

SYLLABUS

Approved,
DEAN
Prof.univ.dr.ing.Gilbert-Rainer GILLICH

1. Program Data

1.1. Institution of Higher Education	Babeş-Bolyai University
1.2. Faculty	Faculty of Engineering
1.3. Department	Department of Engineering Science
1.4. Field of Study	Electrical Engineering
1.5. Course of Study	Bachelor
1.6. Study Programme	Electromechanics

2. Discipline Data

2.1. Discipline Name	Static power converters						
2.2. Course Coordinator	Prof.univ.dr.ing. Răduca Eugen						
2.3.1. Seminary Coordinator	-						
2.3.2. Laboratory Coordinator	Drd.ing. Anghel Dorian						
2.3.3. Project Coordinator	Drd.ing. Anghel Dorian						
2.4. Year of Study	IV	2.5. Semester	I	2.6. Evaluation Time	E	2.7. Discipline Regime	Cmp

3. Estimated Total Time (hours per semester of teaching activities)

3.1. Number of Hours per Week	5	from which: 3.2. Course	2	3.3. project&laboratory	3
3.4. Total Hours from the Curriculum Plan	70	from which: 3.5. Course	28	3.6. project&laboratory	42
Time Fund Distribution - hours					55
Study of Handbook, Course Materials, Bibliography & Notes					21
Additional Documentation in Library, on Special E-learning Platforms & in the Field					12
Preparation of seminars/laboratories/ projects, topics, reports, portfolios & essays					16
Mentoring					2
Examination					2
Other Activities					2
3.7. Total Time of Individual Study	55				
3.8. Total Hours per Semester	125				
3.9. Number of Credits	5				

4. Pre-condition (where is the case)

4.1. of Curriculum	• Mathematics, Physics (electricity), Electronics
4.2. of Competences	• PC usage

5. Condition (where is the case)

5.1. of Course Progress	• Video projector, PC, tablet, chalk or online platform (as appropriate)
5.2.1. of Seminary Progress	•
5.2.2. of Laboratory Progress	• knowledge of laboratory work and related equipment
5.2.3. of Project Progress	• knowledge of the topic

6. Acquired Specific Competences

Professional Competences	Selection, installation, operation and maintenance of electrical engineering systems (CP 3). Application of methods for design, analysis and testing of electrical elements and systems (CP 4). Interpretation and substantiation on technological, functional and economic criteria of electrical systems solutions (CP 5).
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Transversal Competences	Respecting the principles, norms and values of the code of professional ethics by approaching a rigorous, efficient and responsible work strategy in solving problems and making decisions (CT 1) Application of relationship techniques and efficient work in a multidisciplinary team, on various hierarchical levels, within the specific project management work team (CT 2)
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7. Discipline Objectives (coming out from the Checklist of Acquired Specific Competences)

7.1. General Objective of Discipline	1. To consolidate the theoretical and practical basis of the students, acquired in other previously studied disciplines: mathematics, electrical engineering, electronics, technical informatics. 2. To instruct students theoretically and practically in the knowledge of systems and equipment possible to be encountered in the activity of engineer 3. To train and develop the ability of students to become good professionals in research, design and production
7.2. Specific Objectives	Acquiring the skills to work with electronic power devices and to carry out theoretical and applied activities of design, service, research with various static converters

8. Content

8.1. Course	Teaching methods	Observation
1. INTRODUCTION The object of the discipline; Classification of static converters Power semiconductor devices: transistors, thyristors, triacs, parameters and characteristics	Lecture, graphic materials, problematic dialogue	2 hours
2. SWITCHING General; Switching process to real converters; transient current and switching angle	Lecture, graphic materials, problematic dialogue	2 hours
3. NON-CONTROLLED RECTIFIER General block diagram; parameters and characteristics of single-phase single-phase rectifiers, single-phase two-phase rectifiers with medium and bridge socket, three-phase single-alternation, three-phase two-phase alternating, zero-phase with zero point, dodecaphase and polyphase rectifiers. Smoothing filters: capacitive filter; inductive filter;	Lecture, graphic materials, problematic dialogue	4 hours
4. NETWORK CONTROLLED CONTROLLERS General; single-phase rectifiers: variants with symmetrical and asymmetrical control; single-phase rectifiers with leaking diode; three-phase rectifiers monoalternation and bialternation semi-controlled and fully controlled: electronic diagrams, operation, electrical parameters switching process; the permanent driving regime and the interrupted driving regime; smoothing coil calculation; four-dial converters with and without current	Lecture, graphic materials, problematic dialogue	5 hours
5. CONTINUOUS VOLTAGE VARIABLES General, classification; one-dial DC voltage variator (VTC), steady-state and interrupted-mode; VTC operation in other dials: four-dial VTC; VTC switching block. Standard switching block VTC variants	Lecture, graphic materials, problematic dialogue	3 hours
6 AUTONOMOUS INVERTERS General; current inverters: single-phase current inverters, series-parallel three-phase current inverter, oscillating circuit inverters; Voltage inverters: single-phase inverters three-phase inverters; output voltage regulation; width modulation (PWM); sinusoidal modulation; constructive types of autonomous voltage and current inverters	Lecture, graphic materials, problematic dialogue	4 hours
7. FREQUENCY CONVERTERS Classification; direct frequency converters and natural switching; cycloconverters, operation, construction types; direct frequency converters with artificial switching: generalities, procedures for obtaining the output voltage; frequency converter with intermediate circuit	Lecture, graphic materials, problematic dialogue	2 hours
8. CONTROL BLOCK OF ELECTRONIC POWER CONVERTERS General block diagram, classification; control block functions; control signal characteristics for power electronic devices; Control and circuits for controlling electronic power devices: SCR thyristors, triacs, bipolar power transistors, MOS power transistors, GTO gate lock thyristors; specialized integrated circuits for network control of thyristors, triacs and transistors	Lecture, graphic materials, problematic dialogue	4 hours

Control of static converters with computer and microcontrollers		
9. POWER MODULES Definition and composition of power modules; types of power modules; thermal model; industrial power modules	Lecture, graphic materials, problematic dialogue	2 hours
Bibliography 1.E. Răduca - Course notes 2. F.Ionescu, J.P.Six s.a. - Power electronics Ed. Tehnica, Bucharest 1998 3. Gârlasu St., Răduca E. - Power electronics - course - Univ "Eftimie Murgu" Resita 1994 4. Suciu D. - Power electronics: principles and applications, Matrix Rom Bucharest, 2007 5. I.Alexa - Inverters and rectifiers with high energy parameters Technical Publishing House, Bucharest 1986		
8.2.1. Seminary	Teaching methods	Observation
8.2.2. Laboratory	Teaching methods	Observation
1. Instructaj de protecția muncii, prezentarea tematicii și a laboratorului	Theme, dialogue, conclusions	2 hours
2. Determinarea performanțelor unui tranzistor de putere	Verification of the topic, dialogue, experimentation / simulation, conclusions	2 hours
3. Studiul contactorului static monofazat	Verification of the topic, dialogue, experimentation / simulation, conclusions	2 hours
4. Studiul punții trifazate semicomandate	Verification of the topic, dialogue, experimentation / simulation, conclusions	2 hours
5. Studiul unui redresor trifazat cu tiristoare SCR complet comandat	Verification of the topic, dialogue, experimentation / simulation, conclusions	2 hours
6. Studiul unui chopper cu semiconductoare	Verification of the topic, dialogue, experimentation / simulation, conclusions	2 hours
7. Studiul unui convertor în patru cadrane	Verification of the topic, dialogue, experimentation / simulation, conclusions	2 hours
8. Studiul unui DCG cu procesorul bipolar tip TDA 1085	Verification of the topic, dialogue, experimentation / simulation, conclusions	2 hours
9. Studiul inverterului industrial G120	Verification of the topic, dialogue, experimentation / simulation, conclusions	2 hours
10. Studiul comenzii unui inverter trifazat cu TEC-MOS de putere	Verification of the topic, dialogue, experimentation / simulation, conclusions	2 hours
11. Studiul CI de comandă tip BAA 145	Verification of the topic, dialogue, experimentation / simulation, conclusions	2 hours
12. Studiarea unor module industriale de putere	Verification of the topic, dialogue, experimentation / simulation, conclusions	2 hours
13. Studiul utilizării unui plc Seria S7 in circuite convertitoare	Verification of the topic, dialogue, experimentation / simulation, conclusions	2 hours

14. Recuperări. Discuții finale. Încheiere activitate de laborator	Dialogue, test, note	2 hours
Bibliography		
1.E. Răduca, I Pădureanu - Laboratory supervisor		
2. Gârlasu St., Răduca E. - Static converters - course - Univ "Eftimie Murgu" Resita 1994		
3. Suci D. - Power electronics: principles and applications, Matrix Rom Bucharest, 2007		
8.2.3. Project:-	Teaching methods	Observation
1. Assignment of the topic: To design a three-phase inverter with transistors powered by a semi-controlled rectifier with thyristors with the following input data: $U_i = \dots$, $U_e = \dots$, $P_e = \dots$ (individual data per student)	Exposure, dialogue	2 hours
2. Consultations and verifications along the way	Exposure, dialogue, verification, testing, notation	10 hours
3. Supporting the project	Dialogue, check, test, note	2 hours

9. Corroborating Discipline's Contents with the Expectation of the Epistemic Community Representatives, the Professional Associations and the Employers' Representatives from the Programme Corresponding Field

- They have been established with the main employers by previous discussions at the study programme substantiation.

10. Evaluation

Type of activity	10.1. Evaluation criteria	10.2. Evaluation methods	10.3. Weight from the final grade
10.4. Course	Debates participation	Number of interventions	5 %
	Acquired knowledge level	Exam (oral)	65 %
10.5.1. Seminary	Activity / implication	Interventions	
	Gained competence level	Interactive	
10.5.2. Laboratory	Activity / implication	Interventions	5 %
	Gained competence level in practice	Interactive	10 %
10.5.3. Project	Readiness in phrasing the project stages		5 %
	Project quality		10 %
10.6. Performance Minimum Standard			
<ul style="list-style-type: none"> • Promoting application activities; • Promoting grade 5 examination 			

Completion Date

May 2022

Course Coordinator's Signature

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Seminary / Laboratory Coordinator's Signature

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Department Endorsement Date

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Chief of Department Signature

Ș.l.dr.fiz. Cornel Hațiegan