COURSE DESCRIPTION CARD - SYLLABUS

Course name
Energy Converison Systems for RES [S2Elenerg1-ŹOiME>UP]

Course

Field of study
Electrical Power Engineering

Year/Semester
2/3

Area of study (specialization)
Renewable Sources and Storage of Energy

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
15

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Knowledge - Knowledge in mathematics, electrical engineering, and electronics at the level of the third year of first-cycle studies. Skills - The ability to effectively self-study in a field related to the chosen field of study; ability to make the right decisions when solving simple tasks and formulating problems in the field of widely understood electrical engineering. Competences - The student is aware of expanding their competences, shows readiness to work in a team, the ability to comply with the rules in force during lecture and laboratory classes.

Course objective

Getting to know the structure and control algorithms of power electronic converter, cooperating with energy sources in the form of wind and water generators and photovoltaic panels - at the basic level.

Course-related learning outcomes

Knowledge:
1. has an orderly and in-depth knowledge of the operation of generating sources in the power system using conventional, nuclear and renewable fuels. he knows the issues of improving the efficiency of the electricity and heat generation process.

2. has knowledge of the operation and use of devices for processing and converting electricity.

Skills:
he can use his knowledge to design devices, measurement, diagnostic and expert systems used in the power industry.

Social competences:
is aware of the importance of the power industry for the country and society, and recognizes its shared responsibility for its development in line with environmental protection requirements is ready to act responsibly as a designer and diagnostician of electrical power and measurement devices.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lecture
Assessment of knowledge and skills demonstrated during the written test-problem exam - based on the number of points obtained.
Laboratory
1. Continuous assessment, rewarding the increase in the ability to use known principles and methods,
2. Assessment of knowledge and skills related to the exercise, evaluation of the exercise report.
Getting extra points for activity during classes, especially for:
- proposing to discuss additional aspects of the issue,
- effectiveness of applying the acquired knowledge while solving a given problem,
- ability to work within a team that practically performs a specific task in a laboratory,
- comments related to the improvement of teaching materials,
- continuous assessment, rewarding activity and substantive content of the statement.

Programme content

Lecture
Structures of power systems for RES.
Structures and properties of basic types of power electronic converters – un-controlled and controlled rectifier systems, inverters and DC / DC converters, used in systems for RES. Pulse modulation methods.
Algorithms for controlling converter systems for RES.
Review of types of electric generators for RES - parameters and characteristics. Photovoltaic cells and panels - parameters and characteristics. Principles of cooperation of converter systems with energy sources.
Basics of designing energy systems for RES.
Laboratory
Exercises devoted to:
- testing the electrical and thermal characteristics of the photovoltaic panel,
- testing the characteristics of DC / DC converters, BUCK, BOOST, and BUCK-BOOST for various control algorithms,
- familiarization with the methods of synchronizing the converter control signals with the voltage waveform in the power grid,
- testing the characteristics of transistor inverters for cooperation with the power grid, working in current and voltage mode.

Course topics

none

Teaching methods

1. Lecture with multimedia presentation (diagrams, formulas, definitions, etc.) supplemented by the content of the board.
2. Laboratory exercises: multimedia presentation, presentation illustrated with examples given on a blackboard, and performance of tasks given by the teacher - practical exercises.

Bibliography

Basic
1. Kaźmierkowski M., Matysik J., Podstawy elektroniki i energoelektroniki, Oficyna Wydawnicza Politechniki Warszawskiej, 1996.
2. Barlik R., Nowak M., Poradnik inżyniera energoelektronika, WNT, Warszawa, 2, 2013.
3. Anuszczyk J., Maszyny elektryczne w energetyce. Zagadnienia wybrane, WNT, 2006.
4. Jastrzębska G., Ogniwa słoneczne. Budowa, technologia i zastosowanie, WKŁ, 2014.
Additional
1. Rozanov Y., Ryvkin S., Chaplygin E., Voronin P., Fundamentals of Power Electronics: Operating Principles, Design, Formulas, And Applications; CRC Press, 2015.
2. Nehrir M., Wang C., Strunz K., Aki H.; Ramakumar R.; Bing J.; Miao Z.; Salameh Z., A review of hybrid renewable/alternative energy systems for electric power generation: Configurations, control, and applications, IEEE Transactions on Sustainable Energy, 2011, 2, pp. 392-403.
3. Gwóźdź M., Krystkowiak M., Ciepliński Ł., Strzelecki R., A Wind Energy Conversion System Based on a Generator with Modulated Magnetic Flux, Energies, 2020, vol. 13, no. 12, s. 3285-1-3285-17.

Breakdown of average student's workload

	Hours	ECTS
Total workload	55	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	25	1,00