_
Ω
α
Ν
0
Q
ı.
_
J
Q
. •
₹
-
₹
>
₹
?
>
α
-
÷
ے
_

Skills It knows to apply the knowledge from the range of physics, electrical engineering, electronics and mathematical analysis There has the consciousness of the necessity of extending of her competences, a readiness to the collection of the cooperation within the framework of the group Assumptions and objectives of the course: Practical knowledge of propriety and basic characteristics of power electronics converters, rectifiers, AC/AC converters, AC/DC converters and inverters. Study outcomes and reference to the educational results for a field of study Knowledge: 1. to apply the knowledge on the subject constructions, operations and designings of power electronics systems in chosen branches of industry - [K_W04 ++ K_W14 +++] 2. to characterize basic criteria of the analysis and synthesis for simple power electronics systems - [K_W04 ++] Skills: 1. to use the knowledge within the range constructions and mechanisms of action of elements and basic power electronics			STUDY MODULE DE	ESCRIPTION FORM				
Electrical Engineering (general academic, practical) (brak) 3 / 6 Elective path/specialty - Subject offered in: Polish obligatory Cycle of study: First-cycle studies part-time No. of hours Lecture: - Classes: - Laboratory: 10 Project/seminars: - 2 Status of the course in the study program (Basic, major, other) (brak) (brak) Education areas and fields of science and art technical sciences 2 100% Responsible for subject / lecturer: dr hab, inz. Ryszard Porada, prof. nadzw. email: yeszard porada@put.poznan.pl tel. 48 of 166 2360 Faculty of Electrical Engineering U. Plotrows 3 60-965 Poznah Prerequisites in terms of knowledge, skills and social competencies: 1 Knowledge It has basic knowledge from physics, electrical engineering, electronics and mathematical analysis 3 Social There has the consciousness of the necessity of extending of her competences, a readiness to competencies the collection of the cooperation within the framework of the group Assumptions and objectives of the course: Practical knowledge of propriety and basic characteristics of power electronics converters, rectifiers, AC/AC converters, AC/DC converters and inverters. Study outcomes and reference to the educational results for a field of study Knowledge: 1. to apply the knowledge on the subject constructions, operations and designings of power electronics systems - [K_W04 ++] Skills: 1. to specify the knowledge on the subject constructions, operations and designings of power electronics systems in chosen branches of industry: (K_W04 ++ K_W14 +++) Skills: 1. to specify the knowledge within the range constructions and mechanisms of action of elements and basic power electronics systems - [K_W04 ++] Skills: 1. to specify the knowledge within the range constructions and mechanisms of action of elements and basic power electronics systems - [K_W04 ++] Skills:			er Electronics					
Electrical Engineering Course (compulsory, electrical polish Course (compulsory, electrical polish Polish Polish Course (compulsory, electrical polish Polish Polish Polish Course (compulsory, electrical polish								
Cycle of study: First-cycle studies No. of hours Lecture: - Classes: - Laboratory: 10 Project/seminars: - Z Status of the course in the study program (Basic, major, other) (brak) Education areas and fields of science and art technical sciences Responsible for subject / lecturer: dr hab. in2. Ryszard Porada, prof. nadzw. email: nyszard.porada@put.poznan.pl tel. 48 61 665 2360 Project/seminars: - Z 100% Responsible for subject / lecturer: dr hab. in2. Ryszard Porada, prof. nadzw. email: nyszard.porada@put.poznan.pl tel. 48 61 665 2360 Prerequisites in terms of knowledge, skills and social competencies: Knowledge	Elec	trical Engineerin	ıg	1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -				
First-cycle studies No. of hours Lecture: - Classes: - Laboratory: 10 Project/seminars: - 2 Status of the course in the study program (Basic, major, other) (brak) Education areas and fields of science and art Eechnical sciences Responsible for subject / lecturer: dr hab. inż. Ryszard Porada, prof. nadzw. email: ryszard-porada@put_poznan.pl tel. 48 61 665 2360 Faculty of Electrical Engineering ul. Piotrowo 3A 60-965 Poznan Prerequisites in terms of knowledge, skills and social competencies: 1 Knowledge It has basic knowledge from physics, electrical engineering, electronics and mathematical analysis 3 Social competencies There has the consciousness of the necessity of extending of her competences, a readiness to the collection and objectives of the course: Practical knowledge of propriety and basic characteristics of power electronics converters, rectifiers, AC/AC converters, AC/DC converters and inverters. Study outcomes and reference to the educational results for a field of study Knowledge: 1. to apply the knowledge on the subject constructions, operations and designings of power electronics systems in chosen branches of industry - K_W04 ++ K_W14 +++ 2. to characterize basic criteria of the analysis and synthesis for simple power electronics systems - K_W04 ++ K_W14 +++ 3 Li to use the knowledge within the range constructions and mechanisms of action of elements and basic power electronics systems - K_W02 ++ K_W14 ++ 3 Li to the knowledge within the range constructions and mechanisms of action of elements and basic power electronics systems - K_W02 ++ K_W14 ++ 3 Li to see the knowledge within the range constructions and mechanisms of action of elements and basic power electronics systems - K_W02 ++ K_W14 ++ 4 Li to see the knowledge within the range constructions and computer simulations to the analysis and evaluation of elements operation and power electronics systems - K_W02 ++ K_W14 ++ 5 Li to characterize basic criteria of the analysis and computer simulations to the analysis an	Elective	e path/specialty	-					
No. of hours Lecture: - Classes: - Laboratory: 10 Project/seminars: - 2 Status of the course in the study program (Basic, major, other) (brak) Education areas and fields of science and art technical sciences Responsible for subject / lecturer: dr hab. inz. Ryszard Porada, prof. nadzw. email: nyszard-porada@put.poznan.pl tel. 48 61 665 2360 Facutly of Electrical Engineering ul. Piotrowo 3A 60-965 Poznan Prerequisites in terms of knowledge, skills and social competencies: I knowledge It has basic knowledge from physics, electrical engineering, electronics and mathematical analysis Skills It knows to apply the knowledge from the range of physics, electrical engineering, electronics and mathematical analysis Social competencies There has the consciousness of the necessity of extending of her competences, a readiness to the collection of the cooperation within the framework of the group Assumptions and objectives of the course: Study outcomes and reference to the educational results for a field of study Knowledge: 1. to apply the knowledge on the subject constructions, operations and designings of power electronics systems in chosen branches of industry - [K_W04 ++ K_W14 +++] 2. to characterize basic criteria of the analysis and synthesis for simple power electronics systems - [K_W04 ++] Skills: 1. to use the knowledge within the range constructions and mechanisms of action of elements and basic power electronics systems - [K_W04 ++] Skills: 1. to see known methods and mathematical models and computer simulations to the analysis and evaluation of elements operation and power electronics systems - [K_W04 ++]	Cycle o	of study:		Form of study (full-time,part-time)				
Lecture: - Classes: - Laboratory: 10 Project/seminars: - 2 Status of the course in the study program (Basic, major, other) (brak) (brak) (brak) (brak) Education areas and fields of science and art ECTS distribution (number and %) 2 100% Responsible for subject science and art Education areas and field of science and arch Education areas and fields of science and arch Education areas and fields of science and arch ECTS distribution (number and 9%) 2 100% Responsible for subject flecturer: It has basic knowledge from physics, electrical engineering, electronics and mathematical analysis There has the consciousness of the necessity of extending of her competences, a readiness to the collection of the couperation within the framework of the group Assumptions	First-cycle studies			part-time				
Comparison Control C	No. of I	nours			No. of credits			
Competencies Comp	Lectu	re: - Classe	s: - Laboratory: 10	Proiect/seminars:	- 2			
Competencies Comp	Status	of the course in the study	•		ield)			
ECTS distribution (number and %) Responsible for subject / lecturer: dr hab. in². Ryszard Porada, prof. nadzw. email: ryszard.porada@put.poznan.pl tel. 48 61 685 2360 Faculty of Electrical Engineering ul. Piotrowo 3A 60-965 Poznań Prerequisites in terms of knowledge, skills and social competencies: 1 Knowledge It has basic knowledge from physics, electrical engineering, electronics and mathematical analysis 3 Social There has the consciousness of the necessity of extending of her competences, a readiness to and mathematical analysis Assumptions and objectives of the course: Practical knowledge of propriety and basic characteristics of power electronics converters, rectifiers, AC/AC converters, AC/DC converters and inverters. Study outcomes and reference to the educational results for a field of study Knowledge: 1. to apply the knowledge on the subject constructions, operations and designings of power electronics systems in chosen branches of industry - [K_W04 ++ K_W14 +++] 2. to characterize basic criteria of the analysis and synthesis for simple power electronics systems - [K_W04 ++] Skills: 1. to use the knowledge within the range constructions and mechanisms of action of elements and basic power electronics systems - [K_W04 ++] Skills: 1. to use the knowledge within the range constructions and mechanisms of action of elements and basic power electronics systems - [K_W04 ++] Scoula competencies:								
Responsible for subject / lecturer: dr hab. in². Ryszard Porada, prof. nadzw. email: ryszard.porada@put.poznan.pl tet. 48 61 665 2360 Faculty of Electrical Engineering ul. Piotrowo 3A 60-965 Poznań Prerequisites in terms of knowledge, skills and social competencies: 1 Knowledge It knows to apply the knowledge from physics, electrical engineering, electronics and mathematical analysis 2 Skills It knows to apply the knowledge from the range of physics, electrical engineering, electronics and mathematical analysis 3 Social There has the consciousness of the necessity of extending of her competences, a readiness to the collection of the cooperation within the framework of the group Assumptions and objectives of the course: Practical knowledge of propriety and basic characteristics of power electronics converters, rectifiers, AC/AC converters, AC/DC converters and inverters. Study outcomes and reference to the educational results for a field of study Knowledge: 1. to apply the knowledge on the subject constructions, operations and designings of power electronics systems in chosen branches of industry - K_W14 +++ 2. to characterize basic criteria of the analysis and synthesis for simple power electronics systems - K_W04 ++ Skills: 1. to use the knowledge within the range constructions and mechanisms of action of elements and basic power electronics systems - K_W03 ++ Skills: 1. to use the knowledge within the range constructions and mechanisms of action of elements and basic power electronics systems - K_W03 ++ Skills: 2. to characterize basic criteria of the analysis and computer simulations to the analysis and evaluation of elements operation and power electronics systems - K_U02 ++ K_U11 ++ Scoial competencies:	Educat	ion areas and fields of sci	ience and art	,	ECTS distribution (number			
dr hab. inż. Ryszard Porada, prof. nadzw. email: ryszard.porada@put.poznan.pl tel. 48 61 665 2360 Faculty of Electrical Engineering ul. Piotrowo 3A 60-965 Poznań Prerequisites in terms of knowledge, skills and social competencies: Knowledge	tech	nical sciences			•			
dr hab. inż. Ryszard Porada, prof. nadzw. email: ryszard.porada@put.poznan.pl tel. 48 61 665 2360 Faculty of Electrical Engineering ul. Piotrowo 3A 60-965 Poznań Prerequisites in terms of knowledge, skills and social competencies: Knowledge								
It has basic knowledge from physics, electrical engineering, electronics and mathematical analysis Skills It knows to apply the knowledge from the range of physics, electrical engineering, electronics and mathematical analysis Social competencies There has the consciousness of the necessity of extending of her competences, a readiness to the collection of the cooperation within the framework of the group Assumptions and objectives of the course:	dr hab. inż. Ryszard Porada, prof. nadzw. email: ryszard.porada@put.poznan.pl tel. 48 61 665 2360 Faculty of Electrical Engineering							
Skills It knows to apply the knowledge from the range of physics, electrical engineering, electronics and mathematical analysis There has the consciousness of the necessity of extending of her competences, a readiness to the collection of the cooperation within the framework of the group Assumptions and objectives of the course: Practical knowledge of propriety and basic characteristics of power electronics converters, rectifiers, AC/AC converters, AC/DC converters and inverters. Study outcomes and reference to the educational results for a field of study Knowledge: 1. to apply the knowledge on the subject constructions, operations and designings of power electronics systems in chosen branches of industry - [K_W04 ++ K_W14 +++] 2. to characterize basic criteria of the analysis and synthesis for simple power electronics systems - [K_W04 ++] Skills: 1. to use the knowledge within the range constructions and mechanisms of action of elements and basic power electronics systems - [K_U03 ++] 2. o use known methods and mathematical models and computer simulations to the analysis and evaluation of elements operation and power electronics systems - [K_U02 ++ K_U11 ++] Social competencies:	Prer	equisites in term	ns of knowledge, skills and	d social competencies:				
Social There has the consciousness of the necessity of extending of her competences, a readiness to the competencies The collection of the cooperation within the framework of the group Assumptions and objectives of the course: Practical knowledge of propriety and basic characteristics of power electronics converters, rectifiers, AC/AC converters, AC/DC converters and inverters. Study outcomes and reference to the educational results for a field of study Knowledge: 1. to apply the knowledge on the subject constructions, operations and designings of power electronics systems in chosen branches of industry - [K_W04 ++ K_W14 +++] 2. to characterize basic criteria of the analysis and synthesis for simple power electronics systems - [K_W04 ++] Skills: 1. to use the knowledge within the range constructions and mechanisms of action of elements and basic power electronics systems - [K_U03 ++] 2. o use known methods and mathematical models and computer simulations to the analysis and evaluation of elements operation and power electronics systems - [K_U02 ++ K_U11 ++] Social competencies:	1	Knowledge						
Assumptions and objectives of the course: Practical knowledge of propriety and basic characteristics of power electronics converters, rectifiers, AC/AC converters, AC/DC converters and inverters. Study outcomes and reference to the educational results for a field of study Knowledge: 1. to apply the knowledge on the subject constructions, operations and designings of power electronics systems in chosen branches of industry - [K_W04 ++ K_W14 +++] 2. to characterize basic criteria of the analysis and synthesis for simple power electronics systems - [K_W04 ++] Skills: 1. to use the knowledge within the range constructions and mechanisms of action of elements and basic power electronics systems - [K_U03 ++] 2. o use known methods and mathematical models and computer simulations to the analysis and evaluation of elements operation and power electronics systems - [K_U02 ++ K_U11 ++] Social competencies:	2	Skills						
Practical knowledge of propriety and basic characteristics of power electronics converters, rectifiers, AC/AC converters, AC/DC converters and inverters. Study outcomes and reference to the educational results for a field of study Knowledge: 1. to apply the knowledge on the subject constructions, operations and designings of power electronics systems in chosen branches of industry - [K_W04 ++ K_W14 +++] 2. to characterize basic criteria of the analysis and synthesis for simple power electronics systems - [K_W04 ++] Skills: 1. to use the knowledge within the range constructions and mechanisms of action of elements and basic power electronics systems - [K_U03 ++] 2. o use known methods and mathematical models and computer simulations to the analysis and evaluation of elements operation and power electronics systems - [K_U02 ++ K_U11 ++] Social competencies:	3		There has the consciousness of the necessity of extending of her competences, a readiness to the collection of the cooperation within the framework of the group					
Practical knowledge of propriety and basic characteristics of power electronics converters, rectifiers, AC/AC converters, AC/DC converters and inverters. Study outcomes and reference to the educational results for a field of study Knowledge: 1. to apply the knowledge on the subject constructions, operations and designings of power electronics systems in chosen branches of industry - [K_W04 ++ K_W14 +++] 2. to characterize basic criteria of the analysis and synthesis for simple power electronics systems - [K_W04 ++] Skills: 1. to use the knowledge within the range constructions and mechanisms of action of elements and basic power electronics systems - [K_U03 ++] 2. o use known methods and mathematical models and computer simulations to the analysis and evaluation of elements operation and power electronics systems - [K_U02 ++ K_U11 ++] Social competencies:	Assı	mptions and ob	ectives of the course:					
Knowledge: 1. to apply the knowledge on the subject constructions, operations and designings of power electronics systems in chosen branches of industry - [K_W04 ++ K_W14 +++] 2. to characterize basic criteria of the analysis and synthesis for simple power electronics systems - [K_W04 ++] Skills: 1. to use the knowledge within the range constructions and mechanisms of action of elements and basic power electronics systems - [K_U03 ++] 2. o use known methods and mathematical models and computer simulations to the analysis and evaluation of elements operation and power electronics systems - [K_U02 ++ K_U11 ++] Social competencies:	Practi	cal knowledge of propi	riety and basic characteristics of po	ower electronics converters, rec	ctifiers, AC/AC converters,			
1. to apply the knowledge on the subject constructions, operations and designings of power electronics systems in chosen branches of industry - [K_W04 ++ K_W14 +++] 2. to characterize basic criteria of the analysis and synthesis for simple power electronics systems - [K_W04 ++] Skills: 1. to use the knowledge within the range constructions and mechanisms of action of elements and basic power electronics systems - [K_U03 ++] 2. o use known methods and mathematical models and computer simulations to the analysis and evaluation of elements operation and power electronics systems - [K_U02 ++ K_U11 ++] Social competencies:		Study outco	mes and reference to the	educational results for	a field of study			
branches of industry - [K_W04 ++ K_W14 +++] 2. to characterize basic criteria of the analysis and synthesis for simple power electronics systems - [K_W04 ++] Skills: 1. to use the knowledge within the range constructions and mechanisms of action of elements and basic power electronics systems - [K_U03 ++] 2. o use known methods and mathematical models and computer simulations to the analysis and evaluation of elements operation and power electronics systems - [K_U02 ++ K_U11 ++] Social competencies:	Knov	wledge:			-			
Skills: 1. to use the knowledge within the range constructions and mechanisms of action of elements and basic power electronics systems - [K_U03++] 2. o use known methods and mathematical models and computer simulations to the analysis and evaluation of elements operation and power electronics systems - [K_U02++K_U11++] Social competencies:	to apply the knowledge on the subject constructions, operations and designings of power electronics systems in chosen branches of industry - [K_W04 ++ K_W14 +++]							
1. to use the knowledge within the range constructions and mechanisms of action of elements and basic power electronics systems - [K_U03 ++] 2. o use known methods and mathematical models and computer simulations to the analysis and evaluation of elements operation and power electronics systems - [K_U02 ++ K_U11 ++] Social competencies:	2. to characterize basic criteria of the analysis and synthesis for simple power electronics systems - [K_W04 ++]							
systems - [K_U03 ++] 2. o use known methods and mathematical models and computer simulations to the analysis and evaluation of elements operation and power electronics systems - [K_U02 ++ K_U11 ++] Social competencies:	Skills:							
operation and power electronics systems - [K_U02 ++ K_U11 ++] Social competencies:	1. to use the knowledge within the range constructions and mechanisms of action of elements and basic power electronics systems - [K_U03 ++]							
Social competencies:					and evaluation of elements			
1. Has the consciousness of the importance and the understands different aspects and results of activity of electrician								
engineer in this of the influence on the medium, and related to this of the responsibility for undertaken decisions - $[K_K01 ++]$								

Assessment methods of study outcomes

Faculty of Electrical Engineering

laboratory exercises:

- ? the test and awarding the knowledge of need-to-know to realization of placed problems in the given area of tasks,
- ? verification skills on every exercises
- ? evaluation of the knowledge and skills related to the realization of laboratory exercise, the evaluation of the report from done exercises.

Obtaining additional points for activity during exercises, in particular way for:

- ? proposing to discuss additional aspects of the subject
- ? effective use of knowledge obtained during solving of given problem;
- ? comments related to improve teaching material,
- ? aesthetics of solved problems and reports ? within homework.

Course description

The power electronics? targets and assignments, general characterization of the object. Semiconductor elements in the power electronics. Types of power electronics systems, the classification and basic functions. AC/DC converters? non-controlled and controlled rectifiers. AC/AC systems - alternating voltage controllers. DC/DC converters? DC voltage controller (thyristor and transistor). DC/AC converters? independent transistor inverters? systems and methods of controlled. Chosen problems of the compatibility of power electronics systems

Basic bibliography:

- 1. Barlik R., Nowak M., Technika tyrystorowa, Wydawnictwa Naukowo-Techniczne, Warszawa 1997.
- 2. Frąckowiak L., Januszewski S., Energoelektronika. Cz. 1, Półprzewodnikowe przyrządy i moduły energoelektroniczne, Wydawnictwo Politechniki Poznańskiej, Poznań 2001.
- 3. Mikołajuk K., Podstawy analizy obwodów energoelektronicznych, Państwowe Wydawnictwo Naukowe, Warszawa 1998.
- 4. Mohan N., Undeland N., Robins W., Power Electronics, Jon Wiley & Sons Inc., New York 1999.
- 5. Tunia H., Smirnow A., Nowak M., Barlik R., Układy energoelektroniczne. Obliczanie, modelowanie, projektowanie, Wydawnictwa Naukowo-Techniczne, Warszawa 1982.

Additional bibliography:

- 1. Frąckowiak L., Energoelektronika. Cz. 2, Wydawnictwo Politechniki Poznańskiej, Poznań 2000
- 2. Kaźmierkowski M., Krishnan R., Blaabjerg H., Control in Power Electronics, Academic Press, Amsterdam 2002.
- 3. Piróg S., Energoelektronika, Uczelniane Wydawnictwa Naukowo-Dydaktyczne AGH, Kraków 1998.
- 4. Strzelecki R., Supronowicz H., Współczynnik mocy w systemach zasilania prądu przemiennego i metody jego poprawy, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2000.

Result of average student's workload

Activity	Time (working hours)
1. participation in the laboratory exercises	30
2. participation in consultations on the laboratory exercises	10
3. preparation for the laboratory exercises	15
4. preparation for the laboratory exercises pass	10

Student's workload

Source of workload	hours	ECTS
Total workload	65	2
Contact hours	40	1
Practical activities	30	1