STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Modern storage and energy conversion systems	**1010312431010328893**

Field of study	Profile of study (general academic, practical)	Year /Semester
Power Engineering	**general academic**	**2 / 3**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
Sustainable Development of Power	**Polish**	**obligatory**

Cycle of study:	Form of study (full-time,part-time)
Second-cycle studies	**full-time**

No. of hours	No. of credits
Lecture: **30** Classes: **-** Laboratory: **-** Project/seminars: **-**	**2**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
other	**university-wide**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**2 100%**
Technical sciences	**2 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic knowledge of electrical engineering, electronics, energy, microprocessor technology and electrical machines.
2	**Skills**	Knowledge of the laws and phenomena of the physical and electrical. Linking physics with the principles of operation of technical equipment.
3	**Social competencies**	Awareness of the importance and need for the use of electrical and electronic engineering work. The ability to expand its powers.

Assumptions and objectives of the course:

Knowing the theoretical and practical problems of electrical engineering and energy.

To acquaint students with activities related to the proper management of sources, storage and receivers of electric energy in order to achieve the best possible management of resources and energy.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. He has a detailed knowledge of the principles of the construction, operation and exploitation of power system components related to the quality and reliability of power supply. - [K_W04 ++]

2. He has practical knowledge in the field of power electronics systems used to improve the quality and flexibility of electricity supply. - [K_W08 ++]

3. He has knowledge of development trends in the area of reliability of power supply and energy storage in the power supply system. - [K_W18 +]

Skills:

1. He can suggest improvements of existing technical solutions in the field of systems related to the provision, processing and accumulation of energy. - [K_U14 ++]

2. Able to analyze and diagnose operation of equipment related to the provision, processing and accumulation of energy. - [K_U07 +]

Social competencies:

1. Able to think and act in a creative and entrepreneurial, understands the need to formulate and providing the public with information and opinions on the achievements of energy and electrical engineering. - [K_K01 ++]

Assessment methods of study outcomes

Assess the knowledge and skills demonstrated during the examination of a problematic, realized in the form of written or oral.

Course description

The effect of disturbances in supply networks, elimination of these negative impacts; improve the quality and reliability of power receivers priority, guaranteed power supply systems, scalable power and runtime emergency power rating of practical performance and functionality of power systems; redundant structure; energy storages (batteries, supercapacitors, kinetic energy storage, fuel cells, compressed air systems, superconducting energy storage) and alternative power supply systems (power generators and their cooperation with the UPS and mains); nature of the various energy receivers, reactive power compensation.

Update 2017:

Applied methods of education:

lecture - lecture with multimedia presentation (including: drawings, photographs, animations, sound, films) supplemented with examples given on the board; Presenting a new topic preceded by a reminder of related content, known to students from other subjects; taking into account various aspects of the issues presented, including: economic, environmental, legal, social, etc .

Basic bibliography:

1. Bolkowski S., Teoria obwodów elektrycznych, WNT, W-wa 2015

2. Charoy A., Zakłócenia w urządzeniach elektronicznych. Zasady i porady instalacyjne, cz. 1-4, z serii: Kompatybilność elektromagnetyczna, WNT, Warszawa 1999-2000

3. Clayton R. P., Introduction to electromagnetic compatibility, Wiley - Interscience, John Wiley & Sons Inc., New Jersey, 2006

4. Kurdziel R., Podstawy elektrotechniki, WNT, Warszawa 1973

5. Markiewicz H., Bezpieczeństwo w elektroenergetyce, WNT, Warszawa 1999

6. Piątek Z., Jabłoński P., Podstawy teorii pola elektromagnetycznego, WNT, W-wa

Additional bibliography:

1. Krakowski M., Elektrotechnika teoretyczna, tom 1, Teoria obwodów, tom 2, Pole elektromagnetyczne, PWN, Warszawa 1999

2. Wiatr J., Miegoń M., Zasilacze UPS oraz baterie akumulatorów w układach zasilania gwarantowanego, seria Zeszyty dla elektryków - nr 4, DW MEDIUM, W-wa, 2008

3. Bednarek K., Kasprzyk L., Hłasko E., Modele funkcjonowania zasobników energii stosowanych w układach mobilnych, Poznan University of Technology Academic Journals, Electrical Engineering, No 86, Poznań 2016, s. 277-289.

4. Kasprzyk L., Bednarek K., Dobór hybrydowego zasobnika energii do pojazdu elektrycznego, Przeglad Elektrotechniczny, No 12 (91), 2015, s. 129-132, nr DOI: 10.15199/48.2015.12.32.

5. Kasprzyk L., Bednarek K., Burzyński D., Symulacja pracy akumulatorów kwasowo-ołowiowych, Przeglad Elektrotechniczny, Nr 12 (92), 2016, s. 61-64, nr DOI: 10.15199/48.2016.12.16.

6. Kasprzyk L., Bednarek K., Elektromagnetyzm a zagadnienia gromadzenia energii, Przegląd Elektrotechniczny, No 12 (90), 2014, s. 221-224, nr DOI: 10.12915/pe.2014.12.55.

Result of average student's workload

Activity	Time (working hours)
1. participation in class lectures	30
2. participate in the consultations on the lecture	6
3. exam preparation	20
4. participation in the exam	2

Student's workload

Source of workload	hours	ECTS
Total workload	58	2
Contact hours	38	1
Practical activities	0	0