 Specific objectives | • Knowing the ethics and integrity rules within the scientific activity<br>• Understanding the editing requirements for an honest scientific publication<br>• Assimilating the deontological principles regarding teamwork |

### 8. Content

| 8.1 Course | Teaching methods | Number of hours | Remarks |
|---|---|---|---|
| Introductive elements about ethics and integrity within the scientific activity | Projector based presentation. Discussions. | 2 | |
| Standards for ethics in science and research | Projector based presentation. Discussions. | 2 | |
| Editing principles for an honest academic publication | Projector based presentation. Discussions. | 2 | |
| Ethics for citations. References search, citing styles | Projector based presentation. Demonstrations. | 2 | |
| Plagiarism, self-plagiarism and associated problems. Identification and prevention | Projector based presentation. Demonstrations. | 2 | |
| Professional deontology regarding teamwork. Principles, legislation, challenges | Projector based presentation. Discussions. | 2 | |
| Responsibility regarding the research results. Risks, caution and limits | Projector based presentation. Demonstrations. | 2 | |

Bibliography

1. C.P.Ion, Lecture notes ( accesible on e-learning: https://elearning.unitbv.ro/enrol/index.php?id=2666).
2. Gail Baura, Engineering Ethics, 1st Edition, 2006, An Industrial Perspective ISBN: 9780080458021, disponibila la biblioteca Unitbv
3. Edwards, M. A., & Roy, S. (2017). Academic research in the 21st century: Maintaining scientific integrity in a climate of perverse incentives and hypercompetition. Environmental Engineering Science, 34(1), 51-61, https://www.liebertpub.com/doi/full/10.1089/ees.2016.0223
4. Legea nr. Legea nr. 206/2004 (actualizata) privind buna conduită în cercetarea științifică, dezvoltarea tehnologică și inovare.

**9. Correlation of course content with the demands of the labour market (epistemic communities, professional associations, potential employers in the field of study)**

| |
|---|
| European regulations and reccomendations issued by the IEEE society are aconsidered. |

**10. Evaluation**

| Activity type | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Percentage of the final grade |
|---|---|---|---|
| 10.4 Course | The capacity to explain the rules for ethics and academic integrity | Colloquy | 80% |
| | The degree of involvement in debates, discussions, homework accomplishment | Evaluation throughout the semester | 20% |
| 10.6 Minimal performance standard | | | |
| Mastering the rules and basic values regarding ethics and academic integrity by accomplishing a scientific paper with an imposed template | | | |

This course outline was certified in the Department Board meeting on 23/09/2024 and approved in the Faculty Board meeting on 24/09/2024.

| | |
|---|---|
| **Assoc. Prof. Dr. Eng. Titus Constantin BĂLAN,**<br>**Dean** | **Assoc. Prof. Dr. Eng. Lia ACIU,**<br>**Head of Department** |
| **Assoc. Prof. Dr. Eng. Catalin Petrea ION,**<br>**Course holder** | |

Note:

1) Field of study – select one of the following options: BA/MA/PhD. (to be filled in according to the forceful classification list for study programmes);

2) Study level – choose from among: BA/MA/PhD;

3) Course status (content) – for the BA level, select one of the following options: **FC** (fundamental course) / **DC** (course in the study domain)/ **SC** (speciality course)/ **CC** (complementary course); for the MA level, select one of the following options: **PC** (proficiency course)/ SC (synthesis course)/ **AC** (advanced course);

4) Course status (attendance type) – select one of the following options: **CPC** (compulsory course)/ **EC** (elective course)/ **NCPC** (non-compulsory course);

5) One credit is the equivalent of 25 study hours (teaching activities and individual study).

# COURSE OUTLINE

**1. Data about the study programme**

| | |
|---|---|
| 1.1 Higher education institution | Transilvania University of Brasov |
| 1.2 Faculty | Electrical Engineering and Computer Science |
| 1.3 Department | Electrical Engineering and Applied Physics |
| 1.4 Field of study[1)] | Electrical Engineering |
| 1.5 Study level[2)] | MA |
| 1.6 Study programme | Advanced Electrical Systems |

**2. Data about the course**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2.1 Name of course | Research practical stage SEA-1(SEA106) | | | | | | | |
| 2.2 Course convenor | - | | | | | | | |
| 2.3 Seminar/ laboratory/ project convenor | Conf.dr.ing. Luminita BAROTE | | | | | | | |
| 2.4 Study year | I | 2.5 Semester | 1 | 2.6 Evaluation type | C | 2.7 Course status | Content[3)] | SC |
| | | | | | | | Attendance type[4)] | CPC |

**3. Total estimated time (hours of teaching activities per semester)**

| | | | | | |
|---|---|---|---|---|---|
| 3.1 Number of hours per week | **10** | out of which: 3.2 lecture | **0** | 3.3 seminar/ laboratory/ project | **10 P-AsP** |
| 3.4 Total number of hours in the curriculum | 140 | out of which: 3.5 lecture | 0 | 3.6 seminar/ laboratory/ project | 140 P-AsP |
| Time allocation | | | | | hours |
| Study of textbooks, course support, bibliography and notes | | | | | 0 |
| Additional documentation in libraries, specialized electronic platforms, and field research | | | | | 20 |
| Preparation of seminars/ laboratories/ projects, homework, papers, portfolios, and essays | | | | | 30 |
| Tutorial | | | | | 8 |
| Examinations | | | | | 2 |
| Other activities.................................... | | | | | |

| | |
|---|---|
| **3.7 Total number of hours of student activity** | 60 |
| **3.8 Total number per semester** | 200 |
| **3.9 Number of credits[5)]** | 8 |

**4. Prerequisites (if applicable)**

| | |
|---|---|
| 4.1 curriculum-related | • |
| 4.2 competences-related | • |

**5. Conditions (if applicable)**

| | |
|---|---|
| 5.1 for course development | • |
| 5.2 for seminar/ laboratory/ project development | • Established by the research practical stage coordinator |

**6. Specific competences and learning outcomes**

| | |
|---|---|
| Professional competences | **Cp.2 Using modern knowledge in the analysis, evaluation, and operation of electrical subsystems.**<br>• L.O.2.1 The graduate knows methods of physical and mathematical description of the structure and operation of electrical systems.<br>• L.O.2.2 The graduate uses advanced theories to justify the processes of operation, command, and control of advanced electrical systems.<br>**Cp.4 Modeling and optimizing electrical and electronic systems for efficient energy use.**<br>• L.O.4.1 The graduate applies modern methods of modeling and optimizing electrical and power electronic systems for efficient energy use.<br>• L.O.4.4 The graduate designs projects in the field of renewable energy sources, energy storage, and distribution systems.<br>• L.O.4.5 The graduate is capable of modeling and implementing renewable energy systems integrated into intelligent distributed electrical networks.<br>**Cp.5 The development of new solutions for the realization of applications with advanced electrical systems, in the perspective of socio-economic sustainability.**<br>• L.O.5.2. The graduate uses modern theories in the design and optimization of applications with advanced electrical systems.<br>• L.O.5.3. The graduate uses concepts for the realization of applications with low energy consumption, for the control of energy production and management, monitoring and control of the environment.<br>• L.O.5.5. The graduate develops research projects using principles of sustainable development. |
| Transversal competences | **Ct.1 Responsible management of tasks and resources, considering professional ethics and social responsibility**<br>• L.O.1.2 The graduate is able to work with professional autonomy, applying the knowledge acquired in practical situations.<br>• L.O.1.3 The graduate assumes responsibility in undertaking activities, integrating advanced electrical systems into the environment in a spirit of sustainable development.<br>**Ct.2 Efficiency and responsibility in managing teamwork**<br>• L.O.2.1 The graduate can perform specific roles within a multidisciplinary team, contributing to the achievement of common objectives.<br>**Ct.3 Continuous professional development and lifelong learning**<br>• L.O.2.3 The graduate can effectively use language skills and information technology knowledge for personal and professional development. |

**7. Course objectives (resulting from the specific competences to be acquired)**

| | |
|---|---|
| 7.1 General course objective | • Programming skills for using specific software in electrical engineering<br>• Forming the skills for analysis, calculus, modelling and simulation for optimizing electrical systems and processes related to the energy production and conversion;<br>• Knowing and applying the measuring, maintenance and monitoring techniques used for energy conversion;<br>• Forming the skills for optimal management of energy projects. |
| 7.2 Specific objectives | • Forming of skills for modelling and optimization of advanced electrical systems in according with the sustainable development principles: renewable energy sources, storage systems, power distribution systems, control and command systems, power management systems and other systems related to the production, storage, transport and efficient use of energy. |

| | |
|---|---|
| | • Forming the competences for innovative design of renewable energy systems, of storage and distribution of energy;<br>• Forming skills related to the power systems maintenance. |

**8. Content**

| 8.1 Course | Teaching methods | Number of hours | Remarks |
|---|---|---|---|
| N/A | | | |
| 8.2 Seminar/ laboratory/ **project** | Teaching-learning methods | Number of hours | Remarks |
| I. Presentation of how the practical stage research is carried out, research topics, coordinators and discipline requirements.<br>Chosing the project themes.<br><u>Examples of research project themes:</u><br><br>*Electrical machines and drives*<br>1. Applying modern calculus methods of electromagnetic field in electric machines;<br>2. Modelling and optimal designing of designing of permanent magnets machines;<br>3. Control of permanent magnets motors for electrical drives.<br><br>*Power electronic converters*<br>1. Optimal designing of power inverters for single- and three-phase grids with renewable energy sources;<br>2. Applying modern control methods for controlling AC converters for smart grids and microgrids;<br>3. Applying modern methods for inverters control;<br><br>*Monitoring and prediction of electrical systems operation*<br>1. Modern monitoring systems for defects in electrical machines;<br>2. Systems for testing, measurement and monitoring of electrical cables;<br>3. Modern methods for analysis and simulation of noise;<br>4. Monitoring and efficient utilisation of electrical systems for power supply to consumers;<br><br>*Systems for production, distribution and transport of electrical energy*<br>1. Optimal designing of power supply circuits and protection system for networks with renewable energy sources;<br>2. Choosing the optimal solution of energy storage for autonomous microgrids with microhydro power plants;<br>3. Modelling and simulations of systems designed for supplying consumers with renewable energy systems;<br>4. Modeling and simulation of hybrid systems with renewable energy sources connected to the grid;<br>5. Control of small scale wind turbines for integration in | Oral presentation | 10 h | |

| | | | |
|---|---|---|---|
| autonomous microgrids;<br>6, Control of a small-scale PV power plant for autonomous microgrid applications<br><br>*Energy storage and recovery*<br>1. Optimal designing of flywheel-based energy storage systems;<br>2. Solutions for interconnecting energy storage systems to the grid;<br>3. Optimal designing of power supply systems for electric vehicle;<br>4. Control strategies used in power supply systems;<br>5. Implementing a thermo-electric system for energy recovery;<br>6. Solutions for frequency control in microgrids, based on pumped-hydro storage;<br>7. Methods for state of charge estimation for different storage systems;<br>8.Modelling and simulation of hybrid systems with RES operating autonomously.<br><br>*Electromagnetic compatibility and power quality*<br>1. Analysis of the distorted regime in distribution electrical networks for compatibility with renewable energy sources;<br>2. Analysis of the distorted regime on electrical equipments performances;<br>3. Implementing testing techniques for electrical and electronic equipments for electromagnetic immunity.<br>4. Monitoring and centralized control of the electrical energy parameters for microgrids with RES;<br><br>*Materials and sensors*<br>1. Modern methods for characterising the magnetic materials used in the construction of electrical equipments;<br>2. Modern methods for magneto-electrical characterisation of nanostructural magnetic systems;<br>3. Establishing the field and angle characteristics of some sensors used in nanostructural magnetic systems;<br>4. Study of piezoelectric and magnetostrictive phenomena of some materials used as vibration sensors;<br>5. Modeling micromagnetical sensors for magnetic field;<br>6. Simulating the behavior of magnetic nano- oscillatory of high frequency. | | | |
| II. Carrying out the practical research stage in an environment organized by the project coordinator. | Project-based learning;<br>Teamwork | 130 h | |
| III. Defending the research project report by students | Oral presentation | 2 h | |
| Bibliography<br>Provided by the project coordinator. | | | |

**9. Correlation of course content with the demands of the labour market (epistemic communities, professional associations, potential employers in the field of study)**

| |
|---|
| The course ensures the achievement of several interdisciplinary competences, which are in accordance with the specific requirements of the international job market from various domains, especially in research and development (R&D) services. Moreover, the international regulations recommended by the association IEEE are considered. |

**10. Evaluation**

| Activity type | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Percentage of the final grade |
|---|---|---|---|
| 10.4 Course | N/A | | |
| | | | |
| 10.5 Seminar/ laboratory/ **project** | The degree of project theme fulfilment | Evaluation of student activity during semester by the project coordinator | 50% |
| | | Project report defending by an oral presentation | 50% |
| 10.6 Minimal performance standard | | | |
| • A research project evaluated by the research stage coordinator as fulfilling the minimum requirements for the accomplished activities and an oral presentation of the report. | | | |

This course outline was certified in the Department Board meeting on 23/09/2024 and approved in the Faculty Board meeting on 24/09/2024.

| | |
|---|---|
| **Assoc. Prof. Titus Constantin BALAN,**<br>**Dean** | **Assoc. Prof. Lia ACIU,**<br>**Head of Department** |
| **N/A**<br>**Course holder** | **Assoc. Prof. Luminita BAROTE**<br>**Holder of project (SEA coordinator)** |

Note:

1) Field of study – select one of the following options: Bachelor / Master / Doctorat (to be filled in according to the forceful classification list for study programmes);

2) Study level – choose from among: Bachelor / Master / Doctorat;

3) Course status (content) – for the Bachelor level, select one of the following options: **FC** (fundamental course) / **DC** (course in the study domain)/ **SC** (speciality course)/ **CC** (complementary course); for the Master level, select one of the following options: **PC** (proficiency course)/ SC (synthesis course)/ **AC** (advanced course);

4) Course status (attendance type) – select one of the following options: **CPC** (compulsory course)/ **EC** (elective course)/ **NCPC** (non-compulsory course);

5) One credit is the equivalent of 25 study hours (teaching activities and individual study).

# COURSE OUTLINE

## 1. Data about the study programme

| | |
|---|---|
| 1.1 Higher education institution | Transylvania University of Brasov |
| 1.2 Faculty | Electrical Engineering and Computer Science |
| 1.3 Department | Electrical Engineering and Applied Physics |
| 1.4 Field of study[1)] | Electrical Engineering |
| 1.5 Study level[2)] | MA |
| 1.6 Study programme | Advanced Electrical Systems |

## 2. Data about the course

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2.1 Name of course | Entrepreneurship (SEA112) | | | | | | | |
| 2.2 Course convenor | | | | Lupșa-Tătaru Dana Adriana | | | | |
| 2.3 Seminar/ laboratory/ project convenor | | | | Lupșa-Tătaru Dana Adriana | | | | |
| 2.4 Study year | I | 2.5 Semester | 1 | 2.6 Evaluation type | E | 2.7 Course status | Content[3)] | CC |
| | | | | | | | Attendance type[4)] | NCPC |

## 3. Total estimated time (hours of teaching activities per semester)

| | | | | | |
|---|---|---|---|---|---|
| 3.1 Number of hours per week | **4** | out of which: 3.2 lecture | **2** | 3.3 seminar/ laboratory/ project | **2** |
| 3.4 Total number of hours in the curriculum | 56 | out of which: 3.5 lecture | 28 | 3.6 seminar/ laboratory/ project | 28 |

| | |
|---|---|
| Time allocation | hours |
| Study of textbooks, course support, bibliography and notes | 24 |
| Additional documentation in libraries, specialized electronic platforms, and field research | 8 |
| Preparation of seminars/ laboratories/ projects, homework, papers, portfolios, and essays | 10 |
| Tutorial | |
| Examinations | 2 |
| Other activities…………………………… | |

| | |
|---|---|
| **3.7 Total number of hours of student activity** | 44 |
| **3.8 Total number per semester** | 100 |
| **3.9 Number of credits[5)]** | 4 |

## 4. Prerequisites (if applicable)

| | |
|---|---|
| 4.1 curriculum-related | • Basic management knowledge. |
| 4.2 competences-related | • |

## 5. Conditions (if applicable)

| | |
|---|---|
| 5.1 for course development | • Classroom equipped with video projector and computers |
| 5.2 for seminar/ laboratory/ project development | • Seminar room equipped with computers |

**6. Specific competences and learning outcomes**

| | |
|---|---|
| Professional competences | **Cp5. Developing new solutions for accomplishing applications with advanced electrical systems, for socio-economical sustainability**<br>L.O.5.1. The graduate is capable of identifying and assimilating the methods for development and optimization of electrical systems;<br>L.O.5.2. The graduate uses modern theories for designing and optimization of advanced electrical systems applications;<br>L.O.5.5. The graduate develops research projects using sustainable development principles; |
| Transversal competences | **Ct.3 Continuous professional development and lifelong learning**<br>L.O.3.1. The graduate is capable of objective self-evaluation of the continuous professional training needs;<br>L.O.3.2. The graduate can effectively use language skills and information technology knowledge for personal and professional development.<br>L.O.3.2. The graduate knows how to adapt to the dynamics of the labor market through constant learning and effective insertion on the labor market. |

**7. Course objectives (resulting from the specific competences to be acquired)**

| | |
|---|---|
| 7.1 General course objective | • Gaining knowledge about specific entrepreneurial strategies, models used for start-ups |
| 7.2 Specific objectives | • Developing knowledge and capacity for analysis and synthesis regarding the main aspects related to entrepreneurship. |

**8. Content**

| 8.1 Course | Teaching methods | Number of hours | Remarks |
|---|---|---|---|
| 1. Business. Concepts, characteristics | Academic debate | 4 | |
| 2. Business approach. Partners, clients, planning, strategic decision, small business | Academic debate | 4 | |
| 3. Business blunders | Academic debate | 4 | |
| 4. Entrepreneurship. Concepts | Academic debate | 4 | |
| 5. Entrepreneurship and innovation | Academic debate | 4 | |
| 6. Entrepreneurial strategies | Academic debate | 4 | |
| 7. Prohibitions in entrepreneurship | Academic debate | 4 | |

Bibliography


1. Luban, F., Sisteme bazate pe cunoştinte în management, Editura ASE, Bucureşti, 2006
2. Nicolescu, O., Managementul întreprinderilor mici şi mijlocii, Editura Economică, Bucureşti, 2001
3. Nicolescu, O., Nicolescu, L., Economia, firma şi managementul bazate pe cunoştinte, Ed. Economică, Bucuresti, 2005
4. Wallace, D.P., Knowledge Management: Historical and Cross-Disciplinary Themes, Libraries Unlimited Inc., 2007


| 8.2 Seminar/ laboratory/ project | Teaching-learning methods | Number of hours | Remarks |
|---|---|---|---|
| 1. Debate on the differences between knowledge management and information management | Academic debate, team project | 4 | |
| 2. Case study on knowledge management processes (1) | | 4 | |
| 3. Case study on knowledge management processes (2) | | 4 | |
| 4. Application of models for assessing the maturity of organizational culture favorable to knowledge management | | 4 | |
| 5. Debates and comparisons on the European model for | | 4 | |

| | | | |
|---|---|---|---|
| implementing knowledge management | | | |
| 6. Good practices in knowledge management. Case studies. | | 4 | |
| 7. Operationalization of tools for assessing the efficiency of implementing knowledge management systems | | 4 | |


Bibliography

1. Luban, F., Sisteme bazate pe cunoştinte în management, Editura ASE, Bucureşti, 2006
2. Nicolescu, O., Managementul întreprinderilor mici şi mijlocii, Editura Economică, Bucureşti, 2001
3. Nicolescu, O., Nicolescu, L., Economia, firma şi managementul bazate pe cunoştinte, Ed. Economică, Bucuresti, 2005
4. Wallace, D.P., Knowledge Management: Historical and Cross-Disciplinary Themes, Libraries Unlimited Inc., 2007


**9. Correlation of course content with the demands of the labour market (epistemic communities, professional associations, potential employers in the field of study)**

| |
|---|
| |

**10. Evaluation**

| Activity type | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Percentage of the final grade |
|---|---|---|---|
| 10.4 Course | At least one topic covered | Quantitative evaluation | 40% |
| 10.5 Seminar/ laboratory/ project | A team project | Qualitative evaluation | 60% |
| 10.6 Minimal performance standard | | | |
| • A course topic, a project | | | |

This course outline was certified in the Department Board meeting on 23/09/2024 and approved in the Faculty Board meeting on 24/09/2024.

| | |
|---|---|
| **Dean,**<br>Conf.dr.ing. Titus Constantin BĂLAN | **Head of Department**<br>Conf. dr. ing. Lia Elena ACIU |
| **Course holder**<br>**Lect.dr. Lupșa-Tătaru Dana Adriana** | **Lect.dr. Lupșa-Tătaru Dana Adriana**<br>**Holder of seminar** |

Note:

1) Field of study – select one of the following options: Bachelor / Master / Doctorat (to be filled in according to the forceful classification list for study programmes);

2) Study level – choose from among: Bachelor / Master / Doctorat;

3) Course status (content) – for the Bachelor level, select one of the following options: **FC** (fundamental course) / **DC** (course in the study domain)/ **SC** (speciality course)/ **CC** (complementary course); for the Master level, select one of the following options: **PC** (proficiency course)/ SC (synthesis course)/ **AC** (advanced course);

4) Course status (attendance type) – select one of the following options: **CPC** (compulsory course)/ **EC** (elective course)/ **NCPC** (non-compulsory course);

5) One credit is the equivalent of 25 study hours (teaching activities and individual study).

# COURSE OUTLINE

**1. Data about the study programme**

| | |
|---|---|
| 1.1 Higher education institution | Transilvania University of Brasov |
| 1.2 Faculty | Electrical Engineering and Computer Science |
| 1.3 Department | Electrical Engineering and Applied Physics |
| 1.4 Field of study[1)] | Electrical Engineering |
| 1.5 Study level[2)] | MA |
| 1.6 Study programme | Advanced Electrical Systems |

**2. Data about the course**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2.1 Name of course | Digital Electrical Systems (SEA207) | | | | | | | |
| 2.2 Course convenor | Lect.PhD.Eng. Gheorghe-Dan SOREA | | | | | | | |
| 2.3 Seminar/ laboratory/ project convenor | Lect.PhD.Eng. Gheorghe-Dan SOREA | | | | | | | |
| 2.4 Study year | 1 | 2.5 Semester | 2 | 2.6 Evaluation type | E | 2.7 Course status | Content[3)] | SC |
| | | | | | | | Attendance type[4)] | CPC |

**3. Total estimated time (hours of teaching activities per semester)**

| | | | | | |
|---|---|---|---|---|---|
| 3.1 Number of hours per week | **3** | out of which: 3.2 lecture | **1** | 3.3 seminar/ laboratory/ project | **2** |
| 3.4 Total number of hours in the curriculum | 42 | out of which: 3.5 lecture | 14 | 3.6 seminar/ laboratory/ project | 28 |
| Time allocation | | | | | hours |
| Study of textbooks, course support, bibliography and notes | | | | | 28 |
| Additional documentation in libraries, specialized electronic platforms, and field research | | | | | 23 |
| Preparation of seminars/ laboratories/ projects, homework, papers, portfolios, and essays | | | | | 28 |
| Tutorial | | | | | 1 |
| Examinations | | | | | 3 |
| Other activities.................................... | | | | | |

| | |
|---|---|
| **3.7 Total number of hours of student activity** | 83 |
| **3.8 Total number per semester** | 125 |
| **3.9 Number of credits[5)]** | 5 |

**4. Prerequisites (if applicable)**

| | |
|---|---|
| 4.1 curriculum-related | • Courses: Programming |
| 4.2 competences-related | • Digital Competences |

**5. Conditions (if applicable)**

| | |
|---|---|
| 5.1 for course development | • Room with multimedia equipment, 20 places |
| 5.2 for seminar/ laboratory/ project development | • Computer network: server + workstations |

**6. Specific competences and learning outcomes**

| | |
|---|---|
| Professional competences | Cp1. Operating with modern methods and techniques for computer processing information |
| Transversal competences | Ct1. Handling the responsabilities required by the assignments and resources with respect to professional ethics and social responsability<br>Ct2. Continuous professional development and long life learning |

**7. Course objectives (resulting from the specific competences to be acquired)**

| | |
|---|---|
| 7.1 General course objective | • The given materials will assure the student the knowledge about the digital electrical systems |
| 7.2 Specific objectives | • Capacity of transposing of a model into practical applications |

**8. Content**

| 8.1 Course | Teaching methods | Number of hours | Remarks |
|---|---|---|---|
| C1-2. Introduction in HTML+CSS | Interactive course with didactical materials | 4 | |
| C3-4. Introduction in PHP | Interactive course with didactical materials | 4 | |
| C5-7. Relational databases SQL | Interactive course with didactical materials | 6 | |
| Bibliography<br>Tutorials online: http://www.w3schools.com | | | |
| 8.2 Seminar/ laboratory/ project | Teaching-learning methods | Number of hours | Remarks |
| L1-4. Creation of Web pages | Tutorials | 8 | |
| L5-8. Creation of PHP scripts | Tutorials and programming | 8 | |
| L9-14. Creation of a database and connecting it to a Web interface | Tutorials and programming | 12 | |
| Bibliography<br>1. D.Sorea, Lecture notes, ( accesible on e-learning: https://elearning.unitbv.ro/2024/course/view.php?id=5698)<br>2. Tutorials online: http://www.w3schools.com | | | |

**9. Correlation of course content with the demands of the labour market (epistemic communities, professional associations, potential employers in the field of study)**

| |
|---|
| The course will assure the required competences for understanding and applying the IT knowledge into electrical engineering, according to the specific requirements of the international working market |

**10. Evaluation**

| Activity type | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Percentage of the final grade |
|---|---|---|---|
| 10.4 Course | Capacity of understanding of basics of IT | Quiz test | 20% |
| 10.5 Seminar/ laboratory/ project | Realization of small/medium application | presentation | 80% |
| 10.6 Minimal performance standard | | | |
| • Understanding the basic principles and standards of digital technologies<br>• Simulation of a technical application based on digital technologies | | | |

This course outline was certified in the Department Board meeting on 23/09/2024 and approved in the Faculty Board meeting on 24/09/2024.

| | |
|---|---|
| **Assoc. Prof. Dr. Eng. Titus Constantin BĂLAN,**<br>**Dean** | **Assoc. Prof. Dr. Eng. Lia Elena ACIU,**<br>**Head of Department** |
| **Lect. Dr. Eng. Gheorghe Dan SOREA**<br>**Course holder** | **Lect. Dr. Eng. Gheorghe Dan SOREA**<br>**Holder of seminar/ laboratory/ project** |

Note:

1) Field of study – select one of the following options: Bachelor / Master / Doctorat (to be filled in according to the forceful classification list for study programmes);

2) Study level – choose from among: Bachelor / Master / Doctorat;

3) Course status (content) – for the Bachelor level, select one of the following options: **FC** (fundamental course) / **DC** (course in the study domain)/ **SC** (speciality course)/ **CC** (complementary course); for the Master level, select one of the following options: **PC** (proficiency course)/ SC (synthesis course)/ **AC** (advanced course);

4) Course status (attendance type) – select one of the following options: **CPC** (compulsory course)/ **EC** (elective course)/ **NCPC** (non-compulsory course);

5) One credit is the equivalent of 25 study hours (teaching activities and individual study).

# COURSE OUTLINE

## 1. Data about the study programme

| | |
|---|---|
| 1.1 Higher education institution | Transilvania University of Brașov |
| 1.2 Faculty | Electrical Engineering and Computer Science |
| 1.3 Department | Electrical Engineering and Applied Physics |
| 1.4 Field of study[1)] | Electrical Engineering |
| 1.5 Study level[2)] | MA |
| 1.6 Study programme | Advanced Electrical Systems |

## 2. Data about the course

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2.1 Name of course | | | Electric propulsion systems (SEA208) | | | | | |
| 2.2 Course convenor | | | Assoc. Prof. Dr. Eng. Ion Catalin Petrea | | | | | |
| 2.3 Laboratory convenor | | | Assoc. Prof. Dr. Eng. Ion Catalin Petrea | | | | | |
| 2.4 Study year | I | 2.5 Semester | 2 | 2.6 Evaluation type | E | 2.7 Course status | Content[3)] | SC |
| | | | | | | | Attendance type[4)] | CPC |

## 3. Total estimated time (hours of teaching activities per semester)

| | | | | | |
|---|---|---|---|---|---|
| 3.1 Number of hours per week | **4** | out of which: 3.2 lecture | **2** | 3.3 laboratory/project | **1/1** |
| 3.4 Total number of hours in the curriculum | 56 | out of which: 3.5 lecture | 28 | 3.6 laboratory/project | 14/14 |
| Time allocation | | | | | hours |
| Study of textbooks, course support, bibliography and notes | | | | | 21 |
| Additional documentation in libraries, specialized electronic platforms, and field research | | | | | 21 |
| Preparation of seminars/ laboratories/ projects, homework, papers, portfolios, and essays | | | | | 23 |
| Tutorial | | | | | 2 |
| Examinations | | | | | 2 |
| Other activities..................................... | | | | | - |

| | |
|---|---|
| **3.7 Total number of hours of student activity** | 69 |
| **3.8 Total number per semester** | 125 |
| **3.9 Number of credits[5)]** | 5 |

## 4. Prerequisites (if applicable)

| | |
|---|---|
| 4.1 curriculum-related | • |
| 4.2 competences-related | • Adequate knowledge related to Electrical Engineering |

## 5. Conditions (if applicable)

| | |
|---|---|
| 5.1 for course development | • Class room equipped with multimedia equipment. Capacity: 30 seats |
| 5.2 for seminar/ laboratory/ project development | • Laboratory equipped with computers - 15 working places |

## 6. Specific competences

| | | |
|---|---|---|
| Professional competences | **Cp.5 Development of new solutions for the accomplishment of applications with advanced electrical systems, in the perspective of socio-economical sustainability**<br>• L.O.5.3 The graduate uses concepts to accomplish applications with reduced energy consumption, for the control of energy generation and management, monitoring and control of the environment |
| Transversal competences | **Ct.1 Responsible management of tasks and resources, considering professional ethics and social responsibility**<br>• L.O.1.2 The graduate is able to work with professional autonomy, applying the knowledge acquired in practical situations.<br>• L.O.1.3 The graduate assumes responsibility in undertaking activities, integrating advanced electrical systems into the environment in a spirit of sustainable development.<br>**Ct.2 Efficiency and responsibility in managing teamwork**<br>• L.O.2.1 The graduate can perform specific roles within a multidisciplinary team, contributing to the achievement of common objectives. |

**7. Course objectives (resulting from the specific competences to be acquired)**

| | |
|---|---|
| 7.1 General course objective | • Knowledge and skills acquisition in order to understand the operation of electric propulsion systems |
| 7.2 Specific objectives | • Knowing the methods for physical and mathematical description of the electrical system structure and operation<br>• Tinted usage of evaluation methods and underlying of applications specific to electrical systems, taking into account the principles related to energy conversion and electromagnetic compatibility<br>• Assuming the techniques and description of the methods and algorithms for the modeling and optimization of advanced electrical systems<br>• Applying modern methods and methods for modeling and optimization of electric and electronic systems for efficient energy use<br>• Using assisted design methods to model and optimize electric and electronic systems for obtaining energy efficient applications |

**8. Content**

| 8.1 Course | Teaching methods | Number of hours | Remarks |
|---|---|---|---|
| Introduction in the field of electric propulsion systems | Interactive teaching materials presented with video projector. Exemplifications and demonstrations on the blackboard if necessary. | 2 | |
| Electrical machines for electric propulsion systems | | 4 | |
| Power electronics and energy storage for electric propulsion systems | | 4 | |
| Control systems for electric propulsion systems | | 4 | |
| Electric vehicles: generalities, charging infrastructure | | 2 | |
| Powertrains for electric propulsion systems | | 2 | |
| Electric propulsion systems for the rails sector | | 2 | |
| Electric propulsion systems for urban transport | | 2 | |
| Electric propulsion systems for water transport | | 2 | |
| Electric propulsion systems for aerial transport | | 2 | |
| Summarizing and discussions about the exam subjects | | 2 | |

| | | | |
|---|---|---|---|
| Bibliography<br>[1] ION Cătalin Petrea, Electrical propulsion systems, Lecture notes (accesible on e-learning: https://elearning.unitbv.ro/2024/course/view.php?id=6306<br>[2] Paul C. Krause, Oleg Wasynczuk, Scott D. Sudhoff, Analysis of electric machinery and drive systems, John Wiley and Sons, 2002<br>[3] Bogdan M. Wilamowski, J. david Irwin, Power electronics and motor drives, CRC Press, 2011 Adam Harvey, | | | |
| 8.2 Laboratory | Teaching-learning methods | Number of hours | Remarks |
| Simulation of DC-DC converters for electric vehicles | Simulations using Matlab/Simulink | 2 | |
| Simulation of inverters for electric vehicles | | 2 | |
| Simulation of charging station for electric vehicles | | 2 | |
| Simulation of electric traction characteristics for an AC motor | | 2 | |
| Simulation of an induction motor based propulsion system | | 2 | |
| Simulation of synchronous motor based propulsion system | | 2 | |
| Laboratory test | Evaluation | 2 | |
| Bibliography<br>[1] ION Cătalin Petrea, Electrical propulsion systems, Laboratory guide, available on the portal | | | |
| Project | | | |
| Analysis of the state-of-the art for a specific component of an electric propulsion system | Individual work | 14 | |
| Bibliography<br>[1] Corneliu Marinescu et all., Retele hibride cu surse regenerabile de energie : evolutii moderne, Editura Universitatii 'Transilvania' din Brasov, 2011<br>[2] John G. Hayes, G. Abas Goodarzi, Electric Powertrain, 2018 John Wiley & Sons Ltd | | | |

**9. Correlation of course content with the demands of the labour market (epistemic communities, professional associations, potential employers in the field of study)**

| |
|---|
| European regulations and reccomendations issued by the IEEE society are aconsidered. |

**10. Evaluation**

| Activity type | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Percentage of the final grade |
|---|---|---|---|
| 10.4 Course | Application of advanced electrical systems knowledge to understand the operation of electric propulsion systems | Written exam | 60% |
| 10.5 Laboratory/project | Laboratory: The capacity to develop a Simulink program that emulates the operation of an electric propulsion system | Laboratory test | 20% |

| | | | |
|---|---|---|---|
| | Project: The capacity to synthetize the specifications for a key component of an electric propulsion system | Project defense | 20% |
| 10.6 Minimal performance standard | | | |
| • Understanding and explaining the concepts related to the electric propulsion system<br>• Access to the exam is conditioned by the passing of both the laboratory test and project defence<br>• Access to the laboratory test is conditioned by the presence to all laboratory activities<br>• Project defence is conditioned by the gain of intermediate evaluations | | | |

This course outline was certified in the Department Board meeting on de 23/09/2024 and approved in the Faculty Board meeting on 24/09/2024

| | |
|---|---|
| **Assoc. Prof. Dr. Eng. Titus Constantin BĂLAN,**<br>**Dean** | **Assoc. Prof. Dr. Eng. Lia ACIU,**<br>**Head of Department** |
| **Assoc. Prof. Dr. Eng. Catalin Petrea ION,**<br>**Course holder** | **Assoc. Prof. Dr. Eng. Catalin Petrea ION,**<br>**Holder of laboratory/ project** |

Note:

1) Field of study – select one of the following options: BA/MA/PhD. (to be filled in according to the forceful classification list for study programmes);

2) Study level – choose from among: BA/MA/PhD;

3) Course status (content) – for the BA level, select one of the following options: **FC** (fundamental course) / **DC** (course in the study domain)/ **SC** (speciality course)/ **CC** (complementary course); for the MA level, select one of the following options: **PC** (proficiency course)/ SC (synthesis course)/ **AC** (advanced course);

4) Course status (attendance type) – select one of the following options: **CPC** (compulsory course)/ **EC** (elective course)/ **NCPC** (non-compulsory course);

5) One credit is the equivalent of 25 study hours (teaching activities and individual study).

# COURSE OUTLINE

## 1. Data about the study programme

| | |
|---|---|
| 1.1 Higher education institution | Transilvania University of Brasov |
| 1.2 Faculty | Electrical Engineering and Computer Science |
| 1.3 Department | Electrical Engineering and Applied Physics |
| 1.4 Field of study[1)] | Electrical Engineering |
| 1.5 Study level[2)] | MA |
| 1.6 Study programme | Advanced Electrical Systems |

## 2. Data about the course

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2.1 Name of course | Integrated Electrical Installations Design (SEA209) | | | | | | | |
| 2.2 Course convenor | Lect. phd. eng. Septimiu MOTOAȘCĂ | | | | | | | |
| 2.3 Seminar/ laboratory/ project convenor | Lect. phd. eng. Septimiu MOTOAȘCĂ | | | | | | | |
| 2.4 Study year | 1 | 2.5 Semester | 2 | 2.6 Evaluation type | E | 2.7 Course status | Content[3)] | SD |
| | | | | | | | Attendance type[4)] | ID |

## 3. Total estimated time (hours of teaching activities per semester)

| | | | | | |
|---|---|---|---|---|---|
| 3.1 Number of hours per week | **3** | out of which: 3.2 lecture | **1** | 3.3 seminar/ laboratory/ project | **0/1/1** |
| 3.4 Total number of hours in the curriculum | 42 | out of which: 3.5 lecture | 14 | 3.6 seminar/ laboratory/ project | 0/14/14 |

| Time allocation | hours |
|---|---|
| Study of textbooks, course support, bibliography and notes | 20 |
| Additional documentation in libraries, specialized electronic platforms, and field research | 20 |
| Preparation of seminars/ laboratories/ projects, homework, papers, portfolios, and essays | 36 |
| Tutorial | 3 |
| Examinations | 4 |
| Other activities.................................... | |

| | |
|---|---|
| **3.7 Total number of hours of student activity** | 83 |
| **3.8 Total number per semester** | 125 |
| **3.9 Number of credits[5)]** | 5 |

## 4. Prerequisites (if applicable)

| | |
|---|---|
| 4.1 curriculum-related | • Completion of Computer Graphics and CAD courses in the undergraduate cycle |
| 4.2 competences-related | • Completion of electrical installation courses in the undergraduate cycle |

## 5. Conditions (if applicable)

| | |
|---|---|
| 5.1 for course development | • Lecture room with projector |
| 5.2 for seminar/ laboratory/ project development | • Laboratory room with computers and pre-installed software |

## 6. Specific competences and learning outcomes

| | |
|---|---|
| Professional competences | CP1. Working with modern concepts and calculation methods for computer-aided design of electrical systems.<br>L.O.1.1.The graduate presents an in-depth knowledge of programming languages, environments and technologies and specific tools for electrical engineering applications.<br>L.O.1.2. The graduate uses specific computational tools for the design and optimization of advanced electrical systems.<br>L.O.1.3. The graduate is capable of the integrated use of concepts in solving electrical engineering problems using methods based on the use of dedicated software and appropriate CAD tools.<br>L.O.1.4. The graduate achieves a nuanced appreciation and pertinent evaluation of CAD methods and means in the realization of applications in the area of specialization.<br>CP2 The development of new solutions for the realization of applications with advanced electrical systems, in the perspective of socio-economic sustainability.<br>L.O.2.1.The graduate evaluates methods of analysis and quality improvement, with the elaboration of specific corrective/preventive measures.<br>L.O.2.2. The graduate develops research projects using principles of sustainable development.<br>L.O.2.3. The graduate performs the maintenance of systems with renewable energy sources in accordance with the current technical, economic and environmental requirements. |
| Transversal competences | CT1 Responsible management of tasks and resources, considering professional ethics and social responsibility<br>L.O.1.1. The graduate has the ability to perform professional tasks responsibly, taking into account moral and ethical values.<br>L.O.1.2. The graduate knows how to work in conditions of professional autonomy, with the practical application of the acquired knowledge.<br>L.O.1.3. The graduate assumes responsibility in the activities undertaken, in the spirit of integrating advanced electrical systems into the environment, under the conditions of sustainable development.<br>CT2 Efficiency and responsibility in managing teamwork<br>L.O.2.1. The graduate has the ability to carry out specific work roles in a multidisciplinary team, contributing to the achievement of common objectives.<br>L.O.2.2. The graduate shows an entrepreneurial spirit, highlighted by innovation and active involvement in the performance of team tasks.<br>L.O.2.3. The graduate can lead and coordinate the activities of a team, ensuring cohesion and efficiency in achieving objectives. |

## 7. Course objectives (resulting from the specific competences to be acquired)

| | |
|---|---|
| 7.1 General course objective | • The materials presented in the course and laboratory hours aim to provide the student with basic training for the design and use of low-voltage installations for prosumers. |
| 7.2 Specific objectives | • Ensuring the necessary skills for dimensioning a low-voltage electrical installation at a prosumer, with the correct choice of component elements according to the national and international standards in force;<br>• Knowledge and differentiation of specific electrical devices and equipment from a low-voltage electrical installation for the prosumer; |

## 8. Content

| 8.1 Course | Teaching methods | Number of hours | Remarks |
|---|---|---|---|
| 1 Introduction. Consumer electrical installations, classification, definitions and composition | Interactive course with examples based on slides with a video projector. | 2 hours | |

| | | | |
|---|---|---|---|
| 2 Legislation in the field of electricity and prosumers. | Interactive course with examples based on slides with a video projector. | 2 hours | |
| 3 General rules for designing electrical installations. Types of tasks. The power required by an electrical installation at a prosumer. | Interactive course with examples based on slides with a video projector. | 2 hours | |
| 4 Low voltage electrical networks. Schemes of distribution and supply networks. Radial networks. Prosumer metering. | Interactive course with examples based on slides with a video projector. | 2 hours | |
| 5 Apparatus for power supply of prosumers and specific problems. | Interactive course with examples based on slides with a video projector. | 2 hours | |
| 6 Calculation of low-voltage electrical installations at prosumers | Interactive course with examples based on slides with a video projector. | 2 hours | |
| 7 Protection installations. Grounding installations. Protection against electric shocks. Protection against overvoltages. | Interactive course with examples based on slides with a video projector. | 2 hours | |

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1. S. Motoasca, Lecture notes, ( accesible on e-learning: https://elearning.unitbv.ro/2024/course/view.php?id=6803)
2. Cilinghir V., Alimentarea cu energie electrica a intreprinderilor, Vol1 și vol.2, Ed. Universitatii Transilvania din Brasov, 2000 si 2002 (acces biblioteca)
3. Saracin C., Instalatii electrice, Editura Matrixrom, 2009
4. Cazacu E. Instalatii electrice moderne. Baze teoretice, elemente de calcul si proiectare, Editura Matrixrom, 2017
5. *** SR EN 61082-1+A1+A2, Elaborarea documentelor utilizate în electrotehnică, Partea I: prescripții generale, dec. 2000
6. *** SR EN 60617 Simboluri grafice pentru scheme electrice, 1999
7. Schneider Electric, Manualul Instalatiilor Electrice, 2018
8. https://arhiva.anre.ro/ro/energie-electrica/legislatie/prosumatori/prosumatori-reglementari


| 8.2 Seminar/ laboratory/ project | Teaching-learning methods | Number of hours | Remarks |
|---|---|---|---|
| 1. Labor protection and PSI and presentation of laboratory works | Training and exposure | 2 hours | |
| 2. Presentation of the CaddySEE-Electric program and creation of a model house plan. | Exposure of the laboratory work and realization of the plan on the computer in CaddySEE-Electric. | 2 hours | |
| 3. Dimensioning and realization of the electrical installation on the plan of the typical house. | Exposure of the laboratory work and | 2 hours | |

| | | | |
|---|---|---|---|
| | realization of the plan on the computer in CaddySEE-Electric. | | |
| 4. Calculation of energy consumption and choice of location for the location of the typical house. | Presentation of the laboratory work and realization of the plan and consumption tables in Excel on the computer. | 2 hours | |
| 5. Calculation of the installed power requirement for the photovoltaic panel system using the PVsyst software. | Exposure of the laboratory work and creation of the roof plan and the location of the PV panels on the computer. | 2 hours | |
| 6. Dimensioning of the network connection installations for the prosumer in the typical house. | Presentation of the laboratory work and making the calculations and the final plan on the computer. | 2 hours | |
| The laboratory colloquium | Prosumer sizing according to the given parameters. | 2 hours | |
| The design of the electrical installation of lighting and power for a household prosumer. | Realization of project, conversation, individual work, exhibition. | 14 hours | |

Bibliography


1. https://www.pvsyst.com/
2. https://www.ige-xao.com/en/us/see-electrical/
3. Schneider Electric, Manualul Instalatiilor Electrice, 2018
4. https://arhiva.anre.ro/ro/energie-electrica/legislatie/prosumatori/prosumatori-reglementari
5. Motoasca. S. Computer Graphics – laboratory guide, Ed. Universitatii Transilvania din Brasov, 2023


**9. Correlation of course content with the demands of the labour market (epistemic communities, professional associations, potential employers in the field of study)**

**The content of the discipline provides the young master's students with the necessary basis for employment in companies operating in the design and construction of low-voltage electrical installations for domestic and industrial consumers. The content of the course is adapted to the requirements of employers in the field of electrical installations for prosumers.**

**10. Evaluation**

| Activity type | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Percentage of the final grade |
|---|---|---|---|
| 10.4 Course | Solving exam subjects | Written exam with 3 subjects | 60% |
| 10.5 Seminar/ laboratory/ project | Promotion of the laboratory colloquium | Prosumer sizing according to the given parameters. | 10% |
| | Realization of the project | Checking the obtained results and correctness of the drawn parts | 30% |

| 10.6 Minimal performance standard |
|---|
| • The final average in the exam is calculated only in the situation where the grades obtained in the exam, laboratory and project are at least 5. |

This course outline was certified in the Department Board meeting on 23/09/2024 and approved in the Faculty Board meeting on 24/09/2024.

| | |
|---|---|
| **Assoc. Prof. Titus Constantin BĂLAN,**<br>**Dean** | **Assoc.Prof. Lia-Elena ACIU,**<br>**Head of Department** |
| **Lect. phd. eng. Septimiu MOTOAȘCĂ,**<br>**Course holder** | **Lect. phd. eng. Septimiu MOTOAȘCĂ,**<br>**Holder of seminar/ laboratory/ project** |

Note:

1) Field of study – select one of the following options: Bachelor / Master / Doctorat (to be filled in according to the forceful classification list for study programmes);

2) Study level – choose from among: Bachelor / Master / Doctorat;

3) Course status (content) – for the Bachelor level, select one of the following options: **FC** (fundamental course) / **DC** (course in the study domain)/ **SC** (speciality course)/ **CC** (complementary course); for the Master level, select one of the following options: **PC** (proficiency course)/ SC (synthesis course)/ **AC** (advanced course);

4) Course status (attendance type) – select one of the following options: **CPC** (compulsory course)/ **EC** (elective course)/ **NCPC** (non-compulsory course);

5) One credit is the equivalent of 25 study hours (teaching activities and individual study).

# COURSE OUTLINE

**1. Data about the study programme**

| | |
|---|---|
| 1.1 Higher education institution | Transilvania University of Brasov |
| 1.2 Faculty | Electrical Engineering and Computer Science |
| 1.3 Department | Electrical Engineering and Applied Physics |
| 1.4 Field of study[1)] | Electrical Engineering |
| 1.5 Study level[2)] | MA |
| 1.6 Study programme | Advanced Electrical Systems |

**2. Data about the course**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2.1 Name of course | | | Smart Electrical Microgrids (SEA210) | | | | | |
| 2.2 Course convenor | | | Prof. Ioan ȘERBAN | | | | | |
| 2.3 Seminar/ laboratory/ project convenor | | | Prof. Ioan ȘERBAN | | | | | |
| 2.4 Study year | 1 | 2.5 Semester | 2 | 2.6 Evaluation type | E | 2.7 Course status | Content[3)] | AC |
| | | | | | | | Attendance type[4)] | CPC |

**3. Total estimated time (hours of teaching activities per semester)**

| | | | | | |
|---|---|---|---|---|---|
| 3.1 Number of hours per week | **4** | out of which: 3.2 lecture | **2** | 3.3 seminar/ laboratory/ project | **2L** |
| 3.4 Total number of hours in the curriculum | 56 | out of which: 3.5 lecture | 28 | 3.6 seminar/ laboratory/ project | 28 |

| | |
|---|---|
| Time allocation | hours |
| Study of textbooks, course support, bibliography and notes | 32 |
| Additional documentation in libraries, specialized electronic platforms, and field research | 8 |
| Preparation of seminars/ laboratories/ projects, homework, papers, portfolios, and essays | 15 |
| Tutorial | 10 |
| Examinations | 4 |
| Other activities.................................... | - |

| | |
|---|---|
| **3.7 Total number of hours of student activity** | 69 |
| **3.8 Total number per semester** | 125 |
| **3.9 Number of credits[5)]** | 5 |

**4. Prerequisites (if applicable)**

| | |
|---|---|
| 4.1 curriculum-related | • |
| 4.2 competences-related | • |

**5. Conditions (if applicable)**

| | |
|---|---|
| 5.1 for course development | • Classroom with video projector and whiteboard |
| 5.2 for seminar/ laboratory/ project development | • Computer room<br>• Laboratory with dedicated test-benches for accomplishing the experimental labs |

**6. Specific competences and learning outcomes**

| | |
|---|---|
| Professional competences | ◘ **Cp.2 Using modern knowledge in the analysis, evaluation, and operation of electrical subsystems.**<br>• **L.O.2.2** The graduate uses advanced theories to justify the processes of operation, command, and control of advanced electrical systems.<br>◘ **Cp.3 Using and applying measurement, analysis, evaluation, and interpretation techniques in the field of electrical systems for energy production, distribution, and utilization.**<br>• **L.O.3.2** The graduate properly uses measuring equipment and testing techniques for electrical systems.<br>◘ **Cp.4 Modeling and optimizing electrical and electronic systems for efficient energy use.**<br>• **L.O.4.1** The graduate applies modern methods of modeling and optimizing electrical and power electronic systems for efficient energy use.<br>• **L.O.4.3** The graduate conducts a quantitative and qualitative assessment of the performance of electrical and power electronic systems for efficient energy use.<br>• **L.O.4.4** The graduate designs projects in the field of renewable energy sources, energy storage, and distribution systems.<br>• **L.O.4.5** The graduate is capable of modeling and implementing renewable energy systems integrated into intelligent distributed electrical networks. |
| Transversal competences | ◘ **Ct.1 Responsible management of tasks and resources, considering professional ethics and social responsibility**<br>• **L.O.1.2** The graduate is able to work with professional autonomy, applying the knowledge acquired in practical situations.<br>• **L.O.1.3** The graduate assumes responsibility in undertaking activities, integrating advanced electrical systems into the environment in a spirit of sustainable development.<br>◘ **Ct.2 Efficiency and responsibility in managing teamwork**<br>• **L.O.2.1** The graduate can perform specific roles within a multidisciplinary team, contributing to the achievement of common objectives.<br>◘ **Ct.3 Continuous professional development and lifelong learning**<br>• **L.O.2.3** The graduate can effectively use language skills and information technology knowledge for personal and professional development. |

**7. Course objectives (resulting from the specific competences to be acquired)**

| | |
|---|---|
| 7.1 General course objective | • Skills training in the domain of smart electrical grids and microgrids with renewable energy sources and of distributed generation systems. |
| 7.2 Specific objectives | • Developing competences for innovative design of renewable energy systems and energy storage systems.<br>• Acquiring knowledge and abilities for modelling and optimization of systems with renewable energy sources, of energy storage and power distribution systems.<br>• Forming the research competences in the field of renewable energy sources integration in the modern electrical systems.<br>• Providing the knowledge of modelling and development of control system for power electronic converters used in electrical microgrids with renewable energy sources. |

**8. Content**

| 8.1 Course | Teaching methods | Number of hours | Remarks |
|---|---|---|---|
| 1. Introduction to distributed generation and renewable energy sources (RES); | Lecture supported by video slides.<br>Examples.<br>Discussions. | | |
| 2. Wind energy conversion systems; | | | |
| 3. Solar photovoltaic energy conversion systems; | | | |
| 4. Small-scale hydroelectric power systems and cogeneration systems; | | | |
| 5. The concept of microgrid (MG); | | | |
| 6. Power quality issues in microgrids; | | | |
| 7. Principles of power control in microgrids; | | | |
| 8. Interfacing RES generators in MGs using power electronic converters; | | | |
| 9. Voltage control in microgrids; | | | |
| 10. Frequency control in microgrids; | | | |
| 11. Integrating energy storage systems in microgrids; | | | |
| 12. The smart grid concept; | | | |
| 13. Protection in microgrids; | | | |
| 14. Course review and discussion of exam topics. | | | |

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[1] I. Șerban, Lecture notes, ( accesible on e-learning, https://elearning.unitbv.ro/2024/course/view.php?id=5276 ).
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[3] N. Hatziargyriou, Microgrids – Arhitectures and Control, IEEE Press-Wiley, 2014;
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[5] C. Marinescu, I. Șerban, L. Clotea, D. Marinescu, C.P. Ion, M. Georgescu, L. Barote, A. Forcos, Rețele hibride cu surse regenerabile de energie. Evoluții moderne, Ed. Universității *Transilvania* Brașov, 2011.
[6] Chowdhury, S.P. Chowdhury, P. Crossley, Micrograds and Active Distribution Networks, Institution of Engineering and Technology, 2009, UK.
[7] R. Teodorescu, M. Lissere, P. Rodriguez, Grid Converters for Photovoltaic and Wind Power Systems, Wiley, 2011, USA.

| 8.2 Seminar/ laboratory/ project | Teaching-learning methods | Number of hours | Remarks |
|---|---|---|---|
| **Laboratory** | | | |
| 1. Labour protection. Presentation of the laboratory testbenches. | Application-based learning;<br>Experimental study in laboratory | | |
| 2. Wind energy conversion system (Part I: structure and operation; Part II: energy quality analysis and compliance with current standards). | | | |
| 3. Photovoltaic energy conversion system (Part I: structure and operation; Part II: energy quality analysis and compliance with current standards). | | | |
| 4. Single-phase inverter operating in standalone and grid-connected mode (Part I: simulation, Part II: experiment)*. | | | |
| 5. Three-phase inverter operating in standalone | | | |

| | | | |
|---|---|---|---|
| and grid-connected mode (Part I: simulation, Part II: experiment)*. | | | |
| 6. Standalone microgrid with RES and storage. | | | |
| 7. Integration of an EV charging station into a microgrid with RES and storage (Part I: structure and operating principle, Part II: energy management within the microgrid). | Evaluation | | |
| 8. Laboratory examination | | | |

Bibliography

[1] I. Serban, Laboratory manual, accessible from the e-learning portal http://elearning.unitbv.ro
[2] I. Serban, Lecture notes, accessible from the e-learning portal http://elearning.unitbv.ro

**9. Correlation of course content with the demands of the labour market (epistemic communities, professional associations, potential employers in the field of study)**

The course ensures the achievement of several interdisciplinary competences, which are in accordance with the specific requirements of the international job market from various domains, especially in research and development (R&D) services. Moreover, the international regulations recommended by the association IEEE are considered.

**10. Evaluation**

| Activity type | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Percentage of the final grade |
|---|---|---|---|
| 10.4 Course | The degree of correct solutions of the exam subjects | Written exam | 60% |
| 10.5 Seminar/ laboratory/ project | Laboratory: The level of developing the required applications | Evaluating the activity during the semester and discussion of the laboratory work in the last session. | 40% |
| 10.6 Minimal performance standard | | | |

- Understanding the basic concepts of RES operation, microgrids and energy storage systems;
- Attending the exam is conditioned by passing the laboratory colloquium;
- All the practical activities related to the laboratory are mandatory.

This course outline was certified in the Department Board meeting on 23/09/2024 and approved in the Faculty Board meeting on24/09/2024

| | |
|---|---|
| **Assoc. Prof. Titus BĂLAN**<br>**Dean** | **Assoc. Prof. Lia ACIU**<br>**Head of Department** |
| **Prof. Ioan SERBAN,**<br>**Course holder** | **Prof. Ioan SERBAN,**<br>**Holder of laborator** |

Note:

1) Field of study – select one of the following options: Bachelor / Master / Doctorat (to be filled in according to the forceful classification list for study programmes);

2) Study level – choose from among: Bachelor / Master / Doctorat;

3) Course status (content) – for the Bachelor level, select one of the following options: **FC** (fundamental course) / **DC** (course in the study domain)/ **SC** (speciality course)/ **CC** (complementary course); for the Master level, select one of the following options: **PC** (proficiency course)/ SC (synthesis course)/ **AC** (advanced course);

4) Course status (attendance type) – select one of the following options: **CPC** (compulsory course)/ **EC** (elective course)/ **NCPC** (non-compulsory course);

5) One credit is the equivalent of 25 study hours (teaching activities and individual study).

# COURSE OUTLINE

## 1. Data about the study programme

| | |
|---|---|
| 1.1 Higher education institution | Transilvania University of Brasov |
| 1.2 Faculty | Electrical Engineering and Computer Science |
| 1.3 Department | Electrical Engineering and Applied Physics |
| 1.4 Field of study[1)] | Electrical Engineering |
| 1.5 Study level[2)] | MA |
| 1.6 Study programme | Advanced Electrical Systems |

## 2. Data about the course

<table>
<tr><td colspan="2">2.1 Name of course</td><td colspan="8">Research practical stage SEA-2 (SEA211)</td></tr>
<tr><td colspan="2">2.2 Course convenor</td><td colspan="8">-</td></tr>
<tr><td colspan="2">2.3 Seminar/ laboratory/ project convenor</td><td colspan="8">Conf. dr. ing. Luminita BAROTE</td></tr>
<tr><td rowspan="2">2.4 Study year</td><td rowspan="2">I</td><td rowspan="2">2.5 Semester</td><td rowspan="2">2</td><td rowspan="2">2.6 Evaluation type</td><td rowspan="2">C</td><td rowspan="2">2.7 Course status</td><td>Content[3)]</td><td>SC</td></tr>
<tr><td>Attendance type[4)]</td><td>CPC</td></tr>
</table>

## 3. Total estimated time (hours of teaching activities per semester)

<table>
<tr><td>3.1 Number of hours per week</td><td>12</td><td>out of which: 3.2 lecture</td><td>0</td><td>3.3 seminar/ laboratory/ project</td><td>12 P-AsP</td></tr>
<tr><td>3.4 Total number of hours in the curriculum</td><td>168</td><td>out of which: 3.5 lecture</td><td>0</td><td>3.6 seminar/ laboratory/ project</td><td>168 P-AsP</td></tr>
<tr><td colspan="5">Time allocation</td><td>hours</td></tr>
<tr><td colspan="5">Study of textbooks, course support, bibliography and notes</td><td>0</td></tr>
<tr><td colspan="5">Additional documentation in libraries, specialized electronic platforms, and field research</td><td>30</td></tr>
<tr><td colspan="5">Preparation of seminars/ laboratories/ projects, homework, papers, portfolios, and essays</td><td>40</td></tr>
<tr><td colspan="5">Tutorial</td><td>10</td></tr>
<tr><td colspan="5">Examinations</td><td>2</td></tr>
<tr><td colspan="5">Other activities....................................</td><td></td></tr>
</table>

| | |
|---|---|
| **3.7 Total number of hours of student activity** | 82 |
| **3.8 Total number per semester** | 250 |
| **3.9 Number of credits[5)]** | 10 |

## 4. Prerequisites (if applicable)

| | |
|---|---|
| 4.1 curriculum-related | • |
| 4.2 competences-related | • |

## 5. Conditions (if applicable)

| | |
|---|---|
| 5.1 for course development | • |
| 5.2 for seminar/ laboratory/ project development | • Established by the research practical stage coordinator |

**6. Specific competences and learning outcomes**

| | |
|---|---|
| Professional competences | **Cp.2 Using modern knowledge in the analysis, evaluation, and operation of electrical subsystems.**<br>• L.O.2.1 The graduate knows methods of physical and mathematical description of the structure and operation of electrical systems.<br>• L.O.2.2 The graduate uses advanced theories to justify the processes of operation, command, and control of advanced electrical systems.<br>**Cp.4 Modeling and optimizing electrical and electronic systems for efficient energy use.**<br>• L.O.4.1 The graduate applies modern methods of modeling and optimizing electrical and power electronic systems for efficient energy use.<br>• L.O.4.4 The graduate designs projects in the field of renewable energy sources, energy storage, and distribution systems.<br>• L.O.4.5 The graduate is capable of modeling and implementing renewable energy systems integrated into intelligent distributed electrical networks.<br>**Cp.5 The development of new solutions for the realization of applications with advanced electrical systems, in the perspective of socio-economic sustainability.**<br>• L.O.5.2. The graduate uses modern theories in the design and optimization of applications with advanced electrical systems.<br>• L.O.5.3. The graduate uses concepts for the realization of applications with low energy consumption, for the control of energy production and management, monitoring and control of the environment.<br>• L.O.5.5. The graduate develops research projects using principles of sustainable development. |
| Transversal competences | **Ct.1 Responsible management of tasks and resources, considering professional ethics and social responsibility**<br>• L.O.1.2 The graduate is able to work with professional autonomy, applying the knowledge acquired in practical situations.<br>• L.O.1.3 The graduate assumes responsibility in undertaking activities, integrating advanced electrical systems into the environment in a spirit of sustainable development.<br>**Ct.2 Efficiency and responsibility in managing teamwork**<br>• L.O.2.1 The graduate can perform specific roles within a multidisciplinary team, contributing to the achievement of common objectives.<br>**Ct.3 Continuous professional development and lifelong learning**<br>• L.O.2.3 The graduate can effectively use language skills and information technology knowledge for personal and professional development. |

**7. Course objectives (resulting from the specific competences to be acquired)**

| | |
|---|---|
| 7.1 General course objective | • Programming skills for using specific software in electrical engineering<br>• Forming the skills for analysis, calculus, modelling and simulation for optimizing electrical systems and processes related to the energy production and conversion;<br>• Knowing and applying the measuring, maintenance and monitoring techniques used for energy conversion;<br>• Forming the skills for optimal management of energy projects. |
| 7.2 Specific objectives | • Forming of skills for modelling and optimization of advanced electrical systems in according with the sustainable development principles: renewable energy sources, storage systems, power distribution systems, control and command systems, power management systems and other |

| | |
|---|---|
| | systems related to the production, storage, transport and efficient use of energy.<br>• Forming the competences for innovative design of renewable energy systems, of storage and distribution of energy;<br>• Forming skills related to the power systems maintenance. |

**8. Content**

| 8.1 Course | Teaching methods | Number of hours | Remarks |
|---|---|---|---|
| N/A | | | |
| 8.2 Seminar/ laboratory/ **project** | Teaching-learning methods | Number of hours | Remarks |
| I. Presentation of how the practical stage research is carried out, research topics, coordinators and discipline requirements.<br>Chosing the project themes.<br>Examples of research project themes:<br><br>*Electrical machines and drives*<br>1. Applying modern calculus methods of electromagnetic field in electric machines;<br>2. Modelling and optimal designing of designing of permanent magnets machines;<br>3. Control of permanent magnets motors for electrical drives.<br><br>*Power electronic converters*<br>1. Optimal designing of power inverters for single- and three-phase grids with renewable energy sources;<br>2. Applying modern control methods for controlling AC converters for smart grids and microgrids;<br>3. Applying modern methods for inverters control;<br><br>*Monitoring and prediction of electrical systems operation*<br>1. Modern monitoring systems for defects in electrical machines;<br>2. Systems for testing, measurement and monitoring of electrical cables;<br>3. Modern methods for analysis and simulation of noise;<br>4. Monitoring and efficient utilization of electrical systems for power supply to consumers;<br><br>*Systems for production, distribution and transport of electrical energy*<br>1. Optimal designing of power supply circuits and protection system for networks with renewable energy sources;<br>2. Choosing the optimal solution of energy storage for autonomous microgrids with micro hydro power plants;<br>3. Modelling and simulations of systems designed for supplying consumers with renewable energy systems;<br>4. Modeling and simulation of hybrid systems with renewable | Oral presentation | 10 h | |

| | | | |
|---|---|---|---|
| energy sources connected to the grid;<br>5. Control of small scale wind turbines for integration in autonomous microgrids;<br>6, Control of a small-scale PV power plant for autonomous microgrid applications<br><br>*Energy storage and recovery*<br>1. Optimal designing of flywheel-based energy storage systems;<br>2. Solutions for interconnecting energy storage systems to the grid;<br>3. Optimal designing of power supply systems for electric vehicle;<br>4. Control strategies used in power supply systems;<br>5. Implementing a thermo-electric system for energy recovery;<br>6. Solutions for frequency control in microgrids, based on pumped-hydro storage;<br>7. Methods for state of charge estimation for different storage systems;<br>8.Modelling and simulation of hybrid systems with RES operating autonomously.<br><br>*Electromagnetic compatibility and power quality*<br>1. Analysis of the distorted regime in distribution electrical networks for compatibility with renewable energy sources;<br>2. Analysis of the distorted regime on electrical equipments performances;<br>3. Implementing testing techniques for electrical and electronic equipments for electromagnetic immunity.<br>4. Monitoring and centralized control of the electrical energy parameters for microgrids with RES;<br><br>*Materials and sensors*<br>1. Modern methods for characterizing the magnetic materials used in the construction of electrical equipment;<br>2. Modern methods for magneto-electrical characterization of nanostructural magnetic systems;<br>3. Establishing the field and angle characteristics of some sensors used in nanostructural magnetic systems;<br>4. Study of piezoelectric and magnetostrictive phenomena of some materials used as vibration sensors;<br>5. Modeling micromagnetical sensors for magnetic field;<br>6. Simulating the behavior of magnetic nano- oscillatory of high frequency. | | | |
| II. Carrying out the practical research stage in an environment organized by the project coordinator. | Project-based learning;<br>Teamwork | 156 h | |
| III. Defending the research project report by students | Oral presentation | 2 h | |
| Bibliography | | | |

| |
|---|
| Provided by the project coordinator. |

**9. Correlation of course content with the demands of the labour market (epistemic communities, professional associations, potential employers in the field of study)**

| |
|---|
| The course ensures the achievement of several interdisciplinary competences, which are in accordance with the specific requirements of the international job market from various domains, especially in research and development (R&D) services. Moreover, the international regulations recommended by the association IEEE are considered. |

**10. Evaluation**

| Activity type | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Percentage of the final grade |
|---|---|---|---|
| 10.4 Course | N/A | | |
| | | | |
| 10.5 Seminar/ laboratory/ **project** | The degree of project theme fulfilment | Evaluation of student activity during semester by the project coordinator | 50% |
| | | Project report defending by an oral presentation | 50% |
| 10.6 Minimal performance standard | | | |
| • A research project evaluated by the research stage coordinator as fulfilling the minimum requirements for the accomplished activities and an oral presentation of the report. | | | |

This course outline was certified in the Department Board meeting on 23/09/2024 and approved in the Faculty Board meeting on 24/09/2024.

| | |
|---|---|
| **Assoc. Prof. Titus Constantin BALAN,**<br>**Dean** | **Assoc. Prof. Lia ACIU,**<br>**Head of Department** |
| **N/A**<br>**Course holder** | **Assoc. Prof. Luminita BAROTE**<br>**Holder of project (SEA coordinator)** |

Note:

1) Field of study – select one of the following options: Bachelor / Master / Doctorat (to be filled in according to the forceful classification list for study programmes);

2) Study level – choose from among: Bachelor / Master / Doctorat;

3) Course status (content) – for the Bachelor level, select one of the following options: **FC** (fundamental course) / **DC** (course in the study domain)/ **SC** (speciality course)/ **CC** (complementary course); for the Master level, select one of the following options: **PC** (proficiency course)/ SC (synthesis course)/ **AC** (advanced course);

[4] Course status (attendance type) – select one of the following options: **CPC** (compulsory course)/ **EC** (elective course)/ **NCPC** (non-compulsory course);

[5] One credit is the equivalent of 25 study hours (teaching activities and individual study).

# COURSE OUTLINE

## 1. Data about the study programme

| | |
|---|---|
| 1.1 Higher education institution | Transilvania University of Brasov |
| 1.2 Faculty | Electrical Engineering and Computer Science |
| 1.3 Department | Electrical Engineering and Applied Physics |
| 1.4 Field of study[1)] | Electrical Engineering |
| 1.5 Study level[2)] | MA |
| 1.6 Study programme | Advanced Electrical Systems |

## 2. Data about the course

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2.1 Name of course | | | Hydro power energy conversion systems (SEA301) | | | | | |
| 2.2 Course convenor | | | Assoc. Prof. Dr. Eng. Ion Catalin Petrea | | | | | |
| 2.3 Laboratory convenor | | | Assoc. Prof. Dr. Eng. Ion Catalin Petrea | | | | | |
| 2.4 Study year | II | 2.5 Semester | 3 | 2.6 Evaluation type | E | 2.7 Course status | Content[3)] | AC |
| | | | | | | | Attendance type[4)] | CPC |

## 3. Total estimated time (hours of teaching activities per semester)

| | | | | | |
|---|---|---|---|---|---|
| 3.1 Number of hours per week | **4** | out of which: 3.2 lecture | **2** | 3.3 laboratory/project | **1/1** |
| 3.4 Total number of hours in the curriculum | 56 | out of which: 3.5 lecture | 28 | 3.6 laboratory/project | 14/14 |

| | |
|---|---|
| Time allocation | hours |
| Study of textbooks, course support, bibliography and notes | 21 |
| Additional documentation in libraries, specialized electronic platforms, and field research | 21 |
| Preparation of seminars/ laboratories/ projects, homework, papers, portfolios, and essays | 23 |
| Tutorial | 2 |
| Examinations | 2 |
| Other activities.................................... | - |

| | |
|---|---|
| **3.7 Total number of hours of student activity** | 69 |
| **3.8 Total number per semester** | 125 |
| **3.9 Number of credits[5)]** | 5 |

## 4. Prerequisites (if applicable)

| | |
|---|---|
| 4.1 curriculum-related | • |
| 4.2 competences-related | • Adequate knowledge related to Electrical Machines |

## 5. Conditions (if applicable)

| | |
|---|---|
| 5.1 for course development | • Class room equipped with multimedia equipment. Capacity: 30 seats |
| 5.2 for seminar/ laboratory/ project development | • Laboratory equipped with computers - 15 working places |

**6. Specific competences**

| | |
|---|---|
| Professional competences | **Cp.5 Development of new solutions for the accomplishment of applications with advanced electrical systems, in the perspective of socio-economical sustainability**<br>• L.O.5.3 The graduate uses concepts to accomplish applications with reduced energy consumption, for the control of energy generation and management, monitoring and control of the environment |
| Transversal competences | **Ct.1 Responsible management of tasks and resources, considering professional ethics and social responsibility**<br>• L.O.1.2 The graduate is able to work with professional autonomy, applying the knowledge acquired in practical situations.<br>• L.O.1.3 The graduate assumes responsibility in undertaking activities, integrating advanced electrical systems into the environment in a spirit of sustainable development.<br>**Ct.2 Efficiency and responsibility in managing teamwork**<br>• L.O.2.1 The graduate can perform specific roles within a multidisciplinary team, contributing to the achievement of common objectives. |

**7. Course objectives (resulting from the specific competences to be acquired)**

| | |
|---|---|
| 7.1 General course objective | • Knowledge and skills acquisition in order to understand the structure and operation of hydro power energy conversion systems |
| 7.2 Specific objectives | • Knowing the methods for physical and mathematical description of the electrical system structure and operation<br>• Tinted usage of evaluation methods and underlying of applications specific to electrical systems, taking into account the principles related to energy conversion and electromagnetic compatibility<br>• Assuming the techniques and description of the methods and algorithms for the modeling and optimization of advanced electrical systems<br>• Identifying and assuming the methods to achieve and optimize the advanced electrical systems<br>• Integrated usage of the concepts to achieve applications with reduced energy consumption, to control the energy production and management, to monitor and control the environment |

**8. Content**

| 8.1 Course | Teaching methods | Number of hours | Remarks |
|---|---|---|---|
| The importance of hydro-electricity within the renewable energy sources | Interactive teaching materials presented with video projector. Exemplifications and demonstrations on the blackboard if necessary. | 2 | |
| Definition of a micro hydro power plant (MHPP); MHPPs situation in Romania. Aspects related to micro hydro power potential exploitation | | 2 | |
| Types of accumulation | | 2 | |
| Hydraulic turbines | | 2 | |
| Generators | | 2 | |
| Auxiliary equipment | | 2 | |
| MHPPs connection to the grid; automatic control and monitoring | | 2 | |
| Modern MHPP toplogies | | 2 | |
| Parameters control for an autonomous MHPP with induction generator | | 2 | |

| | | | |
|---|---|---|---|
| Pumping stations. Pumped hydro power plants | | 4 | |
| Tidal power stations | | 4 | |
| Summarizing and discussions about the exam subjects | | 2 | |

Bibliography

[1] ION Cătalin Petrea, Micro hydro power plants, Course notes, https://elearning.unitbv.ro/enrol/index.php?id=3028
[2] ION Cătalin Petrea, Microhidrocentrale cu generator asincron, Editura Universită ii Transilvania din Braşov, 2009
[3] Penche, C., de Minas, I. (1998) Layman's Guidebook on how to develop a small hydro site. Environmental impact & its mitigation.
[4] Adam Harvey, „Micro-hydro design manual", ITDG Publishing 2006
[5] Scott Davis, Serious microhydro, New Society publishers 2010, ISBN 978-0-86571-638-4

| 8.2 Laboratory | Teaching-learning methods | Number of hours | Remarks |
|---|---|---|---|
| Simulation of a MHPP with induction generator | Simulations using Matlab/Simulink Experimental tests | 2 | |
| Simulation of a MHPP with classical synchronous generator | | 2 | |
| Simulation of a MHPP with permanent magnets synchronous generator | | 2 | |
| The start-up process of an autonomous induction generator | | 2 | |
| The parallel operation of two micro hydro power plants with induction generators on an isolated micro-grid | | 2 | |
| The grid connection of a micro hydro power plant with induction generator with the help of an automation panel | | 2 | |
| Laboratory test | Evaluation | 2 | |

Bibliography

[1] ION Cătalin Petrea, Micro hydro power plants, Laboratory guide, available on the portal
[2] SimPowerSystems. For Use with Simulink®

| Project | | | |
|---|---|---|---|
| Design of the electro-mechanical side of an hydro energy conversion system | Individual work | 14 | |

Bibliography

[1] Penche, C., de Minas, I. (1998) Layman's Guidebook on how to develop a small hydro site. Environmental impact & its mitigation.
[2] Adam Harvey, „Micro-hydro design manual", ITDG Publishing 2006

The laboratory content highlighted above implies the use of the „**Sistemului de dezvoltare all-in-one pentru laborator"** bought within the PNRR project „Transformare digitală pentru inovare și competitivitate", 14039/16.09.2022

**9. Correlation of course content with the demands of the labour market (epistemic communities, professional associations, potential employers in the field of study)**

European regulations and reccomendations issued by the IEEE society are aconsidered.

**10. Evaluation**

| Activity type | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Percentage of the final grade |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 10.4 Course | Application of advanced electrical systems knowledge to describe the operation and control of hydro power energy conversion systems | Written exam | 50% |
| 10.5 Laboratory/project | Laboratory: The capacity to develop a Simulink program that emulates the operation of the electro-mechanical part of a MHPP | Laboratory test | 25% |
| | Project: The capacity to size the electro-mechanical side of a hydro energy conversion system | Project defense | 25% |
| 10.6 Minimal performance standard | | | |

- Understanding and explaining the concepts related to the structure and operation of hydro power energy conversion systems
- Access to the exam is conditioned by the passing of both the laboratory test and project defence
- Access to the laboratory test is conditioned by the presence to all laboratory activities
- Project defence is conditioned by the gain of intermediate evaluations

This course outline was certified in the Department Board meeting on de 23/09/2024 and approved in the Faculty Board meeting on 24/09/2024

| | |
|---|---|
| **Assoc. Prof. Dr. Eng. Titus Constantin BĂLAN,**<br>**Dean** | **Assoc. Prof. Dr. Eng. Lia ACIU,**<br>**Head of Department** |
| **Assoc. Prof. Dr. Eng. Catalin Petrea ION,**<br>**Course holder** | **Assoc. Prof. Dr. Eng. Catalin Petrea ION,**<br>**Holder of laboratory/ project** |

Note:

1) Field of study – select one of the following options: BA/MA/PhD. (to be filled in according to the forceful classification list for study programmes);

2) Study level – choose from among: BA/MA/PhD;

3) Course status (content) – for the BA level, select one of the following options: **FC** (fundamental course) / **DC** (course in the study domain)/ **SC** (speciality course)/ **CC** (complementary course); for the MA level, select one of the following options: **PC** (proficiency course)/ SC (synthesis course)/ **AC** (advanced course);

4) Course status (attendance type) – select one of the following options: **CPC** (compulsory course)/ **EC** (elective course)/ **NCPC** (non-compulsory course);

5) One credit is the equivalent of 25 study hours (teaching activities and individual study).

# COURSE OUTLINE

## 1. Data about the study programme

| | |
|---|---|
| 1.1 Higher education institution | Transilvania University of Brașov |
| 1.2 Faculty | Electrical Engineering and Computer Science |
| 1.3 Department | Electrical Engineering and Applied Physics |
| 1.4 Field of study[1)] | Electrical Engineering |
| 1.5 Study level[2)] | MA |
| 1.6 Study programme | Advanced Electrical Systems |

## 2. Data about the course

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2.1 Name of course | Photovoltaic Power Plants (SEA302) | | | | | | | |
| 2.2 Course convenor | Prof. Ioan ȘERBAN | | | | | | | |
| 2.3 Seminar/ laboratory/ project convenor | Prof. Ioan ȘERBAN<br>Prof. Corneliu MARINESCU | | | | | | | |
| 2.4 Study year | 2 | 2.5 Semester | 1 | 2.6 Evaluation type | E | 2.7 Course status | Content[3)] | AC |
| | | | | | | | Attendance type[4)] | EC |

## 3. Total estimated time (hours of teaching activities per semester)

| | | | | | |
|---|---|---|---|---|---|
| 3.1 Number of hours per week | **4** | out of which: 3.2 lecture | **2** | 3.3 seminar/ laboratory/ project | **1L/1P** |
| 3.4 Total number of hours in the curriculum | 56 | out of which: 3.5 lecture | 28 | 3.6 seminar/ laboratory/ project | 28 |

| Time allocation | hours |
|---|---|
| Study of textbooks, course support, bibliography and notes | 32 |
| Additional documentation in libraries, specialized electronic platforms, and field research | 8 |
| Preparation of seminars/ laboratories/ projects, homework, papers, portfolios, and essays | 15 |
| Tutorial | 10 |
| Examinations | 4 |
| Other activities…………………………… | - |

| | |
|---|---|
| **3.7 Total number of hours of student activity** | 69 |
| **3.8 Total number per semester** | 125 |
| **3.9 Number of credits[5)]** | 5 |

## 4. Prerequisites (if applicable)

| | |
|---|---|
| 4.1 curriculum-related | • |
| 4.2 competences-related | • |

## 5. Conditions (if applicable)

| | |
|---|---|
| 5.1 for course development | • Classroom with video projector and whiteboard |
| 5.2 for seminar/ laboratory/ project development | • Computer room<br>• Laboratory with dedicated test-benches for accomplishing the experimental labs |

## 6. Specific competences and learning outcomes

| | |
|---|---|
| Professional competences | ◘ **Cp.2 Using modern knowledge in the analysis, evaluation, and operation of electrical subsystems.**<br>• **L.O.2.2** The graduate uses advanced theories to justify the processes of operation, command, and control of advanced electrical systems.<br>◘ **Cp.4 Modeling and optimizing electrical and electronic systems for efficient energy use.**<br>• **L.O.4.1** The graduate applies modern methods of modeling and optimizing electrical and power electronic systems for efficient energy use.<br>• **L.O.4.4** The graduate designs projects in the field of renewable energy sources, energy storage, and distribution systems.<br>• **L.O.4.5** The graduate is capable of modeling and implementing renewable energy systems integrated into intelligent distributed electrical networks. |
| Transversal competences | ◘ **Ct.1 Responsible management of tasks and resources, considering professional ethics and social responsibility**<br>• **L.O.1.2** The graduate is able to work with professional autonomy, applying the knowledge acquired in practical situations.<br>• **L.O.1.3** The graduate assumes responsibility in undertaking activities, integrating advanced electrical systems into the environment in a spirit of sustainable development.<br>◘ **Ct.2 Efficiency and responsibility in managing teamwork**<br>• **L.O.2.1** The graduate can perform specific roles within a multidisciplinary team, contributing to the achievement of common objectives.<br>◘ **Ct.3 Continuous professional development and lifelong learning**<br>• **L.O.2.3** The graduate can effectively use language skills and information technology knowledge for personal and professional development. |

## 7. Course objectives (resulting from the specific competences to be acquired)

| | |
|---|---|
| 7.1 General course objective | • Developing knowledge in the field of energy conversion systems for photovoltaic power plants |
| 7.2 Specific objectives | • Building competencies for innovative design of photovoltaic systems and associated systems (storage)<br>• Acquiring knowledge and developing skills for modeling and optimizing photovoltaic systems<br>• Developing research competencies in the field of integrating photovoltaic power plants into electrical grids<br>• Providing knowledge for modeling and developing control systems for power electronic converters used in solar energy conversion. |

## 8. Content

| 8.1 Course | Teaching methods | Number of hours | Remarks |
|---|---|---|---|
| 1. Introduction to energy sources | Lecture supported by video slides.<br>Examples.<br>Discussions. | 2 | |
| 2. Solar energy conversion | | 2 | |
| 3. Photovoltaic (PV) cell: modeling and electrical characteristics | | 2 | |
| 4. Arrangement of PV modules in strings/arrays | | 2 | |
| 5. Orientation of PV modules | | 2 | |
| 6. Power electronic converters for PV plants | | 4 | |
| 7. Control of power electronic converters for PV | | 4 | |

| | | | |
|---|---|---|---|
| plants (Part I – MPPT; Part II – grid inverter control) | | | |
| 8. Standalone PV systems | | 4 | |
| 9. Grid connection of PV plants (technical regulations) | | 2 | |
| 10. Charging electric vehicles from PV plants | | 2 | |
| 11. Course review and discussion of exam topics. | | 2 | |

Bibliography

[1] I. Şerban, Lecture notes, available on e-learning, https://elearning.unitbv.ro/enrol/index.php?id=250 .

[2] R. Teodorescu, M. Lissere, P. Rodriguez, Grid Converters for Photovoltaic and Wind Power Systems, Wiley, 2011, USA.

[3] Raport IEA-PVPS, Guidelines for Operation and Maintenance of Photovoltaic Power Plants in Different Climates, 2022, https://iea-pvps.org/wp-content/uploads/2022/11/IEA-PVPS-Report-T13-25-2022-OandM-Guidelines.pdf

[4] Schneider Electric, Electrical Installation Guide – Chapter P (Photovoltaic Installations), 2018, https://www.se.com/in/en/download/document/EIGED306001EN/

| 8.2 Seminar/ laboratory/ project | Teaching-learning methods | Number of hours | Remarks |
|---|---|---|---|
| **Laboratory** | | | |
| 1. Labour protection. Presentation of the laboratory testbenches. | Application-based learning; Experimental study in laboratory | 2 | |
| 2. Introduction to PV power plants | | 2 | |
| 3. Electrical characteristics of PV modules | | 2 | |
| 4. Analysis of a single-phase PV inverter | | 2 | |
| 5. Analysis of an MPPT system | | 2 | |
| 6. PV-based EV charging station | | 2 | |
| 7. Laboratory examination | Evaluation | 2 | |

Bibliography

[1] I. Serban, Laboratory manual, accessible from the e-learning portal http://elearning.unitbv.ro

[2] I. Serban, Lecture notes, accessible from the e-learning portal http://elearning.unitbv.ro

| | | | |
|---|---|---|---|
| **Project** | | | |
| The project aims to develop electricity supply solutions using PV (photovoltaic) power plants for various applications.<br>Examples of project topics:<br>1. Solar power plant for supplying the locality of Sfintu Gheorghe in the Danube Delta. Hybrid microgrid.<br>2. Water pumping station powered by a PV plant.<br>3. 2 MW solar power plant, grid-connected, located in the N-W area of the Apuseni Mountains.<br>4. Powering a passenger train car with PV (flexible cells). Study of energy production in Romania by seasons, considering different exposures. | Project-base learning<br>Teamwork | 14 | |

Bibliography

1. Corneliu Marinescu, Sizing a PV system, 2024, disponibil pe platforma http://elearning.unitbv.ro

2. Michael Boxwell, Solar Electricity Handbook 2019 Edition, http://www.solarelectricityhandbook.com/

**9. Correlation of course content with the demands of the labour market (epistemic communities, professional associations, potential employers in the field of study)**

| |
|---|
| The course ensures the achievement of several interdisciplinary competences, which are in accordance with the specific requirements of the international job market from various domains, especially in research and development (R&D) services. Moreover, the international regulations recommended by the association IEEE are considered. |

**10. Evaluation**

| Activity type | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Percentage of the final grade |
|---|---|---|---|
| 10.4 Course | The degree of correct solutions of the exam subjects | Written exam | 50% |
| 10.5 Laboratory/ project | Laboratory: The level of developing the required applications | Evaluating the activity during the semester and discussion of the laboratory work in the last session. | 25% |
| | Project: Degree of project tasks fulfilment | Project defence | 25% |
| 10.6 Minimal performance standard | | | |
| • Understanding the basic concepts of PV power plants operation;<br>• Attending the exam is conditioned by passing the laboratory and project evaluations ; | | | |

This course outline was certified in the Department Board meeting on 23/09/2024 and approved in the Faculty Board meeting on24/09/2024

| | |
|---|---|
| **Assoc. Prof. Titus BĂLAN**<br>**Dean** | **Assoc. Prof. Lia ACIU**<br>**Head of Department** |
| **Prof. Ioan SERBAN,**<br>**Course holder** | **Prof. Ioan SERBAN,**<br>**Holder of laboratory**<br><br>**Prof. Corneliu MARINESCU,**<br>**Holder of project** |

Note:

1) Field of study – select one of the following options: Bachelor / Master / Doctorat (to be filled in according to the forceful classification list for study programmes);

[2] Study level – choose from among: Bachelor / Master / Doctorat;

[3] Course status (content) – for the Bachelor level, select one of the following options: **FC** (fundamental course) / **DC** (course in the study domain)/ **SC** (speciality course)/ **CC** (complementary course); for the Master level, select one of the following options: **PC** (proficiency course)/ SC (synthesis course)/ **AC** (advanced course);

[4] Course status (attendance type) – select one of the following options: **CPC** (compulsory course)/ **EC** (elective course)/ **NCPC** (non-compulsory course);

[5] One credit is the equivalent of 25 study hours (teaching activities and individual study).

# COURSE OUTLINE

**1. Data about the study programme**

| | |
|---|---|
| 1.1 Higher education institution | Transilvania University of Brasov |
| 1.2 Faculty | Electrical Engineering and Computer Science |
| 1.3 Department | Electrical Engineering and Applied Physics |
| 1.4 Field of study[1)] | Electrical Engineering |
| 1.5 Study level[2)] | MA |
| 1.6 Study programme/ Qualification | Advanced Electrical Systems (in English) |

**2. Data about the course**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2.1 Name of course | Embedded sensors for electrical engineering applications | | | | | | | |
| 2.2 Course convenor | Assoc. Prof. Dr. Marius VOLMER | | | | | | | |
| 2.3 ~~Seminar~~/ laboratory/ project convenor | Assoc. Prof. Dr. Marius VOLMER | | | | | | | |
| 2.4 Study year | II | 2.5 Semester | I | 2.6 Evaluation type | E | 2.7 Course status | Content[3)] | AC |
| | | | | | | | Attendance type[4)] | EC |

**3. Total estimated time (hours of teaching activities per semester)**

| | | | | | |
|---|---|---|---|---|---|
| 3.1 Number of hours per week | **4** | out of which: 3.2 lecture | **2** | 3.3 seminar/ laboratory/ project | 0/1/1 |
| 3.4 Total number of hours in the curriculum | 56 | out of which: 3.5 lecture | 28 | 3.6 seminar/ laboratory/ project | 14/14 |

| Time allocation | hours |
|---|---|
| Study of textbooks, course support, bibliography and notes | 15 |
| Additional documentation in libraries, specialized electronic platforms, and field research | 15 |
| Preparation of seminars/ laboratories/ projects, homework, papers, portfolios, and essays | 24 |
| Tutorial | 12 |
| Examinations | 3 |
| Other activities................................... | - |

| | |
|---|---|
| **3.7 Total number of individual study hours** | 69 |
| **3.8 Total number per semester** | 125 |
| **3.9 Number of credits[5)]** | 5 |

**4. Prerequisites (if applicable)**

| | |
|---|---|
| 4.1 curriculum-related | • Previous Courses to be followed: *Physics, Analog electronics, Digital Electronics, Electrical and Electronic Measurements, Analysis and signal processing* |
| 4.2 competences-related | • Proper application of specific knowledge in physics, electronics, electrical and electronic measurements, and signal processing, in electrical engineering.<br>• Explanation and interpretation of phenomena presented in domain and specialty courses in electrical engineering. |

**5. Conditions (if applicable)**

| | |
|---|---|
| 5.1 for course development | • Classroom equipped with whiteboard and multimedia equipment. Capacity: 50 seats |
| 5.2 for laboratory/project | • Laboratory room capacity: 20 seats |

**6. Specific competences**

| | |
|---|---|
| Professional competences | • **C.2.** Using modern knowledge for the analysis, evaluation and operation of electrical sub-systems<br>• C.2.1. Knowing the methods for physical and mathematical description of the electrical systems structure and operation.<br>• C.2.4. Professional project development in the field of electrical systems, which also incorporate modern solutions of information technology.<br>• **C3.** Using and applying measurement, analysis, evaluation and interpretation techniques in the domain of electrical systems for energy production, distribution and utilization;<br>• C3.1. Assimilating the measuring techniques and applying the modern methods for measuring and testing in electrical systems<br>• C3.2. Adequate use of measuring equipment and testing techniques of electrical systems.<br>• C3.5. Project development related to measuring, acquisition, data processing and testing of electrical systems parameter.<br>• **C5**. Developing new solutions for accomplishing applications with advanced electrical systems, for socio-economical sustainability<br>• C5.2. Using modern theories for designing and optimization of advanced electrical systems applications.<br>• C5.5. Developing research projects using eco-design and sustainable development principles. |
| Transversal competences | • **CT1**. To carry out responsibly the professional tasks, respecting moral and ethical values, in conditions of professional autonomy and independence, with practical applicability and by assuming the responsibility regarding the activities carried out to integrate the advanced electrical systems within the environment, for sustainable development.<br>• **CT2.** Accomplishing the activities and deploying the specific role of multi-disciplinary teamwork, with entrepreneurial thinking, with leadership skills and diversity approaching abilities regarding the organizational community |

**7. Course objectives (resulting from the specific competences to be acquired)**

| | |
|---|---|
| 7.1 General course objective | • To offer adequate knowledge in the field of micro technologies, embedded microsensors and actuators used for many applications in electrical engineering like energy monitoring, sensors for automotive industry, printed sensors and others. |
| 7.2 Specific objectives | • Analysing and understanding specific phenomena and processes of micro-systems with embedded sensors applied in electrical engineering.<br>• Understanding specific operating principles of systems with integrated microsensors.<br>• Providing the ability to use specific devices and instruments to perform experiments with microsensors to have better understanding of the phenomena studied.<br>• The correct interpretation of data obtained from typical experiments with micro-systems with application in electrical engineering. |

**8. Content**

| 8.1 Course | Teaching methods | Number of hours | Remarks |
|---|---|---|---|
| **1. Introductory aspects.** Microsensors and their using in electrical equipment; Integrated circuit (IC) technology. Thin films deposition techniques. Photolithographic and nanoimprint techniques; Printed sensors; Magnetic and spintronic microstructures and C-based electronics. Modern characterisation techniques. | Interactive teaching materials presented with video projector. | 3 | Teaching centred on students, practical applications |

| | | | |
|---|---|---|---|
| **2. Sensors**. Classifications. Physical principles of sensing. Examples. Static and dynamic transfer functions. Errors; sensors calibrations. Output impedance of different types of sensors. | Interactive teaching materials presented with video projector. | 3 | Teaching centred on students, practical applications |
| **3. Interface electronic circuits.** Excitation circuits; Signal conditioning circuits; C-V, Q-V circuits, etc.; Two-wire, four-wire sensing; Bridge amplifiers; multiplexing circuits for sensors array, Noise; Shielding; Analog-to-Digital convertors; | Interactive teaching materials presented with video projector. | 3 | Teaching centred on students, practical applications |
| **4. Displacement, velocity and acceleration microsensors**; IC Accelerometers and gyrosensors, mode of operation and specific output signals; Examples of IC microsensors and applications. | Interactive teaching materials presented with video projector. | 3 | Teaching centred on students, practical applications |
| **5. Force, strain, and tactile microsensors (piezoresistive, piezoelectric, capacitive and optoelectronic)**; Examples of integrated microsensors, printed sensors, circuitry and applications. | Interactive teaching materials presented with video projector. | 3 | Teaching centred on students, practical applications |
| **6. Temperature and radiation microsensors.** **P**hotoresistors, photodiodes, phototransistors, detectors with semiconductors for ionizing radiation and PIR IC microsensors; Examples and circuitry for temperature microsensors with Seebeck effect, pn junction, and RTD. Examples of printed and embedded microsensors with analog and digital output; applications; | Interactive teaching materials presented with video projector. | 3 | Teaching centred on students, practical applications |
| **7. Magnetic microsensors**; Hall effect microsensors; Anisotropic, Giant magnetoresistance and tunneling magnetoresistance (spintronic) microsensors. Magnetometers, rotation sensors; current sensors; MRAM based on spintronic sensors; Applications. | Interactive teaching materials presented with video projector. | 4 | Teaching centred on students, practical applications |
| **8. MEMS based actuators**; Physical principles of electrostatic and electromagnetic actuators and microactuators; Applications. | Interactive teaching materials presented with video projector. | 3 | Teaching centred on students, practical applications |
| **9. Micro and nano-systems used for energy harvesting**; microgenerators based on piezoelectric, thermoelectric and triboelectric effects; Applications with autonomous sensors in electrical engineering and monitoring processes. | Interactive teaching materials presented with video projector. | 3 | Teaching centred on students, practical applications |

Bibliography

1. Marius Volmer, Nanostructuri magnetice – Obținere, proprietăți, aplicații, Editura Universității Transilvania din Braşov, 2008, ISBN 978-973-598-248-5;

2. Marius Volmer, Sensors and microsensors – Theoretical and practical notes, Editura Universității Transilvania din Braşov, 2022, ISBN 978-606-19-1576-7

3. Marius Volmer, Lecture notes – web resources on e-learning platform

4. Jacob Fraden, Handbook of modern sensors – Physics, Design and Applications, Third eddition, Springer, Handbook of modern sensors (yumpu.com)

5. Introduction to microsensors and microactuators, https://depts.washington.edu/mictech/optics/sensors/week1a.pdf

6. Data Acquisition Handbook; A Reference For DAQ and Analog & Digital Signal Conditioning, 2004-2012 by Measurement Computing Corporation; http://www.mccdaq.com/pdfs/anpdf/data-acquisition-handbook.pdf

| 8.2.1. Laboratory | Teaching-learning methods | Number of hours | Remarks |
|---|---|---|---|
| 1. Introductory meeting: safety measurements in lab.; Physical data handling and graphical plots; Examples | Interactive teaching, examples | 2 | First meeting in lab. |
| 2. Micromagnetic simulations of spintronic structures and of a MRAM cell; | Working in teams | 2 | Activity supervised by teacher |
| 3. IC current microsensor based on GMR effect; | Working in teams | 2 | Activity supervised by teacher; presenting and testing commercial chips. |
| 4. Temperature microsensors: static and dynamic characterization; linearization and cold junction compensation methods; measuring the time constant of such sensors; | Working in teams | 2 | Activity supervised by teacher; presenting and testing commercial chips. |
| 5. Detection characteristics of a Hall effect microsensors used for magnetic field and electrical current detection; | Working in teams | 2 | Activity supervised by teacher; presenting and testing commercial chips. |
| 6. Photodiode microsensor. Static and dynamic detection characteristics. | Working in teams | 2 | Activity supervised by teacher |
| 7. Final meeting for students' evaluation: individual discussions, lab. Portfolios evaluation. | Tests and individual evaluation | 2 | Final meeting |
| 8.2.2. Project | | | |
| 1. Establishing topics for projects. | Interactive teaching, examples | 2 | First meeting for setting the projects subjects. |
| 2. Verifying the work progress; setting the project objectives and documentation steps. | Interactive teaching | 2 | Individual evaluation |
| 3. Verifying the work progress: the state of documentation and project elaboration. | Interactive teaching | 2 | Individual evaluation |
| 4. Verifying the work progress: simulation and design developments. | Interactive teaching | 2 | Individual evaluation |
| 5. Verifying the work progress: simulation and design developments and project elaboration. | Interactive teaching | 2 | Individual evaluation |
| 6. Preliminary check of the final project. | Interactive teaching | 2 | Individual evaluation |
| 7. Project presentation. | Interactive discussions | 2 | Final individual evaluation |

Bibliography

1. Marius Volmer, Sensors and microsensors – Theoretical and practical notes, Editura Universității Transilvania din Braşov, 2022, ISBN 978-606-19-1576-7;
2. Marius Volmer, Embedded sensors for electrical engineering applications, web resource on e-learning platform.

**9. Correlation of course content with the demands of the labour market (epistemic communities, professional associations, potential employers)**

The course offers the adequate knowledges to understand the basics in the field of micro and nano systems used for embedded micro-sensors with applications in electrical engineering.

**10. Evaluation**

| Activity type | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Percentage of the final grade |
|---|---|---|---|
| 10.4 Course | Clarity, consistency and brevity exposure | Written examination with three subjects.<br>For each subject a specific grading scale is assigned. The grading scale is communicated to the students with the subjects | 50% |
| | Exemplification capacity | | |
| | Correctness explanations of studied phenomena | | |
| | The degree in which the students attend the lectures | It is found throughout the semester | Bonus for the final mark |
| 10.5 Laboratory/ project | The quality of the student activity during the lab. hours/the quality of the project content and presentation | Evaluation based on the reports prepared after each laboratory work.<br>Project presentation by student. | 50% |
| 10.6 Minimal performance standard | | | |
| • The final grade is computed only in case when the marks obtained by treating the subjects of theory (according to the specified grading scale) and the marks obtained at the lab activity and project presentation are at least 5. | | | |

This course outline was certified in the Department Board meeting on 23/09/2024 and approved in the Faculty Board meeting on 24/09/2024.

Dean:
Assoc. Prof. Dr. Eng. Titus BĂLAN

Head of Department:
Assoc. Prof. Dr. Eng. Lia Elena ACIU

Course holder:
Assoc. Prof. Dr. VOLMER Marius

Holder of laboratory/project:
Assoc. Prof. Dr. VOLMER Marius

Note:

1) Field of study – select one of the following options: BA/MA/PhD. (to be filled in according to the forceful classification list for study programmes);

2) Study level – *choose from among:* BA/MA/PhD.;

3) Course status (content) – *for the BA level, select one of the following options:* **FC** (fundamental course) / **DC** (course in the study domain)/ **SC** (speciality course)/ **CC** (complementary course); *for the MA level, select one of the following options*: **PC** (proficiency course)/ **SC** (synthesis course)/ **AC** (advanced course)

4) Course status (attendance type) – *select one of the following options:* **CPC** (compulsory course)/ **EC** (elective course)/ **NCPC** (non-compulsory course);

5) One credit is the equivalent of 25 – 30 study hours (teaching activities and individual study).

# COURSE OUTLINE

**1. Data about the study programme**

| | |
|---|---|
| 1.1 Higher education institution | Transilvania University of Brașov |
| 1.2 Faculty | Electrical Engineering and Computer Science |
| 1.3 Department | Electrical Engineering and Applied Physics |
| 1.4 Field of study[1)] | Electrical Engineering |
| 1.5 Study level[2)] | MA |
| 1.6 Study programme | Advanced Electrical Systems |

**2. Data about the course**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2.1 Name of course | Testing to electromagnetic disturbances (SEA304) | | | | | | | |
| 2.2 Course convenor | Marius Daniel CĂLIN | | | | | | | |
| 2.3 Laboratory/ project convenor | Marius Daniel CĂLIN | | | | | | | |
| 2.4 Study year | 2 | 2.5 Semester | 3 | 2.6 Evaluation type | E | 2.7 Course status | Content[3)] | |
| | | | | | | | Attendance type[4)] | |

**3. Total estimated time (hours of teaching activities per semester)**

| | | | | | |
|---|---|---|---|---|---|
| 3.1 Number of hours per week | 4 | out of which: 3.2 lecture | 2 | 3.3 laboratory/ project | 2 |
| 3.4 Total number of hours in the curriculum | 56 | out of which: 3.5 lecture | 28 | 3.6 laboratory/ project | 14/14 |
| Time allocation | | | | | hours |
| Study of textbooks, course support, bibliography and notes | | | | | 28 |
| Additional documentation in libraries, specialized electronic platforms, and field research | | | | | 14 |
| Preparation of laboratories, projects, homework, papers, portfolios | | | | | 14 |
| Tutorial | | | | | 7 |
| Examinations | | | | | 6 |
| Other activities.................................... | | | | | |

| | |
|---|---|
| **3.7 Total number of hours of student activity** | 69 |
| **3.8 Total number per semester/ programme duration** | 125 |
| **3.9 Number of credits[2)]** | 5 |

**4. Prerequisites (if applicable)**

| | |
|---|---|
| 4.1 curriculum-related | • Knowledge of physics, electrical circuits, electrical and electronic measurements. |
| 4.2 competences-related | • Skills for measuring electrical quantities according to a given scheme, numerical simulation abilities of different circuits and suitable interpretation of the results. |

**5. Conditions (if applicable)**

| | |
|---|---|
| 5.1 for course development | • Room equipped with multimedia equipment, with a capacity of 50 seats. |
| 5.2 for laboratory/ project development | • Laboratory room with a capacity of 25 seats, equipped with testing/ measuring systems at electromagnetic disturbances of electrical and electronic equipment. |

**6. Specific competences and learning outcomes**

| | |
|---|---|
| Professional competences | • **Cp.2 Use of modern knowledge in the analysis, evaluation and operation of electrical subsystems**<br>• L.O.2.1. The graduate knows methods of physical and mathematical description of the structure and operation of electrical systems.<br>• L.O.2.3. The graduate is capable of nuanced use of evaluation methods and substantiation of specific applications of electrical systems, taking into account the principles of energy conversion and electromagnetic compatibility<br>**Cp.3 The use and application of measurement, analysis, evaluation and interpretation techniques in the field of electrical systems for the production, distribution and use of energy**<br>L.O.3.1. The graduate knows measurement techniques and applies modern measurement and testing methods in electrical systems.<br>L.O.3.2. The graduate adequately uses measuring equipment and testing techniques for electrical systems.<br>**Cp.5 The development of new solutions for the realization of applications with advanced electrical systems, in the perspective of socio-economic sustainability**<br>L.O.5.1. The graduate is capable of identifying and mastering the methods of realization and optimization of advanced electrical systems.<br>L.O.5.6. The graduate performs the maintenance of systems with renewable energy sources in accordance with current technical, economic and environmental requirements. |
| Transversal competences | **Ct.1 Responsible management of tasks and resources, taking into account professional ethics and social responsibility**<br>L.O.1.3. The graduate assumes responsibility in the activities undertaken, in the spirit of integrating advanced electrical systems into the environment, under the conditions of sustainable development.<br>**Ct.2 Efficiency and responsibility in the management of teamwork**<br>L.O.2.1. The graduate has the ability to carry out specific work roles in a multidisciplinary team, contributing to the achievement of common objectives.<br>**Ct.3 Continuous professional development and lifelong learning**<br>L.O.2.3. The graduate has the ability to effectively use language skills and knowledge of information technology for their own professional and personal development. |

**7. Course objectives (resulting from the specific competences to be acquired)**

| | |
|---|---|
| 7.1 General course objective | • The knowledge and application of methods, techniques and modern procedures of testing to electromagnetic disturbances of electrical and electronic equipment, in such manner that the graduate master to be able to carry out research on the design and optimal use of equipment, according to present immunity and testing to electromagnetic interference standards, to improve the power quality and the energy efficiency. |
| 7.2 Specific objectives | • Learning the measuring techniques and applying the modern measurement and testing to electromagnetic disturbances methods on electrical systems.<br>• Develop projects on measurement, acquisition, data processing and testing electrical system parameters under electromagnetic disturbances influence.<br>• Use of aided design methods for modeling and optimization of electrical and electronic systems operating in the presence of disturbances from the electromagnetic environment in order to obtain applications with high electromagnetic immunity threshold and with higher energy efficiency.<br>• Evaluation of quantitative and qualitative performance of electric and electronic systems that operate in a polluted electromagnetic environment, in order to assure the energy use with higher efficiency.<br>• Assessment of availability and safety operation in a polluted electromagnetic environment of electrical and electronic systems.<br>• Evaluation and validation of analysis methods of advanced electrical systems operation, by developing corrective/ preventive specific measures. |

**8. Content**

| 8.1 Course | Teaching methods | Number of hours | Remarks |
|---|---|---|---|
| **C1. Introduction in testing to electromagnetic disturbances** Course objectives; Elements of terminology; Definition and classification of electromagnetic disturbances; Directives and regulations in EMC testing. | Interactive course | 2 | - |
| **C2-C3. The electromagnetic interference and the immunity of electrical and electronic equipment** Sources of electromagnetic disturbances; Electromagnetic coupling ways; Mitigation mechanisms; Methods and techniques for EMI measurements and assessment of EEE immunity. | Interactive course | 4 | - |
| **C4-C5. Electromagnetic shielding** Elements of terminology; Screen effect; Materials for electromagnetic shielding; Shielding design elements; Methods and techniques for testing the electromagnetic shielding effectiveness; Modeling of electromagnetic screens. | Interactive course | 4 | - |
| **C6-C7. Testing to electrostatic discharges** Elements of terminology; Description of the ESD phenomenon; Antistatic materials; Human-bodies ESD models; ESD testing instrumentation; ESD testing requirements. | Interactive course | 4 | - |
| **C8-C9. Testing to non-sinusoidal regime in power networks** Elements of terminology; Voltage dips; Voltage and frequency variations; Voltage unbalance; Harmonics and inter-harmonics; Non-sinusoidal regime testing instrumentation; EMC compliance requirements for non-sinusoidal regime testing. | Interactive course | 4 | - |

| | | | |
|---|---|---|---|
| **C10-C11. Testing to electromagnetic disturbances generated by power frequency and pulse magnetic fields**<br>Elements of terminology; Methods, procedures and techniques for testing to magnetic field disturbances; Testing levels; EMC compliance requirements for magnetic field testing; EUT immunity assessment; Elements of a testing technical report. | Interactive course | 4 | - |
| **C12-C13. Testing to low-frequency and RF electromagnetic disturbances**<br>Elements of terminology; Particularities of low-frequency 0-150kHz and radio-frequency disturbances 150kHz-1GHz; Testing methods and techniques; EMC compliance requirements. | Interactive course | 4 | - |
| **C14. Health and risks associated with EMF exposure to disturbance testing**<br>Particularities of static and variables electromagnetic fields EMF; Exposure levels; Effects and mitigation solutions for EMF exposure. | Interactive course | 2 | - |

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1. Calin M.D., *Testing to electromagnetic disturbances of technical systems*, Course notes, 2024. (available on e-platform of Transilvania University of Braşov, https://elearning.unitbv.ro).
2. Helerea, E., *Energy and environmental engineering*, Transilvania University of Braşov Press, 2007.
3. Schwab A., *Electromagnetische vertrglichkeit*, Springer-Verlag, 6th edition, 2011.
4. Hill D.A., *Electromagnetic fields in cavities:deterministic and statistical theories*, John Wiley & Sons, 2009.
5. Voldman H.S., *ESD: failure mechanisms and models*, John Wiley & Sons, 2009.
6. Dugan R. et al, *Electrical power systems quality*, 2nd Edition, McGraw-Hill Companies, 2004.
7. Smith A., *Radio frequency principles and applications*, IEEE Press, 1998.


| 8.2 Laboratory/ project | Teaching-learning methods | Number of hours | Remarks |
|---|---|---|---|
| 1. Electro-safety rules specific to testing to EM disturbances of technical systems. Laboratory rules. Presentation of testing stands. | Conversation and case studies | 2 | - |
| 2. Efficiency measuring of reflective enclosures to radiated disturbances. | Team work | 2 | Elements of adequate design of reflective enclosures for radiated disturbances will be addressed. |
| 3. Testing to electrostatic discharges of electrical and electronic EEE | Team work | 2 | Appropriate design elements of increasing the immunity of EEE |

| | | | |
|---|---|---|---|
| equipment. | | | equipment to electrostatic discharges will be addressed |
| 4. Testing to power network disturbances of electrical and electronic equipment. | Team work | 2 | Adequate design elements of increasing the immunity of EEE equipment to non-sinusoidal power supply will be addressed |
| **5. Testing to 50 Hz power magnetic field disturbances of electrical and electronic equipment. *** | Team work | 2 | Adequate design elements of increasing the immunity of EEE equipment to magnetic fields of power-grid will be addressed |
| **6. Testing to conducted disturbances, induced by RF fields of electrical and electronic equipment. *** | Team work | 2 | Appropriate design elements of increasing the immunity of electrical and electronic equipment to RF fields will be addressed |
| 7. Knowledge and skills evaluation. Final laboratory examination (portfolio verification and test). | Interactive activity - written and oral assessment | 2 | - |
| ***** The lab-works use the **Digital Oscilloscope** purchased within the PNRR project "Digital transformation for innovation and competitiveness", 14039/16.09.2022. | | | |

Bibliography


1. Calin M.D., *Testing to electromagnetic disturbances of technical systems*, Working labs and design guide, 2024. (available on e-platform of Transilvania University of Braşov, https://elearning.unitbv.ro).
2. Ogrutan P., Aciu L.E., *Compatibilitate electromagnetică. Aplicații*. Transilvania University of Braşov Press, 2006.
3. Montrose M., Nakauchi E., *Testing for EMC compliance: approaches and techniques*, IEEE Press, 2004.
4. Peterson A., Ray S., Mittra R., *Computational methods for electromagnetics*, IEEE Press, 1998.
5. Mardiguian M., *Electro Static Discharge: understand, simulate, and fix ESD problems*, John Wiley & Sons, 2009.
6. Dugan R. et al, *Electrical power systems quality*, 2nd Edition, McGraw-Hill Companies, 2004.
7. *EMC Standards* available in the laboratory of Transilvania University Research Institute - ICDT.


**9. Correlation of course content with the demands of the labour market (epistemic communities, professional associations, potential employers in the field of study)**

The course provides the knowledge necessary to understand how to apply the methods and techniques of testing to electromagnetic disturbances of technical systems, in order to design and use optimal of electrical and electronic equipment. Knowledge of the impact of electromagnetic disturbance on advanced electrical systems operation and on environment is prerequisites for a sustainable development that all companies and employers take into account. There are taken into account the European regulations regarding EMC requirements and those recommended by professional associations, such as Institute of Electrical and Electronic Engineering - IEEE (www.ieee.org), Romanian Association of Engineers - AGIR (www.agir.ro) and Romanian Association on Electromagnetic Compatibility - ACER (www.acer.ro).

**10. Evaluation**

| Activity type | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Percentage of the final grade |
|---|---|---|---|
| 10.4 Course | Recognition and description of the testing methods to disturbances of technical systems. | Exam test - written and oral | 50 % |

| | | | |
|---|---|---|---|
| 10.5 Laboratory/ project | Proper operation with the techniques and procedures specific of testing to disturbances of electrical and electronic equipment. | Portfolio and final test assessment | 50 % |
| 10.6 Minimal performance standard | | | |
| • Description of the testing methods to electromagnetic disturbances of electrical and electronic equipment.<br>• Completed portfolio at all laboratories/ project work and passing of the final test. | | | |

This course outline was certified in the Department Board meeting on 23/09/2024 and approved in the Faculty Board meeting on 24/09/2024.

| | |
|---|---|
| **Assoc. Prof. Dr.Eng. Titus Constantin BĂLAN,**<br>**Dean** | **Assoc. Prof. Dr.Eng. Lia Elena ACIU,**<br>**Head of Department** |
| **PhD. Lect. Dr.Eng. Marius Daniel CĂLIN,**<br>**Course holder** | **PhD. Lect. Dr.Eng. Marius Daniel CĂLIN,**<br>**Laboratory/ project holder** |

Note:

1) Field of study – select one of the following options: Bachelor / Master / Doctorat (to be filled in according to the forceful classification list for study programmes);

2) Study level – choose from among: Bachelor / Master / Doctorat;

3) Course status (content) – for the Bachelor level, select one of the following options: **FC** (fundamental course) / **DC** (course in the study domain)/ **SC** (speciality course)/ **CC** (complementary course); for the Master level, select one of the following options: **PC** (proficiency course)/ SC (synthesis course)/ **AC** (advanced course);

4) Course status (attendance type) – select one of the following options: **CPC** (compulsory course)/ **EC** (elective course)/ **NCPC** (non-compulsory course);

5) One credit is the equivalent of 25 study hours (teaching activities and individual study).

# COURSE OUTLINE

## 1. Data about the study programme

| | |
|---|---|
| 1.1 Higher education institution | Transilvania University of Brasov |
| 1.2 Faculty | Electrical Engineering and Computer Science |
| 1.3 Department | Electrical Engineering and Applied Physics |
| 1.4 Field of study[1)] | Electrical Engineering |
| 1.5 Study level[2)] | MA |
| 1.6 Study programme | Advanced Electrical Systems |

## 2. Data about the course

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2.1 Name of course | | | Digital Monitoring Systems for Power Quality (SEA305) | | | | | |
| 2.2 Course convenor | | | Lect.PhD.Eng. Gheorghe-Dan SOREA | | | | | |
| 2.3 Seminar/ laboratory/ project convenor | | | Lect.PhD.Eng. Gheorghe-Dan SOREA | | | | | |
| 2.4 Study year | 2 | 2.5 Semester | 3 | 2.6 Evaluation type | E | 2.7 Course status | Content[3)] | AC |
| | | | | | | | Attendance type[4)] | EC |

## 3. Total estimated time (hours of teaching activities per semester)

| | | | | | |
|---|---|---|---|---|---|
| 3.1 Number of hours per week | **3** | out of which: 3.2 lecture | **2** | 3.3 seminar/ laboratory/ project | **1** |
| 3.4 Total number of hours in the curriculum | 42 | out of which: 3.5 lecture | 28 | 3.6 seminar/ laboratory/ project | 14 |

| | |
|---|---|
| Time allocation | hours |
| Study of textbooks, course support, bibliography and notes | 28 |
| Additional documentation in libraries, specialized electronic platforms, and field research | 23 |
| Preparation of seminars/ laboratories/ projects, homework, papers, portfolios, and essays | 28 |
| Tutorial | 1 |
| Examinations | 3 |
| Other activities………………………………. | |

| | |
|---|---|
| **3.7 Total number of hours of student activity** | 83 |
| **3.8 Total number per semester** | 125 |
| **3.9 Number of credits[5)]** | 5 |

## 4. Prerequisites (if applicable)

| | |
|---|---|
| 4.1 curriculum-related | • Courses: Electrical Measurements, Programming, Numerical Methods |
| 4.2 competences-related | • Know how about modern calculation techniques and methods regarding the computer processing data in electrical systems |

## 5. Conditions (if applicable)

| | |
|---|---|
| 5.1 for course development | • Room with multimedia equipment, 20 places |
| 5.2 for seminar/ laboratory/ project development | • Computer network: server + workstations |

**6. Specific competences and learning outcomes**

| | |
|---|---|
| Professional competences | Cp2. Know How in using the modern knowledge for analysis, evaluation and functionality of electrical subsystems<br>Cp3. Know How in using and applying the measurement techniques in analysis and interpretation of the results for electrical systems for energy production, transport, distribution and consumption |
| Transversal competences | Ct1. Handling the responsabilities required by the assignments and resources with respect to professional ethics and social responsability<br>Ct2. Continuous professional development and long life learning |

**7. Course objectives (resulting from the specific competences to be acquired)**

| | |
|---|---|
| 7.1 General course objective | • The given materials will assure the student the knowledge about the digital monitoring systems |
| 7.2 Specific objectives | • Capacity of transposing of a model into practical scenarios<br>• Implementation of the results obtained from monitoring and data processing |

**8. Content**

| 8.1 Course | Teaching methods | Number of hours | Remarks |
|---|---|---|---|
| Introduction in OPC | Interactive course with didactical materials | 2 | |
| Standards and specifications for Direct Access of data | Interactive course with didactical materials | 4 | |
| Standards and specifications for Historical Data Access | Interactive course with didactical materials | 4 | |
| Standards and specifications for Events and Alarms | Interactive course with didactical materials | 4 | |
| Data Protection and Security in OPC Standard | Interactive course with didactical materials | 2 | |
| Migration from OPC Classic to OPC Unified Architecture | Interactive course with didactical materials | 6 | |
| Using OPC UA în Embedded Systems for IIoT (Industrial Internet of Things) | Interactive course with didactical materials | 6 | |
| Bibliography<br>1. D. Sorea, Lecture notes, ( accesible on e-learning: https://elearning.unitbv.ro/enrol/index.php?id=2119)<br>2. https://opcfoundation.org/<br>3. Lange, J., Iwanitz, Fr., Burke, Th. - OPC – From Data Access to Unified Architecture, VDE VERLAG GMBH ISBN 978-3-8007-3242-5, 2010 | | | |
| 8.2 Seminar/ laboratory/ project | Teaching-learning methods | Number of hours | Remarks |
| Configuring an OPC Client application. Testing of the protocol | Computer simulation | 2 | |
| Monitoring and trending the analogical signals from sensors and actuators | Computer simulation | 2 | |
| Developing and configuring an OPC Client application for a smart hybrid stand-alone system | Computer simulation | 10 | |

| |
|---|
| Bibliography<br>https://www.matrikonopc.com/resources/opc-tutorials.aspx<br>https://opcfoundation.org |

**9. Correlation of course content with the demands of the labour market (epistemic communities, professional associations, potential employers in the field of study)**

| |
|---|
| The course will assure the necessary knowledge for understanding and using the OPC technology in applications based on Industrial Internet of Things (IIoT) |

**10. Evaluation**

| Activity type | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Percentage of the final grade |
|---|---|---|---|
| 10.4 Course | Capacity of understanding of OPC standards and specifications | Quiz test | 40% |
| 10.5 Seminar/ laboratory/ project | Realization of the laboratories requirement | colloquium | 10% |
| | Solving a case study | report | 50% |
| 10.6 Minimal performance standard | | | |
| • Understanding the basics of OPC<br>• Simulation of an OPC Client application | | | |

This course outline was certified in the Department Board meeting on23/09/2024 and approved in the Faculty Board meeting on 24/09/2024.

| | |
|---|---|
| **Assoc. Prof. Dr. Eng. Titus Constantin BĂLAN,**<br>**Dean** | **Assoc. Prof. Dr. Eng. Lia Elena ACIU,**<br>**Head of Department** |
| **Lect. Dr. Eng. Gheorghe Dan SOREA**<br>**Course holder** | **Lect. Dr. Eng. Gheorghe Dan SOREA**<br>**Holder of seminar/ laboratory/ project** |

Note:

[1] Field of study – select one of the following options: Bachelor / Master / Doctorat (to be filled in according to the forceful classification list for study programmes);

[2] Study level – choose from among: Bachelor / Master / Doctorat;

[3] Course status (content) – for the Bachelor level, select one of the following options: **FC** (fundamental course) / **DC** (course in the study domain)/ **SC** (speciality course)/ **CC** (complementary course); for the Master level, select one of the following options: **PC** (proficiency course)/ SC (synthesis course)/ **AC** (advanced course);

[4] Course status (attendance type) – select one of the following options: **CPC** (compulsory course)/ **EC** (elective course)/ **NCPC** (non-compulsory course);

[5] One credit is the equivalent of 25 study hours (teaching activities and individual study).

# COURSE OUTLINE

### 1. Data about the study programme

| | |
|---|---|
| 1.1 Higher education institution | Transilvania University of Brasov |
| 1.2 Faculty | Electrical Engineering and Computer Science |
| 1.3 Department | Electrical Engineering and Applied Physics |
| 1.4 Field of study[1)] | Electrical Engineering |
| 1.5 Study level[2)] | MA |
| 1.6 Study programme | Advanced Electrical Systems |

### 2. Data about the course

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2.1 Name of course | | | The design of Human-Machine Interfaces (SEA306) | | | | | |
| 2.2 Course convenor | | | Lect.PhD.Eng. Gheorghe-Dan SOREA | | | | | |
| 2.3 Seminar/ laboratory/ project convenor | | | Lect.PhD.Eng. Gheorghe-Dan SOREA | | | | | |
| 2.4 Study year | 2 | 2.5 Semester | 3 | 2.6 Evaluation type | E | 2.7 Course status | Content[3)] | AC |
| | | | | | | | Attendance type[4)] | EC |

### 3. Total estimated time (hours of teaching activities per semester)

| | | | | | |
|---|---|---|---|---|---|
| 3.1 Number of hours per week | **3** | out of which: 3.2 lecture | **2** | 3.3 seminar/ laboratory/ project | **1** |
| 3.4 Total number of hours in the curriculum | 42 | out of which: 3.5 lecture | 28 | 3.6 seminar/ laboratory/ project | 14 |

| | |
|---|---|
| Time allocation | hours |
| Study of textbooks, course support, bibliography and notes | 28 |
| Additional documentation in libraries, specialized electronic platforms, and field research | 23 |
| Preparation of seminars/ laboratories/ projects, homework, papers, portfolios, and essays | 28 |
| Tutorial | 1 |
| Examinations | 3 |
| Other activities…………………………….. | |

| | |
|---|---|
| **3.7 Total number of hours of student activity** | 83 |
| **3.8 Total number per semester** | 125 |
| **3.9 Number of credits[5)]** | 5 |

### 4. Prerequisites (if applicable)

| | |
|---|---|
| 4.1 curriculum-related | • Courses: Electrical Measurement, Electrical Machines, Sensors and Transducers, Programming |
| 4.2 competences-related | • Know how about modern calculation techniques and methods regarding the computer processing data in electrical systems |

### 5. Conditions (if applicable)

| | |
|---|---|
| 5.1 for course development | • Room with multimedia equipment, 20 places |
| 5.2 for seminar/ laboratory/ project development | • Computer network: server + workstations |

**6. Specific competences and learning outcomes**

| | |
|---|---|
| Professional competences | Cp2. Know How in using the modern knowledge for analysis, evaluation and functionality of electrical subsystems<br>Cp3. Know How in using and applying the measurement techniques in analysis and interpretation of the results for electrical systems for energy production, transport, distribution and consumption |
| Transversal competences | Ct1. Handling the responsabilities required by the assignments and resources with respect to professional ethics and social responsability<br>Ct2. Continuous professional development and long life learning |

**7. Course objectives (resulting from the specific competences to be acquired)**

| | |
|---|---|
| 7.1 General course objective | • The given materials will assure the student the knowledge about the design of human-machine interfaces |
| 7.2 Specific objectives | • Capacity of transposing of a model into practical scenarios<br>• Implementation of the results obtained from simulations |

**8. Content**

| 8.1 Course | Teaching methods | Number of hours | Remarks |
|---|---|---|---|
| Introduction to HMI | Interactive course with didactical materials | 2 | |
| SCADA vs. HMI | Interactive course with didactical materials | 4 | |
| Connexion with PLC by using Modbus | Interactive course with didactical materials | 4 | |
| Connexion with PLC by using Ethernet IP | Interactive course with didactical materials | 4 | |
| Connexion with PLC by using Profibus | Interactive course with didactical materials | 4 | |
| Usage of the client-server model of IIoT | Interactive course with didactical materials | 4 | |
| Simulation of HMI by using Matlab and LabView | Interactive course with didactical materials | 6 | |
| Bibliography<br>1. D. Sorea, Lecture notes, ( accesible on e-learning, https://elearning.unitbv.ro)<br>2. https://www.siemens.com/global/en/products/automation/simatic-hmi/panels.html<br>3. https://opcfoundation.org/ | | | |
| 8.2 Seminar/ laboratory/ project | Teaching-learning methods | Number of hours | Remarks |
| Principles of design of HMI | Computer simulation | 4 | |
| Testing the OPC Protocol | Computer simulation | 2 | |
| HMI Application in LabView for a water pump station | Computer simulation | 4 | |
| HMI + OPC Application in Matlab | Computer simulation | 4 | |
| Bibliography | | | |

4. D. Sorea, Laboratory notes, ( accesible on e-learning, https://elearning.unitbv.ro)
5. https://www.matrikonopc.com/resources/opc-tutorials.aspx
6. https://www.youtube.com/watch?v=zJDsEqCyTqc
7. https://www.youtube.com/watch?v=kujHQgK352o

**9. Correlation of course content with the demands of the labour market (epistemic communities, professional associations, potential employers in the field of study)**

The course will assure the necessary knowledge for understanding and using the HMI in industrial processes

**10. Evaluation**

| Activity type | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Percentage of the final grade |
|---|---|---|---|
| 10.4 Course | Capacity of understanding of HMI principles | Quiz test | 40% |
| 10.5 Seminar/ laboratory/ project | Realization of the laboratories requirement | colloquium | 10% |
| | Solving a case study | report | 50% |
| 10.6 Minimal performance standard | | | |

- Understanding the basics of HMI principles
- Simulation of an HMI application

This course outline was certified in the Department Board meeting on23/09/2024 and approved in the Faculty Board meeting on 24/09/2024.

| | |
|---|---|
| **Assoc. Prof. Dr. Eng. Titus Constantin BĂLAN,**<br>**Dean** | **Assoc. Prof. Dr. Eng. Lia Elena ACIU,**<br>**Head of Department** |
| **Lect. Dr. Eng. Gheorghe Dan SOREA**<br>**Course holder** | **Lect. Dr. Eng. Gheorghe Dan SOREA**<br>**Holder of seminar/ laboratory/ project** |

Note:

[1] Field of study – select one of the following options: Bachelor / Master / Doctorat (to be filled in according to the forceful classification list for study programmes);

[2] Study level – choose from among: Bachelor / Master / Doctorat;

[3] Course status (content) – for the Bachelor level, select one of the following options: **FC** (fundamental course) / **DC** (course in the study domain)/ **SC** (speciality course)/ **CC** (complementary course); for the Master level, select one of the following options: **PC** (proficiency course)/ SC (synthesis course)/ **AC** (advanced course);

[4] Course status (attendance type) – select one of the following options: **CPC** (compulsory course)/ **EC** (elective course)/ **NCPC** (non-compulsory course);

[5] One credit is the equivalent of 25 study hours (teaching activities and individual study).

# COURSE OUTLINE

**1. Data about the study programme**

| | |
|---|---|
| 1.1 Higher education institution | Transilvania University of Brașov |
| 1.2 Faculty | Electrical Engineering and Computer Science |
| 1.3 Department | Electrical Engineering and Applied Physics |
| 1.4 Field of study[1)] | Electrical Engineering |
| 1.5 Study level[2)] | MA |
| 1.6 Study programme | Advanced Electrical Systems |

**2. Data about the course**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2.1 Name of course | | | Wind turbines (SEA307) | | | | | |
| 2.2 Course convenor | | | Luminița Roxana CLOȚEA | | | | | |
| 2.3 Seminar/ laboratory/ project convenor | | | Luminița BAROTE | | | | | |
| 2.4 Study year | 2 | 2.5 Semester | 3 | 2.6 Evaluation type | E | 2.7 Course status | Content[3)] | AC |
| | | | | | | | Attendance type[4)] | EC |

**3. Total estimated time (hours of teaching activities per semester)**

| | | | | | |
|---|---|---|---|---|---|
| 3.1 Number of hours per week | **3** | out of which: 3.2 lecture | **2** | 3.3 seminar/ laboratory/ project | **0/1/0** |
| 3.4 Total number of hours in the curriculum | 42 | out of which: 3.5 lecture | 28 | 3.6 seminar/ laboratory/ project | 0/14/0 |
| Time allocation | | | | | hours |
| Study of textbooks, course support, bibliography and notes | | | | | 35 |
| Additional documentation in libraries, specialized electronic platforms, and field research | | | | | 7 |
| Preparation of seminars/ laboratories/ projects, homework, papers, portfolios, and essays | | | | | 35 |
| Tutorial | | | | | 3 |
| Examinations | | | | | 3 |
| Other activities.................................... | | | | | |

| | |
|---|---|
| **3.7 Total number of hours of student activity** | 83 |
| **3.8 Total number per semester** | 125 |
| **3.9 Number of credits[5)]** | 5 |

**4. Prerequisites (if applicable)**

| | |
|---|---|
| 4.1 curriculum-related | • Modern energy storage systems, control of power electronic converters, smart electrical microgrids. |
| 4.2 competences-related | • Using modern knowledge related to analyse, evaluation and operation of electrical sub-systems. |

**5. Conditions (if applicable)**

| | |
|---|---|
| 5.1 for course development | • Multimedia lecture room. Capacity of the room: 50 places. |
| 5.2 for seminar/ laboratory/ project development | • Special laboratory room, including 15 PCs. |

**6. Specific competences and learning outcomes**

| | |
|---|---|
| Professional competences | Cp1. Operating with modern concepts and calculation methods for the computer-aided design of electrical systems<br>L.O.1.1. The graduate demonstrates a thorough knowledge of programming languages, environments and technologies and specific tools for electrical engineering applications.<br>L.O.1.2 The graduate uses specific calculation tools for the design and optimization of advanced electrical systems.<br>Cp2. Use of modern knowledge in the analysis, evaluation and operation of electrical subsystems.<br>L.O.2.1 The graduate knows methods of physical and mathematical description of the structure and operation of electrical systems.<br>Cp4. Modeling and optimization of electrical and electronic systems for efficient energy use.<br>L.O..4.3. The graduate performs a quantitative and qualitative assessment of the performance of electrical and electronic power systems for the efficient use of energy.<br>Cp.5 The development of new solutions for the realization of applications with advanced electrical systems, in the perspective of socio-economic sustainability.<br>L.O.5.3. The graduate uses concepts for the realization of applications with low energy consumption, for the control of energy production and management, monitoring and control of the environment. |
| Transversal competences | CT1.Responsible management of tasks and resources, considering professional ethics and social responsibility.<br>L.O.1.2 The graduate knows how to work in conditions of professional autonomy, with the practical application of the acquired knowledge.<br>CT3. Continuous professional development and lifelong learning.<br>L.O.3.1 The graduate is capable of objective self-assessment regarding the need for continuous professional training. |

**7. Course objectives (resulting from the specific competences to be acquired)**

| | |
|---|---|
| 7.1 General course objective | • Advanced knowledge and theory related to the conversion of the wind energy, so that the graduated student to be able to develop research activities in the field of wind power systems.. |
| 7.2 Specific objectives | • Knowing the methods for physical and mathematical description of the electrical systems structure and operation.<br>• Using advanced theories for justifying the operation processes and control of advanced electrical systems.<br>• Quantitative and qualitative evaluation of electrical and electronic systems performance for efficient energy use.<br>• Using modern theories for designing and optimization of advanced electrical systems applications. |

**8. Content**

| 8.1 Course | Teaching methods | Number of hours | Remarks |
|---|---|---|---|
| Chapter 1 – Introduction<br>1.1. Wind energy potential map.<br>1.2. Modern wind energy turbines.<br>1.3. State of the art of wind turbines.. | White and blackbord, PC and videoprojector | 2 | |
| Chapter2 – Modelling of the wind turbines<br>2.1. Basic considerations related to modelling and simulation.<br>2.2. Aerodynamic modeling.<br>2.3. Basic Modelling Block Description of Wind Turbines | White and blackbord, PC and videoprojector | 4 | |
| Chapter 3 – Wind power and power systems. | White and blackbord, | 4 | |

| | | | |
|---|---|---|---|
| 3.1. Network integration issues for wind power.<br>3.2. Basic problem of the grid connection of a wind farm.<br>3.3. Power system reliability. | PC and videoprojector | | |
| Chapter 4 – Generators and electronic converters for wind turbines.<br>4.1. Topologies of wind turbines..<br>4.2. Control of wind turbines<br>4.3. Types of electrical generators..<br>4.4. Power electronics for wind power.<br>4.5. State of the art market penetration.<br>4.6. Generator concept.<br>4.7. Power electronics topologies for wind turbines.<br>4.8. Power electronics for wind farms. | White and blackbord, PC and videoprojector | 6 | |
| Chapter 5 – Control iof the grid connected inverter.<br>5.1. Simplified circuit diagram for a three-phase, two-level voltage source converter (VSC).<br>5.2. Voltage oriented control.<br>5.3. Power diagram. | White and blackbord, PC and videoprojector | 2 | |
| Chapter 6 – Squirell cage induction generator for wind turbine.<br>6.1. Generator Torque-Speed Characteristics<br>6.2. Case study – power flow, losses and efficiency. | White and blackbord, PC and videoprojector | 2 | |
| Chapter 7 – Doubly fed induction generator for wind turbine.<br>7.1. Super and Sub synchronous Operation of DFIG<br>7.2. Unity Power Factor Operation of DFIG<br>7.3. Leading and lagging power factor operation.<br>7.4. Space vector model.<br>7.5. Case study. | White and blackbord, PC and videoprojector | 4 | |
| Chapter 8 – Power system requirements for wind power,<br>8.1. Operation of the power system.<br>8.2. Wind power production. | White and blackbord, PC and videoprojector | 2 | |
| Chapter 9 – Power quality standards for wind turbines.<br>9.1. Power quality characteristics of wind turbines.<br>9.2. Case study. | White and blackbord, PC and videoprojector | 2 | |
| Bibliography<br>1. Cloțea L. R., Wind power systems. Course Support, 2024 –electronic form: https://elearning.unitbv.ro/course/view.php?id=2049<br>2. Bin Wu, Power Conversion and Control of Wind Energy Systems, , IEEE Press, 2011.<br>3. S. Heier, Grid Integration of Wind Energy Conversion System, Wiley, 2nd Edition, 2003.<br>4. T. Ackermann, Wind Power in Power Systems, Wiley, 2005. | | | |
| 8.2 Laboratory | Teaching-learning methods | Number of hours | Remarks |
| 1. Computing the Weibull wind density distribution | Individual work | 2 | |

| | | | |
|---|---|---|---|
| for a given location. | | | |
| 2. Data processing using the Matlab program – Case study. | Individual work | 4 | |
| 3. Using the wind turbine for the power supply of single-phase load-case study. | Individual work | 2 | |
| 4. Computing the efficiency of the wind generator using the Matlab program. | Individual work | 2 | |
| 5. System simulation in Matlab . | Individual work | 2 | |
| 6.Final laboratory examination | | 2 | |

Bibliography


1. L. Barote, Laboratory guide, https://elearning.unitbv.ro/course/view.php?id=1919
2. L. Barote, Electrical energy storage systems, Laboratory Handbook, Editura Universitatii Transilvania din Brasov, 2013.
3. L. Barote, Stocarea energiei electrice in sisteme distribuite de generare, Editura Universitatii Transilvania din 3. Brasov, ISBN 978-606-19-0616-1, 2015.
4. I. Serban, Microretele hibride cu surse regenerabile de energie, Ed. Universitatii Transilvania, Brasov, 2008.
5. C. Marinescu, I. Serban, L. Clotea, D. Marinescu, C.P. Ion, M. Georgescu, L. Barote, A. Forcos, Retele hibride cu surse regenerabile de energie. Evolutii moderne, Ed. Universitatii Transilvania Brasov, 2011.
6. C. Marinescu, M. Georgescu, L. Clotea, C.P. Ion, I. Serban, L. Barote, D.M. Valcan, Surse Regenerabile de Energie. Abordari Actuale, Ed. Universitatii Transilvania, Brasov, 2009.


**9. Correlation of course content with the demands of the labour market (epistemic communities, professional associations, potential employers in the field of study)**

The European and the IEEE directives are considered.

**10. Evaluation**

| Activity type | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Percentage of the final grade |
|---|---|---|---|
| 10.4 Course | - knowing the specific theory | Written examination | 50% |
| | - Solving specific applications (case studies) | | |
| 10.5 Laboratory | Final laboratory examination | Oral examination | 50% |
| 10.6 Minimal performance standard | | | |
| • Laboratory evaluation, minimum mark 5.<br>• Graduation of the exam, minimum mark 5. | | | |

This course outline was certified in the Department Board meeting on 23/09/2024 and approved in the Faculty Board meeting on 24/09/2024.

| | |
|---|---|
| **Assoc. Prof. Titus Constantin BĂLAN,**<br>**Dean** | **Assoc. Prof. Lia Elena ACIU,**<br>**Head of Department** |
| **Assoc. Prof. Luminița Roxana CLOȚEA,**<br>**Course holder** | **Assoc. Prof. Luminița BAROTE,**<br>**Holder of project** |

| | |
|---|---|
| | |

Note:

[1] Field of study – select one of the following options: Bachelor / Master / Doctorat (to be filled in according to the forceful classification list for study programmes);

[2] Study level – choose from among: Bachelor / Master / Doctorat;

[3] Course status (content) – for the Bachelor level, select one of the following options: **FC** (fundamental course) / **DC** (course in the study domain)/ **SC** (speciality course)/ **CC** (complementary course); for the Master level, select one of the following options: **PC** (proficiency course)/ SC (synthesis course)/ **AC** (advanced course);

[4] Course status (attendance type) – select one of the following options: **CPC** (compulsory course)/ **EC** (elective course)/ **NCPC** (non-compulsory course);

[5] One credit is the equivalent of 25 study hours (teaching activities and individual study).

# COURSE OUTLINE

**1. Data about the study programme**

| | |
|---|---|
| 1.1 Higher education institution | TRANSILVANIA UNIVERSITY OF BRASOV |
| 1.2 Faculty | Electrical Engineering and Computer Science |
| 1.3 Department | Electrical Engineering and Applied Physics |
| 1.4 Field of study of Master [1)] | Electrical Engineering |
| 1.5 Study level[2)] | MA |
| 1.6 Study programme | Advanced Electrical Systems |

**2. Data about the course**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2.1 Name of course | | | Web applications in electrical engineering (SEA308) | | | | | |
| 2.2 Course convenor | | | Lucian Lupșa-Tătaru, Lecturer PhD | | | | | |
| 2.3 Laboratory convenor | | | Lucian Lupșa-Tătaru, Lecturer PhD | | | | | |
| 2.4 Study year | II | 2.5 Semester | III | 2.6 Evaluation type | E | 2.7 Course status | Content[3)] | AC |
| | | | | | | | Attendance type[4)] | EC |

**3. Total estimated time (hours of teaching activities per semester)**

| | | | | | |
|---|---|---|---|---|---|
| 3.1 Number of hours per week | 3 | out of which: 3.2 lecture | 2 | 3.3 laboratory | 1 |
| 3.4 Total number of hours in the curriculum | 42 | out of which: 3.5 lecture | 28 | 3.6 laboratory | 14 |

| | |
|---|---|
| Time allocation | hours |
| Study of textbooks, course support, bibliography and notes | 29 |
| Additional documentation in libraries, specialized electronic platforms, and field research | 20 |
| Preparation of laboratories, homework, papers, portfolios, and essays | 30 |
| Tutorial | 1 |
| Examinations | 3 |

| | |
|---|---|
| **3.7 Total number of hours of student activity** | 83 |
| **3.8 Total number per semester** | 125 |
| **3.9 Number of credits[5)]** | 5 |

**4. Prerequisites (if applicable)**

| | |
|---|---|
| 4.2 competences-related | • The graduate shows a thorough knowledge of programming languages, environments and technologies, and specific tools for electrical engineering applications.<br>• The graduate perceives the methods of physical and mathematical description of the structure and operation of electrical systems.<br>• The graduate is familiar with measurement techniques, and applies modern measurement and testing methods in electrical systems. |

**5. Conditions (if applicable)**

| | |
|---|---|
| 5.1 for course development | • Room endowed with microcomputers (PC); OS: Win 32/64 or Ubuntu desktop 64; Browser: Chrome/Chromium |
| 5.2 for laboratory | • Room endowed with microcomputers (PC); OS: Win 32/64 or Ubuntu desktop 64; Browser: Chrome/Chromium; Code editors: Notepad++, Geany IDE |

**6. Specific competences and learning outcomes**

| | |
|---|---|
| Professional competences | Cp.1 Handling modern concepts and calculation methods for computer-aided design of electrical systems.<br>R.Î.1.3. The graduate is skilled in the integrated use of concepts in solving electrical engineering problems using methods based on the application of dedicated software and appropriate CAD tools.<br>R.Î.1.4. The graduate achieves a nuanced appreciation and relevant evaluation of CAD methods and tools in the development of applications in the area of specialization.<br>Cp.2 The use of modern techniques to analyze, evaluate and operate electrical subsystems.<br>R.Î.2.3. The graduate is able to apply specialized methods of evaluation and design of applications specific to electrical systems, taking into account the principles of energy conversion and electromagnetic compatibility.<br>R.Î.2.4. The graduate is able to develop professional projects in the field of electrical systems, which also incorporate up-to-date information technology solutions.<br>Cp.4 Modeling and optimizing of electrical and electronic systems for energy efficiency.<br>R.Î.4.3. The graduate carries out a quantitative and qualitative assessment on the performance of electrical and electronic power systems for the efficient use of energy. |
| Transversal competences | Ct.1 Careful management of tasks and resources, taking into account professional ethics and social responsibility<br>R.Î.1.2. The graduate is able to work in conditions of professional autonomy, with practical application of the acquired knowledge.<br>R.Î.1.3. The graduate realizes the responsibility in the undertaken activities, in the context of integrating the advanced electrical systems within the environment, in the conditions of sustainable development.<br>Ct.3 Ongoing professional development and life-long learning.<br>R.Î.3.3. The graduate has the ability to make effective use of language skills and knowledge of information technology for personal and professional development. |

**7. Course objectives (resulting from the specific competences to be acquired)**

| | |
|---|---|
| 7.1 General course objective | • The course provides an introduction to the development and effective use of web applications with the purpose of solving various electrical engineering problems. The first part is geared towards development of interactive applications via JavaScript programming language whilst the latter part deals with the usage of existing web applications, with a focus on visualizing the data collected from dynamic simulation. |
| 7.2 Specific objectives | • In-depth knowledge of programming languages, environments, technologies, and tools specific to electrical engineering applications.<br>• Applying specialized methods of evaluation and design of applications specific to electrical systems, taking into account the principles of energy conversion and electromagnetic compatibility.<br>• Developing professional projects in the field of electrical systems, which also incorporate state-of-the-art information technology solutions. |

**8. Content**

| 8.1 Course | Teaching methods | Number of hours | Remarks |
|---|---|---|---|
| JavaScript introduction: JavaScript as the most popular programming language (JavaScript can change HTML content. JavaScript can change HTML attribute values. JavaScript can change HTML styles). | Lecturing and discussion | 1 | |

| | | | |
|---|---|---|---|
| JavaScript statements: values, operators, expressions, keywords, comments. | Lecturing and discussion | 1 | |
| Attributes of HTML <button> tag. Attributes of HTML <input> tag. Attributes of HTML <textarea> tag. HTML <style> tag. | Lecturing and discussion | 1 | |
| CSS Grid Layout Module. Grid elements. Display property. CSS Grid colums and rows. CSS Grid gaps. CSS Grid lines. CSS Grid container properties. | Lecturing and discussion | 2 | |
| JavaScript variables. JavaScript operators. | Lecturing and discussion | 1 | |
| JavaScript functions. Function invocation. Local variables. | Lecturing and discussion | 1 | |
| JavaScript Events. | Lecturing and discussion | 2 | |
| JavaScript Math object. Math object properties and methods. | Lecturing and discussion | 2 | |
| JavaScript RegExp object. RegExp object properties and methods. | Lecturing and discussion | 2 | |
| JavaScript String. String properties and methods. | Lecturing and discussion | 2 | |
| HTML DOM (Document Object Model) getElementById() method. | Lecturing and discussion | 1 | |
| System model. Characteristic quantities and parameters. I/O quantities. Ordinary differential equations and algebraic correlations between characteristic quantities. The generalized mathematical model of synchronous generator. | Lecturing and discussion | 2 | |
| Synchronous generator. Process model synthesis. Ways of selecting the state variables based on algebraic correlations between the characteristic quantities of the system. Systems of ordinary differential equations. Systems of ordinary differential equations in normal form. Systems of equations in differential-algebraic form. Numerical analysis applied upon ordinary differential equations in normal form. One step and multi-step numerical integration methods. Numerical analysis applied upon systems of equations in differential-algebraic form (overview). | Lecturing and discussion | 2 | |
| Initial value problems for equations in differential-algebraic form. Algorithms of mixing one step numerical methods and elimination methods for solving differential-algebraic equations. Algorithms of mixing the multistep predictor/predictor-corrector numerical methods and elimination methods for solving differential-algebraic equations. | Lecturing and discussion | 2 | |
| Sudden three-phase short circuit at the terminals of initially unloaded synchronous generators. Process | Lecturing and discussion | 2 | |

| | | | |
|---|---|---|---|
| model synthesis. | | | |
| Single line-to-ground and line-to-line short circuit transients of synchronous generators. Unitary treatment. | Lecturing and discussion | 2 | |
| Google Sheets as web application. Graphs in Google Sheets. | Lecturing and discussion | 2 | Resource: https://orcid.org/0000-0002-3320-9850 |


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[2] World Wide Web Consortium (W3C). HTML5. https://w3.org (Massachusetts, USA).

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[4] L. Lupşa-Tătaru, Data Reduction and Visualization in Computer Simulation of Electrical Transients, International Review on Modelling and Simulations, ISSN: 1974-9821, eISSN: 1974-983X, Vol. 9, Issue 3, pp. 155-164, June 2016, doi: 10.15866/iremos.v9i3.8476

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[11] https://orcid.org/0000-0002-3320-9850


| 8.2 Laboratory | Teaching-learning methods | Number of hours | Remarks |
|---|---|---|---|
| Development of a web application to compute the outputs of different functions of one variable. | Exposure, Mini-research (Software implementation), Presentations of reports | 1 | Resource: https://orcid.org/0000-0002-3320-9850 |
| Development of a web application to compute the outputs of real-valued bivariate functions | Exposure, Mini-research (Software implementation), | 1 | Resource: https://orcid.org/0000-0002-3320-9850 |

| | | | |
|---|---|---|---|
| | Presentations of reports | | |
| Development of a web application to compute the outputs of real-valued trivariate functions | Exposure, Mini-research (Software implementation), Presentations of reports | 1 | Resource: https://orcid.org/0000-0002-3320-9850 |
| Building web applications to compute the average rate of change of a function on various intervals. | Exposure, Mini-research (Software implementation), Presentations of reports | 1 | Resource: https://orcid.org/0000-0002-3320-9850 |
| Computing the critical value of stator phase current at sudden three-phase short circuit of an initially unloaded synchronous generator, having at hand the analytic expression (expression in analytic form) of the short circuit stator current. | Exposure, Mini-research (Software implementation), Presentations of reports | 2 | Web applications to compute the rate of change of a function on various intervals are to be employed. |
| Computing the critical value of field current at sudden three-phase short circuit of an initially unloaded synchronous generator, having at hand the analytic expression (expression in analytic form) of the short circuit field current. | Exposure, Mini-research (Software implementation), Presentations of reports | 2 | Web applications to compute the rate of change of a function on various intervals are to be employed. |
| Cauchy problems to simulate the sudden three-phase short circuit at the terminals of a synchronous generator, for various initial conditions. Employing the Google Sheets web application to plot the time-related evolution curves of the stator phase currents, field current, and electromagnetic torque. | Exposure, Mini-research (Software implementation), Presentations of reports | 2 | Resource: https://orcid.org/0000-0002-3320-9850 |
| Cauchy problems to simulate the single line-to-ground short circuit transient of a synchronous generator, for various initial conditions. Employing the Google Sheets web application to plot the time-related evolution curves of the stator phase current, field current, and electromagnetic torque. | Exposure, Mini-research (Software implementation), Presentations of reports | 2 | Resource: https://orcid.org/0000-0002-3320-9850 |
| Cauchy problems to simulate the line-to-line short circuit transient of a synchronous generator, for various initial conditions. Employing the Google Sheets web application to plot the time-related evolution curves of the stator phase currents, field current, electromagnetic torque, and angular velocity. | Exposure, Mini-research (Software implementation), Presentations of reports | 2 | Resource: https://orcid.org/0000-0002-3320-9850 |

Bibliography

[1] L. Lupşa-Tătaru, Procese tranzitorii în maşinile sincrone. Modelare şi simulare (Transients in synchronous machines. Modelling and dynamic simulation), ISBN: 978-973-635-953-8, Editura Universității *Transilvania*, Braşov, 2007.

[2] L. Lupşa-Tătaru, Data Reduction and Visualization in Computer Simulation of Electrical Transients, International Review on Modelling and Simulations, ISSN: 1974-9821, eISSN: 1974-983X, Vol. 9, Issue 3, pp. 155-164, June 2016,

doi: 10.15866/iremos.v9i3.8476
[3] L. Lupşa-Tătaru, Visualization Technique for Real-Time Detecting the Characteristic Quantities Critical Values During Electrical Transient Episodes, Journal of Computations and Modelling, ISSN: 1792-8850 (Online version), 1792-7625 (Print version), Vol. 4, Issue 2, pp. 127-150, June 2014.
[4] L. Lupşa-Tătaru, Procedure of Assessing the Electrical Transients with a View to Relative Extrema Localization, Journal of Computations and Modelling, ISSN: 1792-8850 (Online version), 1792-7625 (Print version), Vol. 3, Issue 4, pp. 263-285, December 2013.
[5] L. Lupşa-Tătaru, Power Generators Transient Fault Analysis by Repeated Time Domain Numerical Integrations, International Review on Modelling and Simulations, ISSN: 1974-9821, eISSN: 1974-983X, Vol. 4, Issue 3, pp. 1270-1278, June 2011.
[6] L. Lupşa-Tătaru, Comparative Simulation Study on Synchronous Generators Sudden Short Circuits, Modelling and Simulation in Engineering, ISSN: 1687-5591, Vol. 2009, Article ID 867150, 11 pages, doi: 10.1155/2009/867150
[7] https://orcid.org/0000-0002-3320-9850

**10. Evaluation**

| Activity type | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Percentage of the final grade |
|---|---|---|---|
| 10.4 Course | Level of perception of the taught content. | Written examination. | 50% |
| 10.5 Laboratory | Accuracy of the algorithms implementation and results interpretation, respectively. | Developing and using web applications. | 50% |
| 10.6 Minimal performance standard | | | |
| • Final grade - a minimum of 5. | | | |

This course outline was certified in the Department Board meeting on 23/09/2024 and approved in the Faculty Board meeting on 24/09/2024.

| | |
|---|---|
| **Associate Prof. Titus Constantin BĂLAN,**<br>**Dean** | **Associate Prof. Lia ACIU,**<br>**Head of Department** |
| **Lucian LUPȘA-TĂTARU, Lecturer PhD,**<br>**Course holder** | **Lucian LUPȘA-TĂTARU, Lecturer PhD,**<br>**Holder of laboratory** |

Note:

[1] Field of study – select one of the following options: Bachelor / Master / Doctorat (to be filled in according to the forceful classification list for study programmes);

[2] Study level – choose from among: Bachelor / Master / Doctorat;

[3] Course status (content) – for the Bachelor level, select one of the following options: **FC** (fundamental course) / **DC** (course in the study domain)/ **SC** (speciality course)/ **CC** (complementary course); for the Master level, select one of the following options: **PC** (proficiency course)/ SC (synthesis course)/ **AC** (advanced course);

[4] Course status (attendance type) – select one of the following options: **CPC** (compulsory course)/ **EC** (elective course)/ **NCPC** (non-compulsory course);

[5] One credit is the equivalent of 25 study hours (teaching activities and individual study).

# COURSE OUTLINE

## 1. Data about the study programme

| | |
|---|---|
| 1.1 Higher education institution | Transilvania University of Brașov |
| 1.2 Faculty | Electrical Engineering and Computer Science |
| 1.3 Department | Electrical Engineering and Applied Physics |
| 1.4 Field of study[1)] | Electrical Engineering |
| 1.5 Study level[2)] | MA |
| 1.6 Study programme | Advanced Electrical Systems |

## 2. Data about the course

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2.1 Name of course | | | Research practical stage SEA-3 (SEA309) | | | | | |
| 2.2 Course convenor | | | - | | | | | |
| 2.3 Seminar/ laboratory/ project convenor | | | Conf. dr. ing. Luminita BAROTE | | | | | |
| 2.4 Study year | II | 2.5 Semester | 1 | 2.6 Evaluation type | C | 2.7 Course status | Content[3)] | SC |
| | | | | | | | Attendance type[4)] | CPC |

## 3. Total estimated time (hours of teaching activities per semester)

| | | | | | |
|---|---|---|---|---|---|
| 3.1 Number of hours per week | **12** | out of which: 3.2 lecture | **0** | 3.3 seminar/ laboratory/ project | **12 P-AsP** |
| 3.4 Total number of hours in the curriculum | 168 | out of which: 3.5 lecture | 0 | 3.6 seminar/ laboratory/ project | 168 P-AsP |

| | |
|---|---|
| Time allocation | hours |
| Study of textbooks, course support, bibliography and notes | 0 |
| Additional documentation in libraries, specialized electronic platforms, and field research | 30 |
| Preparation of seminars/ laboratories/ projects, homework, papers, portfolios, and essays | 30 |
| Tutorial | 20 |
| Examinations | 2 |
| Other activities.................................... | |

| | |
|---|---|
| **3.7 Total number of hours of student activity** | 82 |
| **3.8 Total number per semester** | 250 |
| **3.9 Number of credits[5)]** | 10 |

## 4. Prerequisites (if applicable)

| | |
|---|---|
| 4.1 curriculum-related | • |
| 4.2 competences-related | • |

## 5. Conditions (if applicable)

| | |
|---|---|
| 5.1 for course development | • |
| 5.2 for seminar/ laboratory/ project development | • Established by the research practical stage coordinator |

**6. Specific competences and learning outcomes**

| | |
|---|---|
| Professional competences | **Cp.2 Using modern knowledge in the analysis, evaluation, and operation of electrical subsystems.**<br>• L.O.2.1 The graduate knows methods of physical and mathematical description of the structure and operation of electrical systems.<br>• L.O.2.2 The graduate uses advanced theories to justify the processes of operation, command, and control of advanced electrical systems.<br>**Cp.4 Modeling and optimizing electrical and electronic systems for efficient energy use.**<br>• L.O.4.1 The graduate applies modern methods of modeling and optimizing electrical and power electronic systems for efficient energy use.<br>• L.O.4.4 The graduate designs projects in the field of renewable energy sources, energy storage, and distribution systems.<br>• L.O.4.5 The graduate is capable of modeling and implementing renewable energy systems integrated into intelligent distributed electrical networks.<br>**Cp.5 The development of new solutions for the realization of applications with advanced electrical systems, in the perspective of socio-economic sustainability.**<br>• L.O.5.2. The graduate uses modern theories in the design and optimization of applications with advanced electrical systems.<br>• L.O.5.3. The graduate uses concepts for the realization of applications with low energy consumption, for the control of energy production and management, monitoring and control of the environment.<br>• L.O.5.5. The graduate develops research projects using principles of sustainable development. |
| Transversal competences | **Ct.1 Responsible management of tasks and resources, considering professional ethics and social responsibility**<br>• L.O.1.2 The graduate is able to work with professional autonomy, applying the knowledge acquired in practical situations.<br>• L.O.1.3 The graduate assumes responsibility in undertaking activities, integrating advanced electrical systems into the environment in a spirit of sustainable development.<br>**Ct.2 Efficiency and responsibility in managing teamwork**<br>• L.O.2.1 The graduate can perform specific roles within a multidisciplinary team, contributing to the achievement of common objectives.<br>**Ct.3 Continuous professional development and lifelong learning**<br>• L.O.2.3 The graduate can effectively use language skills and information technology knowledge for personal and professional development. |

**7. Course objectives (resulting from the specific competences to be acquired)**

| | |
|---|---|
| 7.1 General course objective | • Programming skills for using specific software in electrical engineering<br>• Forming the skills for analysis, calculus, modelling and simulation for optimizing electrical systems and processes related to the energy production and conversion;<br>• Knowing and applying the measuring, maintenance and monitoring techniques used for energy conversion;<br>• Forming the skills for optimal management of energy projects. |
| 7.2 Specific objectives | • Forming of skills for modelling and optimization of advanced electrical systems in according with the sustainable development principles: renewable energy sources, storage systems, power distribution systems, control and command systems, power management systems and other systems related to the production, storage, transport and efficient use of |

| | |
|---|---|
| | energy.<br>• Forming the competences for innovative design of renewable energy systems, of storage and distribution of energy;<br>• Forming skills related to the power systems maintenance. |

**8. Content**

| 8.1 Course | Teaching methods | Number of hours | Remarks |
|---|---|---|---|
| N/A | | | |
| 8.2 Seminar/ laboratory/ **project** | Teaching-learning methods | Number of hours | Remarks |
| I. Presentation of how the practical stage research is carried out, research topics, coordinators and discipline requirements.<br>Chosing the project themes.<br><u>Examples of research project themes:</u><br><br>*Electrical machines and drives*<br>1. Applying modern calculus methods of electromagnetic field in electric machines;<br>2. Modelling and optimal designing of designing of permanent magnets machines;<br>3. Control of permanent magnets motors for electrical drives.<br><br>*Power electronic converters*<br>1. Optimal designing of power inverters for single- and three-phase grids with renewable energy sources;<br>2. Applying modern control methods for controlling AC converters for smart grids and microgrids;<br>3. Applying modern methods for inverters control;<br><br>*Monitoring and prediction of electrical systems operation*<br>1. Modern monitoring systems for defects in electrical machines;<br>2. Systems for testing, measurement and monitoring of electrical cables;<br>3. Modern methods for analysis and simulation of noise;<br>4. Monitoring and efficient utilisation of electrical systems for power supply to consumers;<br><br>*Systems for production, distribution and transport of electrical energy*<br>1. Optimal designing of power supply circuits and protection system for networks with renewable energy sources;<br>2. Choosing the optimal solution of energy storage for autonomous microgrids with microhydro power plants;<br>3. Modelling and simulations of systems designed for supplying consumers with renewable energy systems;<br>4. Modeling and simulation of hybrid systems with renewable energy sources connected to the grid; | Oral presentation | 10 h | |

| | | | |
|---|---|---|---|
| 5. Control of small scale wind turbines for integration in autonomous microgrids;<br>6, Control of a small-scale PV power plant for autonomous microgrid applications<br><br>*Energy storage and recovery*<br>1. Optimal designing of flywheel-based energy storage systems;<br>2. Solutions for interconnecting energy storage systems to the grid;<br>3. Optimal designing of power supply systems for electric vehicle;<br>4. Control strategies used in power supply systems;<br>5. Implementing a thermo-electric system for energy recovery;<br>6. Solutions for frequency control in microgrids, based on pumped-hydro storage;<br>7. Methods for state of charge estimation for different storage systems;<br>8.Modelling and simulation of hybrid systems with RES operating autonomously.<br><br>*Electromagnetic compatibility and power quality*<br>1. Analysis of the distorted regime in distribution electrical networks for compatibility with renewable energy sources;<br>2. Analysis of the distorted regime on electrical equipments performances;<br>3. Implementing testing techniques for electrical and electronic equipments for electromagnetic immunity.<br>4. Monitoring and centralized control of the electrical energy parameters for microgrids with RES;<br><br>*Materials and sensors*<br>1. Modern methods for characterising the magnetic materials used in the construction of electrical equipments;<br>2. Modern methods for magneto-electrical characterisation of nanostructural magnetic systems;<br>3. Establishing the field and angle characteristics of some sensors used in nanostructural magnetic systems;<br>4. Study of piezoelectric and magnetostrictive phenomena of some materials used as vibration sensors;<br>5. Modeling micromagnetical sensors for magnetic field;<br>6. Simulating the behavior of magnetic nano- oscillatory of high frequency. | | | |
| II. Carrying out the practical research stage in an environment organized by the project coordinator. | Project-based learning;<br>Teamwork | 156 h | |
| III. Defending the research project report by students | Oral presentation | 2 h | |
| Bibliography<br>Provided by the project coordinator. | | | |

**9. Correlation of course content with the demands of the labour market (epistemic communities, professional associations, potential employers in the field of study)**

| |
|---|
| The course ensures the achievement of several interdisciplinary competences, which are in accordance with the specific requirements of the international job market from various domains, especially in research and development (R&D) services. Moreover, the international regulations recommended by the association IEEE are considered. |

**10. Evaluation**

| Activity type | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Percentage of the final grade |
|---|---|---|---|
| 10.4 Course | N/A | | |
| | | | |
| 10.5 Seminar/ laboratory/ **project** | The degree of project theme fulfilment | Evaluation of student activity during semester by the project coordinator | 50% |
| | | Project report defending by an oral presentation | 50% |
| 10.6 Minimal performance standard | | | |
| • A research project evaluated by the research stage coordinator as fulfilling the minimum requirements for the accomplished activities and an oral presentation of the report. | | | |

This course outline was certified in the Department Board meeting on 23/09/2024 and approved in the Faculty Board meeting on 24/09/2024.

| | |
|---|---|
| **Assoc. Prof. Titus Constantin BALAN**<br>**Dean** | **Assoc. Prof. Lia ACIU,**<br>**Head of Department** |
| **N/A**<br>**Course holder** | **Assoc. Prof. Luminita BAROTE,**<br>**Holder of project (SEA coordinator)** |

Note:

1) Field of study – select one of the following options: Bachelor / Master / Doctorat (to be filled in according to the forceful classification list for study programmes);

2) Study level – choose from among: Bachelor / Master / Doctorat;

3) Course status (content) – for the Bachelor level, select one of the following options: **FC** (fundamental course) / **DC** (course in the study domain)/ **SC** (speciality course)/ **CC** (complementary course); for the Master level, select one of the following options: **PC** (proficiency course)/ SC (synthesis course)/ **AC** (advanced course);

4) Course status (attendance type) – select one of the following options: **CPC** (compulsory course)/ **EC** (elective course)/ **NCPC** (non-compulsory course);

[5] One credit is the equivalent of 25 study hours (teaching activities and individual study).

# COURSE OUTLINE

**1. Data about the study programme**

| | |
|---|---|
| 1.1 Higher education institution | Transylvania University of Brasov |
| 1.2 Faculty | Electrical Engineering and Computer Science |
| 1.3 Department | Electrical Engineering and Applied Physics |
| 1.4 Field of study[1)] | Electrical Engineering |
| 1.5 Study level[2)] | MA |
| 1.6 Study programme | Advanced Electrical Systems |

**2. Data about the course**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2.1 Name of course | European economy and institutions (SEA313) | | | | | | | |
| 2.2 Course convenor | | | | Tescașiu Bianca | | | | |
| 2.3 Seminar/ laboratory/ project convenor | | | | Tescașiu Bianca | | | | |
| 2.4 Study year | II | 2.5 Semester | 1 | 2.6 Evaluation type | C | 2.7 Course status | Content[3)] | CC |
| | | | | | | | Attendance type[4)] | NCPC |

**3. Total estimated time (hours of teaching activities per semester)**

| | | | | | |
|---|---|---|---|---|---|
| 3.1 Number of hours per week | **2** | out of which: 3.2 lecture | **1** | 3.3 seminar/ laboratory/ project | **1** |
| 3.4 Total number of hours in the curriculum | 28 | out of which: 3.5 lecture | 14 | 3.6 seminar/ laboratory/ project | 14 |

| | |
|---|---|
| Time allocation | hours |
| Study of textbooks, course support, bibliography and notes | 7 |
| Additional documentation in libraries, specialized electronic platforms, and field research | 10 |
| Preparation of seminars/ laboratories/ projects, homework, papers, portfolios, and essays | 10 |
| Tutorial | 8 |
| Examinations | 2 |
| Other activities..................................... | |

| | |
|---|---|
| **3.7 Total number of hours of student activity** | 47 |
| **3.8 Total number per semester** | 75 |
| **3.9 Number of credits[5)]** | 3 |

**4. Prerequisites (if applicable)**

| | |
|---|---|
| 4.1 curriculum-related | • Basic knowledge of the theory of international integration and the European economy |
| 4.2 competences-related | • |

**5. Conditions (if applicable)**

| | |
|---|---|
| 5.1 for course development | • Classroom equipped with video projector and computers |
| 5.2 for seminar/ laboratory/ project development | • Seminar room equipped with computers |

**6. Specific competences and learning outcomes**

| | |
|---|---|
| Professional competences | **Cp5. Developing new solutions for accomplishing applications with advanced electrical systems, for socio-economical sustainability**<br>L.O.5.1. The graduate is capable of identifying and assimilating the methods for development and optimization of electrical systems;<br>L.O.5.2. The graduate uses modern theories for designing and optimization of advanced electrical systems applications;<br>L.O.5.5. The graduate develops research projects using sustainable development principles; |
| Transversal competences | **Ct.3 Continuous professional development and lifelong learning**<br>L.O.3.1. The graduate is capable of objective self-evaluation of the continuous professional training needs;<br>L.O.3.2. The graduate can effectively use language skills and information technology knowledge for personal and professional development.<br>L.O.3.2. The graduate knows how to adapt to the dynamics of the labor market through constant learning and effective insertion on the labor market. |

**7. Course objectives (resulting from the specific competences to be acquired)**

| | |
|---|---|
| 7.1 General course objective | • Knowledge of the institutional and decision-making system of the European Union and of European decision-making mechanisms |
| 7.2 Specific objectives | • Knowledge of the composition and representativeness of the European institutions and their functioning<br>• Knowledge of decision-making mechanisms at the community level<br>• Knowledge of the main aspects related to European governance and the reform of the institutional system |

**8. Content**

| 8.1 Course | Teaching methods | Number of hours | Remarks |
|---|---|---|---|
| 1. International integration. The role of integration in the international context. The emergence and evolution of the European Union | Interactive course, with PowerPoint presentation support | 2 | |
| 2. General considerations on the institutional architecture of the European Union | Interactive course, with PowerPoint presentation support | 2 | |
| 3. European Council, Council of the European Union | Interactive course, with PowerPoint presentation support | 2 | |
| 4. European Parliament, European Commission | Interactive course, with PowerPoint presentation support | 2 | |
| 5. Other European institutions | Interactive course, with PowerPoint presentation support | 2 | |
| 6. Decision-making mechanisms in the EU | Interactive course, with PowerPoint presentation support | 2 | |
| 7. European Governance. Constitutive and subsequent Treaties of the Union | Interactive course, with PowerPoint presentation support | 2 | |
| Bibliography<br>◘ Crăcană, M., Căpățână, M., Libera circulație a persoanelor, bunurilor, serviciilor și capitalurilor, Colecția Uniunea Europeană, Seria Europa mea, Editura Tritonic, București, 2007 | | | |

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- Tescașiu, B., Instituții europene. Schimbări şi adaptări din perspective extinderii Uniunii Europene, Editura CH Beck, București, 2009
- Tescașiu, B, Introducere în euromarketing – Concepte fundamentale de marketing specifice Pieței Unice Europene, Editura Universitară, București, 2017

| 8.2 Seminar/ laboratory/ project | Teaching-learning methods | Number of hours | Remarks |
|---|---|---|---|
| 1. Overview of the European institutional system | Debates, case studies | 2 | |
| 2. Administrative systems in European Union countries | Case studies, reviews | 4 | |
| 3. Operational aspects of the European institutions | Debates, case studies | 4 | |
| 4. Romania and its representativeness in the European institutional architecture | Analysis and debate | 2 | |

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- Andoniceanu, A., Sisteme administrative în state ale Uniunii Europene, Editura Universitară, București, 2015

**9. Correlation of course content with the demands of the labour market (epistemic communities, professional associations, potential employers in the field of study)**

**10. Evaluation**

| Activity type | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Percentage of the final grade |
|---|---|---|---|
| 10.4 Course | Correct use and understanding of theoretical concepts | Evaluation through objective items | 70% |
| 10.5 Seminar/ laboratory/ project | Appropriate, correct use of concepts | Evaluation through projects and research topics | 30% |
| 10.6 Minimal performance standard | | | |
| - Achieving at least 50% of the seminar score<br>- Achieving at least 50% of the exam score | | | |

This course outline was certified in the Department Board meeting on 23/09/2024 and approved in the Faculty Board meeting on 24/09/2024.

| | |
|---|---|
| **Dean,**<br>Conf.dr.ing. Titus Constantin BĂLAN | **Head of Department**<br>Conf. dr. ing. Lia Elena ACIU |
| **Prof. dr. TESCAȘIU Bianca,**<br>**Course holder** | **Prof. dr. TESCAȘIU Bianca,**<br>**Holder of seminar** |

Note:

1) Field of study – select one of the following options: Bachelor / Master / Doctorat (to be filled in according to the forceful classification list for study programmes);

2) Study level – choose from among: Bachelor / Master / Doctorat;

3) Course status (content) – for the Bachelor level, select one of the following options: **FC** (fundamental course) / **DC** (course in the study domain)/ **SC** (speciality course)/ **CC** (complementary course); for the Master level, select one of the following options: **PC** (proficiency course)/ SC (synthesis course)/ **AC** (advanced course);

4) Course status (attendance type) – select one of the following options: **CPC** (compulsory course)/ **EC** (elective course)/ **NCPC** (non-compulsory course);

5) One credit is the equivalent of 25 study hours (teaching activities and individual study).

# COURSE OUTLINE

## 1. Data about the study programme

| | |
|---|---|
| 1.1 Higher education institution | Transilvania University of Brașov |
| 1.2 Faculty | Electrical Engineering and Computer Science |
| 1.3 Department | Electrical Engineering and Applied Physics |
| 1.4 Field of study[1)] | Electrical Engineering |
| 1.5 Study level[2)] | MA |
| 1.6 Study programme | Advanced Electrical Systems |

## 2. Data about the course

<table>
<tr><td colspan="2">2.1 Name of course</td><td colspan="8">Research practical stage SEA-4 (SEA410)</td></tr>
<tr><td colspan="2">2.2 Course convenor</td><td colspan="8">-</td></tr>
<tr><td colspan="2">2.3 Seminar/ laboratory/ project convenor</td><td colspan="8">Conf. dr. ing. Luminita BAROTE</td></tr>
<tr><td rowspan="2">2.4 Study year</td><td rowspan="2">II</td><td rowspan="2">2.5 Semester</td><td rowspan="2">2</td><td rowspan="2">2.6 Evaluation type</td><td rowspan="2">C</td><td rowspan="2">2.7 Course status</td><td>Content[3)]</td><td>AC</td></tr>
<tr><td>Attendance type[4)]</td><td>CPC</td></tr>
</table>

## 3. Total estimated time (hours of teaching activities per semester)

<table>
<tr><td>3.1 Number of hours per week</td><td>12</td><td>out of which: 3.2 lecture</td><td>0</td><td>3.3 seminar/ laboratory/ project</td><td>12 P-AsP</td></tr>
<tr><td>3.4 Total number of hours in the curriculum</td><td>168</td><td>out of which: 3.5 lecture</td><td>0</td><td>3.6 seminar/ laboratory/ project</td><td>168 P-AsP</td></tr>
<tr><td colspan="5">Time allocation</td><td>hours</td></tr>
<tr><td colspan="5">Study of textbooks, course support, bibliography and notes</td><td>0</td></tr>
<tr><td colspan="5">Additional documentation in libraries, specialized electronic platforms, and field research</td><td>30</td></tr>
<tr><td colspan="5">Preparation of seminars/ laboratories/ projects, homework, papers, portfolios, and essays</td><td>30</td></tr>
<tr><td colspan="5">Tutorial</td><td>20</td></tr>
<tr><td colspan="5">Examinations</td><td>2</td></tr>
<tr><td colspan="5">Other activities……………………………</td><td></td></tr>
</table>

| | |
|---|---|
| **3.7 Total number of hours of student activity** | 82 |
| **3.8 Total number per semester** | 250 |
| **3.9 Number of credits[5)]** | 10 |

## 4. Prerequisites (if applicable)

| | |
|---|---|
| 4.1 curriculum-related | • |
| 4.2 competences-related | • |

## 5. Conditions (if applicable)

| | |
|---|---|
| 5.1 for course development | • |
| 5.2 for seminar/ laboratory/ project development | • Established by the research practical stage coordinator |

**6. Specific competences and learning outcomes**

| | |
|---|---|
| Professional competences | **Cp.2 Using modern knowledge in the analysis, evaluation, and operation of electrical subsystems.**<br>• L.O.2.1 The graduate knows methods of physical and mathematical description of the structure and operation of electrical systems.<br>• L.O.2.2 The graduate uses advanced theories to justify the processes of operation, command, and control of advanced electrical systems.<br>**Cp.4 Modeling and optimizing electrical and electronic systems for efficient energy use.**<br>• L.O.4.1 The graduate applies modern methods of modeling and optimizing electrical and power electronic systems for efficient energy use.<br>• L.O.4.4 The graduate designs projects in the field of renewable energy sources, energy storage, and distribution systems.<br>• L.O.4.5 The graduate is capable of modeling and implementing renewable energy systems integrated into intelligent distributed electrical networks.<br>**Cp.5 The development of new solutions for the realization of applications with advanced electrical systems, in the perspective of socio-economic sustainability.**<br>• L.O.5.2. The graduate uses modern theories in the design and optimization of applications with advanced electrical systems.<br>• L.O.5.3. The graduate uses concepts for the realization of applications with low energy consumption, for the control of energy production and management, monitoring and control of the environment.<br>• L.O.5.5. The graduate develops research projects using principles of sustainable development. |
| Transversal competences | **Ct.1 Responsible management of tasks and resources, considering professional ethics and social responsibility**<br>• L.O.1.2 The graduate is able to work with professional autonomy, applying the knowledge acquired in practical situations.<br>• L.O.1.3 The graduate assumes responsibility in undertaking activities, integrating advanced electrical systems into the environment in a spirit of sustainable development.<br>**Ct.2 Efficiency and responsibility in managing teamwork**<br>• L.O.2.1 The graduate can perform specific roles within a multidisciplinary team, contributing to the achievement of common objectives.<br>**Ct.3 Continuous professional development and lifelong learning**<br>• L.O.2.3 The graduate can effectively use language skills and information technology knowledge for personal and professional development. |

**7. Course objectives (resulting from the specific competences to be acquired)**

| | |
|---|---|
| 7.1 General course objective | • Programming skills for using specific software in electrical engineering<br>• Forming the skills for analysis, calculus, modelling and simulation for optimizing electrical systems and processes related to the energy production and conversion;<br>• Knowing and applying the measuring, maintenance and monitoring techniques used for energy conversion;<br>• Forming the skills for optimal management of energy projects. |
| 7.2 Specific objectives | • Forming of skills for modelling and optimization of advanced electrical systems in according with the sustainable development principles: renewable energy sources, storage systems, power distribution systems, control and command systems, power management systems and other systems related to the production, storage, transport and efficient use of |

| | |
|---|---|
| | energy.<br>• Forming the competences for innovative design of renewable energy systems, of storage and distribution of energy;<br>• Forming skills related to the power systems maintenance. |

**8. Content**

| 8.1 Course | Teaching methods | Number of hours | Remarks |
|---|---|---|---|
| N/A | | | |
| 8.2 Seminar/ laboratory/ **project** | Teaching-learning methods | Number of hours | Remarks |
| I. Presentation of how the practical stage research is carried out, research topics, coordinators and discipline requirements.<br>Chosing the project themes.<br>Examples of research project themes:<br><br>*Electrical machines and drives*<br>1. Applying modern calculus methods of electromagnetic field in electric machines;<br>2. Modelling and optimal designing of designing of permanent magnets machines;<br>3. Control of permanent magnets motors for electrical drives.<br><br>*Power electronic converters*<br>1. Optimal designing of power inverters for single- and three-phase grids with renewable energy sources;<br>2. Applying modern control methods for controlling AC converters for smart grids and microgrids;<br>3. Applying modern methods for inverters control;<br><br>*Monitoring and prediction of electrical systems operation*<br>1. Modern monitoring systems for defects in electrical machines;<br>2. Systems for testing, measurement and monitoring of electrical cables;<br>3. Modern methods for analysis and simulation of noise;<br>4. Monitoring and efficient utilisation of electrical systems for power supply to consumers;<br><br>*Systems for production, distribution and transport of electrical energy*<br>1. Optimal designing of power supply circuits and protection system for networks with renewable energy sources;<br>2. Choosing the optimal solution of energy storage for autonomous microgrids with microhydro power plants;<br>3. Modelling and simulations of systems designed for supplying consumers with renewable energy systems;<br>4. Modeling and simulation of hybrid systems with renewable energy sources connected to the grid; | Oral presentation | 10 h | |

| | | | |
|---|---|---|---|
| 5. Control of small scale wind turbines for integration in autonomous microgrids;<br>6, Control of a small-scale PV power plant for autonomous microgrid applications<br><br>*Energy storage and recovery*<br>1. Optimal designing of flywheel-based energy storage systems;<br>2. Solutions for interconnecting energy storage systems to the grid;<br>3. Optimal designing of power supply systems for electric vehicle;<br>4. Control strategies used in power supply systems;<br>5. Implementing a thermo-electric system for energy recovery;<br>6. Solutions for frequency control in microgrids, based on pumped-hydro storage;<br>7. Methods for state of charge estimation for different storage systems;<br>8. Modelling and simulation of hybrid systems with RES operating autonomously.<br><br>*Electromagnetic compatibility and power quality*<br>1. Analysis of the distorted regime in distribution electrical networks for compatibility with renewable energy sources;<br>2. Analysis of the distorted regime on electrical equipments performances;<br>3. Implementing testing techniques for electrical and electronic equipments for electromagnetic immunity.<br>4. Monitoring and centralized control of the electrical energy parameters for microgrids with RES;<br><br>*Materials and sensors*<br>1. Modern methods for characterising the magnetic materials used in the construction of electrical equipments;<br>2. Modern methods for magneto-electrical characterisation of nanostructural magnetic systems;<br>3. Establishing the field and angle characteristics of some sensors used in nanostructural magnetic systems;<br>4. Study of piezoelectric and magnetostrictive phenomena of some materials used as vibration sensors;<br>5. Modeling micromagnetical sensors for magnetic field;<br>6. Simulating the behavior of magnetic nano- oscillatory of high frequency. | | | |
| II. Carrying out the practical research stage in an environment organized by the project coordinator. | Project-based learning;<br>Teamwork | 156 h | |
| III. Defending the research project report by students | Oral presentation | 2 h | |
| Bibliography<br>Provided by the project coordinator. | | | |

**9. Correlation of course content with the demands of the labour market (epistemic communities, professional associations, potential employers in the field of study)**

| |
|---|
| The course ensures the achievement of several interdisciplinary competences, which are in accordance with the specific requirements of the international job market from various domains, especially in research and development (R&D) services. Moreover, the international regulations recommended by the association IEEE are considered. |

**10. Evaluation**

| Activity type | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Percentage of the final grade |
|---|---|---|---|
| 10.4 Course | N/A | | |
| | | | |
| 10.5 Seminar/ laboratory/ **project** | The degree of project theme fulfilment | Evaluation of student activity during semester by the project coordinator | 50% |
| | | Project report defending by an oral presentation | 50% |
| 10.6 Minimal performance standard | | | |
| • A research project evaluated by the research stage coordinator as fulfilling the minimum requirements for the accomplished activities and an oral presentation of the report. | | | |

This course outline was certified in the Department Board meeting on 23/09/2024 and approved in the Faculty Board meeting on 24/09/2024.

| | |
|---|---|
| **Assoc. Prof. Titus Constantin BALAN**<br>**Dean** | **Assoc. Prof. Lia ACIU,**<br>**Head of Department** |
| **N/A**<br>**Course holder** | **Assoc. Prof. Luminita BAROTE,**<br>**Holder of project (SEA coordinator)** |

Note:

1) Field of study – select one of the following options: Bachelor / Master / Doctorat (to be filled in according to the forceful classification list for study programmes);

2) Study level – choose from among: Bachelor / Master / Doctorat;

3) Course status (content) – for the Bachelor level, select one of the following options: **FC** (fundamental course) / **DC** (course in the study domain)/ **SC** (speciality course)/ **CC** (complementary course); for the Master level, select one of the following options: **PC** (proficiency course)/ SC (synthesis course)/ **AC** (advanced course);

[4] Course status (attendance type) – select one of the following options: **CPC** (compulsory course)/ **EC** (elective course)/ **NCPC** (non-compulsory course);

[5] One credit is the equivalent of 25 study hours (teaching activities and individual study).

# COURSE OUTLINE

**1. Data about the study programme**

| | |
|---|---|
| 1.1 Higher education institution | Transilvania University of Brașov |
| 1.2 Faculty | Electrical Engineering and Computer Science |
| 1.3 Department | Electrical Engineering and Applied Physics |
| 1.4 Field of study[1)] | Electrical Engineering |
| 1.5 Study level[2)] | MA |
| 1.6 Study programme | Advanced Electrical Systems |

**2. Data about the course**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2.1 Name of course | Practical stage for dissertation thesis preparation (SEA411) | | | | | | | |
| 2.2 Course convenor | - | | | | | | | |
| 2.3 Seminar/ laboratory/ project convenor | Conf. dr. ing. Luminita BAROTE | | | | | | | |
| 2.4 Study year | II | 2.5 Semester | 2 | 2.6 Evaluation type | C | 2.7 Course status | Content[3)] | AC |
| | | | | | | | Attendance type[4)] | CPC |

**3. Total estimated time (hours of teaching activities per semester)**

| | | | | | |
|---|---|---|---|---|---|
| 3.1 Number of hours per week | **12** | out of which: 3.2 lecture | **0** | 3.3 seminar/ laboratory/ project | **12 P-AsP** |
| 3.4 Total number of hours in the curriculum | 168 | out of which: 3.5 lecture | 0 | 3.6 seminar/ laboratory/ project | 168 P-AsP |

| | |
|---|---|
| Time allocation | hours |
| Study of textbooks, course support, bibliography and notes | 0 |
| Additional documentation in libraries, specialized electronic platforms, and field research | 30 |
| Preparation of seminars/ laboratories/ projects, homework, papers, portfolios, and essays | 30 |
| Tutorial | 20 |
| Examinations | 2 |
| Other activities..................................... | |

| | |
|---|---|
| **3.7 Total number of hours of student activity** | 82 |
| **3.8 Total number per semester** | 250 |
| **3.9 Number of credits[5)]** | 10 |

**4. Prerequisites (if applicable)**

| | |
|---|---|
| 4.1 curriculum-related | • |
| 4.2 competences-related | • |

**5. Conditions (if applicable)**

| | |
|---|---|
| 5.1 for course development | • |
| 5.2 for seminar/ laboratory/ project development | • Established by the dissertation thesis coordinator |

**6. Specific competences and learning outcomes**

| | |
|---|---|
| Professional competences | **Cp.2 Using modern knowledge in the analysis, evaluation, and operation of electrical subsystems.**<br>• L.O.2.1 The graduate knows methods of physical and mathematical description of the structure and operation of electrical systems.<br>• L.O.2.2 The graduate uses advanced theories to justify the processes of operation, command, and control of advanced electrical systems.<br>**Cp.4 Modeling and optimizing electrical and electronic systems for efficient energy use.**<br>• L.O.4.1 The graduate applies modern methods of modeling and optimizing electrical and power electronic systems for efficient energy use.<br>• L.O.4.4 The graduate designs projects in the field of renewable energy sources, energy storage, and distribution systems.<br>• L.O.4.5 The graduate is capable of modeling and implementing renewable energy systems integrated into intelligent distributed electrical networks.<br>**Cp.5 The development of new solutions for the realization of applications with advanced electrical systems, in the perspective of socio-economic sustainability.**<br>• L.O.5.2. The graduate uses modern theories in the design and optimization of applications with advanced electrical systems.<br>• L.O.5.3. The graduate uses concepts for the realization of applications with low energy consumption, for the control of energy production and management, monitoring and control of the environment.<br>• L.O.5.5. The graduate develops research projects using principles of sustainable development. |
| Transversal competences | **Ct.1 Responsible management of tasks and resources, considering professional ethics and social responsibility**<br>• L.O.1.2 The graduate is able to work with professional autonomy, applying the knowledge acquired in practical situations.<br>• L.O.1.3 The graduate assumes responsibility in undertaking activities, integrating advanced electrical systems into the environment in a spirit of sustainable development.<br>**Ct.2 Efficiency and responsibility in managing teamwork**<br>• L.O.2.1 The graduate can perform specific roles within a multidisciplinary team, contributing to the achievement of common objectives.<br>**Ct.3 Continuous professional development and lifelong learning**<br>• L.O.2.3 The graduate can effectively use language skills and information technology knowledge for personal and professional development. |

**7. Course objectives (resulting from the specific competences to be acquired)**

| | |
|---|---|
| 7.1 General course objective | • Programming skills for using specific software in electrical engineering<br>• Forming the skills for analysis, calculus, modelling and simulation for optimizing electrical systems and processes related to the energy production and conversion;<br>• Knowing and applying the measuring, maintenance and monitoring techniques used for energy conversion;<br>• Forming the skills for optimal management of energy projects. |
| 7.2 Specific objectives | • Forming of skills for modelling and optimization of advanced electrical systems in according with the sustainable development principles: renewable energy sources, storage systems, power distribution systems, control and command systems, power management systems and other systems related to the production, storage, transport and efficient use of |

| | |
|---|---|
| | energy.<br>• Forming the competences for innovative design of renewable energy systems, of storage and distribution of energy;<br>• Forming skills related to the power systems maintenance. |

**8. Content**

| 8.1 Course | Teaching methods | Number of hours | Remarks |
|---|---|---|---|
| N/A | | | |
| 8.2 Seminar/ laboratory/ **project** | Teaching-learning methods | Number of hours | Remarks |
| I. Presentation of how the practical stage research for dissertation thesis is carried out and discipline requirements. Choosing the dissertation thesis themes.<br><u>Examples of research project themes:</u><br><br>*Electrical machines and drives*<br>1. Applying modern calculus methods of electromagnetic field in electric machines;<br>2. Modelling and optimal designing of designing of permanent magnets machines;<br>3. Control of permanent magnets motors for electrical drives.<br><br>*Power electronic converters*<br>1. Optimal designing of power inverters for single- and three-phase grids with renewable energy sources;<br>2. Applying modern control methods for controlling AC converters for smart grids and microgrids;<br>3. Applying modern methods for inverters control;<br><br>*Monitoring and prediction of electrical systems operation*<br>1. Modern monitoring systems for defects in electrical machines;<br>2. Systems for testing, measurement and monitoring of electrical cables;<br>3. Modern methods for analysis and simulation of noise;<br>4. Monitoring and efficient utilisation of electrical systems for power supply to consumers;<br><br>*Systems for production, distribution and transport of electrical energy*<br>1. Optimal designing of power supply circuits and protection system for networks with renewable energy sources;<br>2. Choosing the optimal solution of energy storage for autonomous microgrids with microhydro power plants;<br>3. Modelling and simulations of systems designed for supplying consumers with renewable energy systems;<br>4. Modeling and simulation of hybrid systems with renewable energy sources connected to the grid; | Oral presentation | 10 h | |

| | | | |
|---|---|---|---|
| 5. Control of small scale wind turbines for integration in autonomous microgrids;<br>6, Control of a small-scale PV power plant for autonomous microgrid applications<br><br>*Energy storage and recovery*<br>1. Optimal designing of flywheel-based energy storage systems;<br>2. Solutions for interconnecting energy storage systems to the grid;<br>3. Optimal designing of power supply systems for electric vehicle;<br>4. Control strategies used in power supply systems;<br>5. Implementing a thermo-electric system for energy recovery;<br>6. Solutions for frequency control in microgrids, based on pumped-hydro storage;<br>7. Methods for state of charge estimation for different storage systems;<br>8.Modelling and simulation of hybrid systems with RES operating autonomously.<br><br>*Electromagnetic compatibility and power quality*<br>1. Analysis of the distorted regime in distribution electrical networks for compatibility with renewable energy sources;<br>2. Analysis of the distorted regime on electrical equipments performances;<br>3. Implementing testing techniques for electrical and electronic equipments for electromagnetic immunity.<br>4. Monitoring and centralized control of the electrical energy parameters for microgrids with RES;<br><br>*Materials and sensors*<br>1. Modern methods for characterising the magnetic materials used in the construction of electrical equipments;<br>2. Modern methods for magneto-electrical characterisation of nanostructural magnetic systems;<br>3. Establishing the field and angle characteristics of some sensors used in nanostructural magnetic systems;<br>4. Study of piezoelectric and magnetostrictive phenomena of some materials used as vibration sensors;<br>5. Modeling micromagnetical sensors for magnetic field;<br>6. Simulating the behavior of magnetic nano- oscillatory of high frequency. | | | |
| II. Carrying out the practical research stage for dissertation thesis in an environment organized by the project coordinator. | Project-based learning;<br>Teamwork | 156 h | |
| III. Evaluation of practical stage for dissertation thesis by the coordinator | Synthetic presentation of the project | 2 h | |

| |
|---|
| Bibliography<br>Provided by the project coordinator. |

**9. Correlation of course content with the demands of the labour market (epistemic communities, professional associations, potential employers in the field of study)**

| |
|---|
| The course ensures the achievement of several interdisciplinary competences, which are in accordance with the specific requirements of the international job market from various domains, especially in research and development (R&D) services. Moreover, the international regulations recommended by the association IEEE are considered. |

**10. Evaluation**

| Activity type | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Percentage of the final grade |
|---|---|---|---|
| 10.4 Course | N/A | | |
| | | | |
| 10.5 Seminar/ laboratory/ **project** | The degree of project theme fulfilment | Evaluation of student activity during semester by the disertation thesis coordinator | 100% |
| 10.6 Minimal performance standard | | | |
| • A research project evaluated by the research stage coordinator as fulfilling the minimum requirements for the accomplished activities and an oral presentation of the report. | | | |

This course outline was certified in the Department Board meeting on 23/09/2024 and approved in the Faculty Board meeting on 24/09/2024.

| | |
|---|---|
| **Assoc. Prof. Titus Constantin BALAN**<br>**Dean** | **Assoc. Prof. Lia ACIU,**<br>**Head of Department** |
| **N/A**<br>**Course holder** | **Assoc. Prof. Luminita BAROTE,**<br>**Holder of project (SEA coordinator)** |

Note:

1) Field of study – select one of the following options: Bachelor / Master / Doctorat (to be filled in according to the forceful classification list for study programmes);

2) Study level – choose from among: Bachelor / Master / Doctorat;

3) Course status (content) – for the Bachelor level, select one of the following options: **FC** (fundamental course) / **DC** (course in the study domain)/ **SC** (speciality course)/ **CC** (complementary course); for the Master level, select one of the following options: **PC** (proficiency course)/ SC (synthesis course)/ **AC** (advanced course);

[4] Course status (attendance type) – select one of the following options: **CPC** (compulsory course)/ **EC** (elective course)/ **NCPC** (non-compulsory course);

[5] One credit is the equivalent of 25 study hours (teaching activities and individual study).

# COURSE OUTLINE

**1. Data about the study programme**

| | |
|---|---|
| 1.1 Higher education institution | Transilvania University of Brașov |
| 1.2 Faculty | Electrical Engineering and Computer Science |
| 1.3 Department | Electrical Engineering and Applied Physics |
| 1.4 Field of study[1)] | Electrical Engineering |
| 1.5 Study level[2)] | MA |
| 1.6 Study programme | Advanced Electrical Systems |

**2. Data about the course**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2.1 Name of course | | | Dissertation thesis preparation (SEA412) | | | | | |
| 2.2 Course convenor | | | - | | | | | |
| 2.3 Seminar/ laboratory/ project convenor | | | Conf. dr. ing. Luminita BAROTE | | | | | |
| 2.4 Study year | II | 2.5 Semester | 2 | 2.6 Evaluation type | C | 2.7 Course status | Content[3)] | SC |
| | | | | | | | Attendance type[4)] | CPC |

**3. Total estimated time (hours of teaching activities per semester)**

| | | | | | |
|---|---|---|---|---|---|
| 3.1 Number of hours per week | 2 | out of which: 3.2 lecture | **0** | 3.3 seminar/ laboratory/ project | **2 P-AsP** |
| 3.4 Total number of hours in the curriculum | 28 | out of which: 3.5 lecture | 0 | 3.6 seminar/ laboratory/ project | 28 P-AsP |

| | |
|---|---|
| Time allocation | hours |
| Study of textbooks, course support, bibliography and notes | 0 |
| Additional documentation in libraries, specialized electronic platforms, and field research | 30 |
| Preparation of seminars/ laboratories/ projects, homework, papers, portfolios, and essays | 180 |
| Tutorial | 10 |
| Examinations | 2 |
| Other activities………………………………. | |

| | |
|---|---|
| **3.7 Total number of hours of student activity** | 222 |
| **3.8 Total number per semester** | 250 |
| **3.9 Number of credits[5)]** | 10 |

**4. Prerequisites (if applicable)**

| | |
|---|---|
| 4.1 curriculum-related | • |
| 4.2 competences-related | • |

**5. Conditions (if applicable)**

| | |
|---|---|
| 5.1 for course development | • |
| 5.2 for seminar/ laboratory/ project development | • Established by the dissertation thesis coordinator |

**6. Specific competences and learning outcomes**

| | |
|---|---|
| Professional competences | **Cp.2 Using modern knowledge in the analysis, evaluation, and operation of electrical subsystems.**<br>• L.O.2.1 The graduate knows methods of physical and mathematical description of the structure and operation of electrical systems.<br>• L.O.2.2 The graduate uses advanced theories to justify the processes of operation, command, and control of advanced electrical systems.<br>**Cp.4 Modeling and optimizing electrical and electronic systems for efficient energy use.**<br>• L.O.4.1 The graduate applies modern methods of modeling and optimizing electrical and power electronic systems for efficient energy use.<br>• L.O.4.4 The graduate designs projects in the field of renewable energy sources, energy storage, and distribution systems.<br>• L.O.4.5 The graduate is capable of modeling and implementing renewable energy systems integrated into intelligent distributed electrical networks.<br>**Cp.5 The development of new solutions for the realization of applications with advanced electrical systems, in the perspective of socio-economic sustainability.**<br>• L.O.5.2. The graduate uses modern theories in the design and optimization of applications with advanced electrical systems.<br>• L.O.5.3. The graduate uses concepts for the realization of applications with low energy consumption, for the control of energy production and management, monitoring and control of the environment.<br>• L.O.5.5. The graduate develops research projects using principles of sustainable development. |
| Transversal competences | **Ct.1 Responsible management of tasks and resources, considering professional ethics and social responsibility**<br>• L.O.1.2 The graduate is able to work with professional autonomy, applying the knowledge acquired in practical situations.<br>• L.O.1.3 The graduate assumes responsibility in undertaking activities, integrating advanced electrical systems into the environment in a spirit of sustainable development.<br>**Ct.2 Efficiency and responsibility in managing teamwork**<br>• L.O.2.1 The graduate can perform specific roles within a multidisciplinary team, contributing to the achievement of common objectives.<br>**Ct.3 Continuous professional development and lifelong learning**<br>• L.O.2.3 The graduate can effectively use language skills and information technology knowledge for personal and professional development. |

**7. Course objectives (resulting from the specific competences to be acquired)**

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| 7.1 General course objective | • Programming skills for using specific software in electrical engineering<br>• Forming the skills for analysis, calculus, modelling and simulation for optimizing electrical systems and processes related to the energy production and conversion;<br>• Knowing and applying the measuring, maintenance and monitoring techniques used for energy conversion;<br>• Forming the skills for optimal management of energy projects. |
| 7.2 Specific objectives | • Forming of skills for modelling and optimization of advanced electrical systems in according with the sustainable development principles: renewable energy sources, storage systems, power distribution systems, control and command systems, power management systems and other systems related to the production, storage, transport and efficient use of energy.<br>• Forming the competences for innovative design of renewable energy |

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| | systems, of storage and distribution of energy;<br>• Forming skills related to the power systems maintenance. |

**8. Content**

| 8.1 Course | Teaching methods | Number of hours | Remarks |
|---|---|---|---|
| N/A | | | |
| 8.2 Seminar/ laboratory/ **project** | Teaching-learning methods | Number of hours | Remarks |
| II. Mentoring activities for dissertation thesis preparation organized by the project coordinator | Dialog | 28 h | |
| Bibliography<br>Provided by the project coordinator. | | | |

**9. Correlation of course content with the demands of the labour market (epistemic communities, professional associations, potential employers in the field of study)**

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| The course ensures the achievement of several interdisciplinary competences, which are in accordance with the specific requirements of the international job market from various domains, especially in research and development (R&D) services. Moreover, the international regulations recommended by the association IEEE are considered. |

**10. Evaluation**

| Activity type | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Percentage of the final grade |
|---|---|---|---|
| 10.4 Course | N/A | | |
| | | | |
| 10.5 Seminar/ laboratory/ **project** | The degree of dissertation project requirements fulfilment | Evaluation of student activity by the disertation thesis coordinator | 100% |
| 10.6 Minimal performance standard | | | |
| • Accomplishing a dissertation thesis which comply with the minimal standards imposed by the project coordinator | | | |

This course outline was certified in the Department Board meeting on 23/09/2024 and approved in the Faculty Board meeting on 24/09/2024.

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| **Assoc. Prof. Titus Constantin BALAN**<br>**Dean** | **Assoc. Prof. Lia ACIU,**<br>**Head of Department** |
| **N/A**<br>**Course holder** | **Assoc. Prof. Luminita BAROTE,**<br>**Holder of project (SEA coordinator)** |

Note:

[1] Field of study – select one of the following options: Bachelor / Master / Doctorat (to be filled in according to the forceful classification list for study programmes);

[2] Study level – choose from among: Bachelor / Master / Doctorat;

[3] Course status (content) – for the Bachelor level, select one of the following options: **FC** (fundamental course) / **DC** (course in the study domain)/ **SC** (speciality course)/ **CC** (complementary course); for the Master level, select one of the following options: **PC** (proficiency course)/ SC (synthesis course)/ **AC** (advanced course);

[4] Course status (attendance type) – select one of the following options: **CPC** (compulsory course)/ **EC** (elective course)/ **NCPC** (non-compulsory course);

[5] One credit is the equivalent of 25 study hours (teaching activities and individual study).