Transilvania University of Brașov, Romania
Study program: Advanced Electrical Systems (in English)
Syllabus for ERASMUS + students

Faculty: Electrical Engineering and Computer Science
Study period: 2 years (master)

1st Year

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Analysis and signal processing	SEA101	5	2		2	

Course description (Syllabus): General aspects of acquisition and processing of data. Data Acquisition systems functions. Fields of use. Recent trends. Technologies, platforms, and standards. Circuits for signal conditioning Converting the signal output voltage of the electrical transduction; Adaptation-level signals; SAPD galvanic separation of the source signal; Analog signal filters; Analog signals pre-processing; Analog to digital signals conversion; Sampling of an analog signals. Sampling Circuit; Digital Signal processing. Encode analog signals; Analog-digital converters. Numerical processing systems ports: Parallel and serial ports of computers. The serial interface: RS family. The parallel interface: GPIB bus. Modular instrumentation: VXI, PXI. Dedicated interfaces: USB, Ethernet, CAN. Virtual instrumentation notions. Main Lab VIEW elements used for developing DAQ systems. Configuration of Wireless Acquisition Systems. Smart sensors and MEMS. Description of Wireless Sensor Networks. Interfaces, standards and network topologies. Extension board. Bridges and ports. Extension boards. Types of motherboards. Types of extension boards. Extension buses. Arduino. Steps in Arduino programming. Arduino applications.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Environmental policy and electromagnetic compatibility	SEA102	5	2		1	

Course description (Syllabus): EU Environmental policies; Principles underlying concept implementation SD (sustainable development); The European environmental policy instruments; Environmental indicators; National Level Indicators.; Organizing environmental information: Indictor types, environmental issues; Types of pollution due to electrical systems; Methods to reduce the environmental electromagnetic pollution; The interaction between the biological and electromagnetic environment.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Utility-scale energy storage systems	SEA103	5	2		1	1

Course description (Syllabus): Professional training of the master's degree students will be done by the theoretical and computer aided design level of knowledge regarding the electrical energy storage systems. Are estimated to obtain advanced competences in mathematical modelling, computer-aided design, and dedicated software applications. Electrical Energy Storage Systems and energy markets; Parameters and mathematical models for batteries with Pb, Ni-Cd, NiMH, Na-S, Li; Superconducting Capacitors (Ultracapacitors); Fuel Cells; Vanadium Redox flow Batteries (VRB); Pumped – Hydroelectric Storage; Compressed Air Energy Storage; Flywheels; Superconducting Magnetic Energy Storage; Applications in Electrical Energy Transmission and Distribution.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Control of power electronic converters	SEA104	5	2		1	1

Course description (Syllabus): Introduction; Fundamentals of soft commutation ZCS, ZVS, ZVT. Switching semiconductor devices MOSFET and IGBT. Drive circuits. Voltage control drive circuits. Three phase inverters. Control techniques. Control of the induction machine. Scalar control. Vector control. Practical control schemes. Control of permanent magnet synchronous motor, control of permanent magnet DC brushless machine. Uninterruptable power supplies. Energy storage systems Current controllers. Structure of digital control systems of electronic converters.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Ethics and academic integrity in the field of electrical engineering	SEA105	2	1			

Course description (Syllabus): The course objective is to provide students with basic knowledge about ethics and academic integrity in the scientific activity.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Research practice SEA-1	SEA106	8				10

Course description (Syllabus): Research practice carried out in university or in a private company on a research subject specific to the SEA master domain, such as: Electrical machines and drives; Power electronics; Monitoring and prediction of electrical systems operation; Systems for production, distribution, and transport of electrical power; Renewable energy; Electric vehicle charging infrastructure; Energy storage and recovery; Electromagnetic compatibility and power quality; Materials and sensors.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Digital electrical systems	SEA207	5	1		2	

Course description (Syllabus): The course objective is to provide a basic knowledge of the digital technologies to the students with applications on the advanced electrical systems. Introduction to databases, information technologies, digital modelling of electrical systems.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Electric propulsion systems	SEA208	5	2		1	1

Course description (Syllabus): The general discipline objective consists of ensuring the skills in the field of electric propulsion systems. The course content covers the following topics: introduction in the field of electric propulsion systems; electrical machines for propulsion systems; power electronics and storage environments for propulsion systems; control features of electric propulsion systems; electrical vehicles- charging infrastructure; powertrains for electrical vehicles; electric propulsion systems for: railway, urban, naval and aerial transport .

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Integrated design of electrical installations	SEA209	5	1		1	1

Course description (Syllabus): The general discipline objective consists in training the skills in the domain of electrical installation design using CAD techniques. The course aim is to offer advanced ways to design electrical installation. The laboratory is using CAD programs for design of electrical installation. The project aim is to design a small electrical installation that has photovoltaic system integrated.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Smart electrical microgrids	SEA210	5	2		2	

Course description (Syllabus): The general discipline objective consists in training the skills in the domain of smart electrical grids, microgrids with renewable energy sources and distributed generation systems. The course content covers the following main issues: main distributed energy resources; concept of smart grid and microgrid; interfacing renewable energy sources; power quality issues in a microgrid; voltage and frequency control in microgrids; protections in a microgrid.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Research practice SEA-2	SEA211	10				12

Course description (Syllabus): Research practice carried out in university or in a private company on a research subject specific to the SEA master domain, such as: Electrical machines and drives; Power electronics; Monitoring and prediction of electrical systems operation; Systems for production, distribution, and transport of electrical power; Renewable energy; Electric vehicle charging infrastructure; Energy storage and recovery; Electromagnetic compatibility and power quality; Materials and sensors.

2nd Year

Optional disciplines

Optional package 1 (2 disciplines will be selected)

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Hydro power energy conversion systems	SEA301	5	2		1	1

Course description (Syllabus): The importance of hydroelectricity in the renewable energy sources area; Micro hydro power plants; Definition of micro hydro power plants (MHPPs); MHPPs situation in Romania; Green certificates for MHPPs; Hydro-electric potential categories; MHPP base technology; Types of accumulation; MHPP power calculation; Hydraulic turbines; Electrical generators; Electro-mechanical equipment development; Auxiliary equipment; Autonomous MHPPs; The opportunity of using the induction generator: parameters control, single-phase operation; MHPPs integration into the system; Automatic control and monitoring; Operation optimization (SCADA systems); Pumped storage – MHPP level.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Photovoltaic power plants	SEA302	5	2		1	1

Course description (Syllabus): Solar Technologies; Physics of PV Cell; PV Inverters; MPPT; PV, Batteries and Charge Controllers; Sizing a PV system; PV System Control; Grid requirements for PV generators; Grid connected PV plants; Case Studies; Storage for PV Stand-Alone Systems; SmartGrids and Distributed networks.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Embedded sensors for electrical engineering applications	SEA303	5	2		1	1

Course description (Syllabus): Microsensors; classification, microfabrication processes; MEMS technology. Analog and digital sensors, self-powered sensors, wearable sensors; printed sensors and associated electronics. Embedded sensors for functional and structural health monitoring of electrical systems and (micro)actuation; design considerations. Applications for health monitoring and tele-medicine.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Testing to electromagnetic disturbances	SEA308	5	2		1	1

Course description (Syllabus): Electromagnetic environment - overview of natural and human made electromagnetic disturbance sources; challenges and benefits. Directives and regulations in EMC testing related to electromagnetic immunity and electromagnetic interference of technical systems. Testing to electrostatic discharges: description of phenomena, testing procedures, modelling and simulation, mitigation techniques. Testing to power-grid.

Optional package 2 (2 disciplines will be selected)

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Digital Monitoring Systems for Power Quality	SEA305	5	2		1	

Course description (Syllabus): The course is an introduction to modern digital monitoring systems and automated data acquisition based on the latest IT technologies, which can be applied to automated industrial processes or development of new smart devices to be connected through the Internet of Things.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Human Machine Interface Design	SEA306	5	2		1	

Course description (Syllabus): The course objective is to provide an introduction to the human-machine interfaces (HMI) of the modern electrical systems and to improve the design by using the most advanced principles of usability and ergonomy. Introduction to usability principles of HMI, sensors, actuators, automated systems with PLCs, electrical devices and systems built with IIoT technologies.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Wind power plants	SEA307	5	2		1	

Course description (Syllabus): Introduction; Wind energy conversion system; Generators and power electronics for wind turbines; The transfer of the electrical energy to the supply grid; Control and supervision of wind turbines; Power quality standards for wind turbines; Power quality measurements; The value of wind power; Future concepts, wind power and voltage control, wind power in areas with limited transmission capacity, benefits of active management of distribution systems, transmission systems for offshore wind farms, hydrogen as a means of transporting and balancing wind power production; Dynamic modelling of wind turbines for power system studies.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Web applications in electrical engineering	SEA308	5	2		1	

Course description (Syllabus): 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 the existing web applications, with a focus on visualizing the data collected from dynamic simulation.

Compulsory disciplines

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Research practice SEA-3	SEA309	10				12

Course description (Syllabus): Research practice carried out in university or in a private company on a research subject specific to the SEA master domain, such as: Electrical machines and drives; Power electronics; Monitoring and prediction of electrical systems operation; Systems for production, distribution, and transport of electrical power; Renewable energy; Electric vehicle charging infrastructure; Energy storage and recovery; Electromagnetic compatibility and power quality; Materials and sensors.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Research practice SEA-4	SEA410	10				12

Course description (Syllabus): Research practice carried out in university or in a private company on a research subject specific to the SEA master domain, such as: Electrical machines and drives; Power electronics; Monitoring and prediction of electrical systems operation; Systems for production, distribution, and transport of electrical power; Renewable energy; Electric vehicle charging infrastructure; Energy storage and recovery; Electromagnetic compatibility and power quality; Materials and sensors.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Practice for dissertation thesis preparation	SEA411	10				12

Course description (Syllabus): Students will have to carry out a practice for preparing their dissertation thesis, under the supervision of a faculty teacher.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Dissertation thesis elaboration	SEA412	10				2

Course description (Syllabus): Elaboration of a dissertation thesis under the supervision of a faculty teacher.