**Nazwa przedmiotu:**

Power Electronics

**Koordynator przedmiotu:**

Marek Michalczuk, Phd

**Status przedmiotu:**

Obowiązkowy

**Poziom kształcenia:**

Studia I stopnia

**Program:**

Electric and Hybrid Vehicles Engineering

**Grupa przedmiotów:**

Obowiązkowe

**Kod przedmiotu:**

1150-00000-ISP-0219

**Semestr nominalny:**

4 / rok ak. 2022/2023

**Liczba punktów ECTS:**

3

**Liczba godzin pracy studenta związanych z osiągnięciem efektów uczenia się:**

1) Number of contact hours / - 54 hours
a) lecture - 30 hours;
b) laboratory - 15 hour;
c) consultations - 3 hours;
d) exam - 6 hours;
2) Student's own work 30 hours
Analysis of computer models 10 hours;
Literature studies 5 hours;
Preparation for tests and exam 15 hours;
3) TOTAL - 89 hours

**Liczba punktów ECTS na zajęciach wymagających bezpośredniego udziału nauczycieli akademickich:**

2 ECTS points - number of contact hours - 54 including:
a) lecture -30 hours;
b) exercises;
c) laboratory - 15 hours;
d) project;
e) consultations - 3 hours;
f) exam - 6 hours;

**Język prowadzenia zajęć:**

angielski

**Liczba punktów ECTS, którą student uzyskuje w ramach zajęć o charakterze praktycznym:**

1 ECTS point
15 hours Participation in laboratory classes;
10 hours - Analysis of computer models received from the teacher.

**Formy zajęć i ich wymiar w semestrze:**

|  |  |
| --- | --- |
| Wykład:  | 30h |
| Ćwiczenia:  | 0h |
| Laboratorium:  | 15h |
| Projekt:  | 0h |
| Lekcje komputerowe:  | 0h |

**Wymagania wstępne:**

Knowledge of the basics of electrical engineering, control theory and electrical machines.

**Limit liczby studentów:**

Brak

**Cel przedmiotu:**

The aim of the course is to acquire knowledge about the construction and properties of the power converters, as well as to acquire skills in the design of basic power electronic circuits.

**Treści kształcenia:**

LECTURE:
1. Introduction
- Power switches and converters in electric energy conversion systems
- Application areas of converters and development perspectives
2. Structure and properties of semiconductor devices
- Power diodes
- SCR thyristors
- IGCT thyristors
- IGBT transistors
- MOSFET transistors
- Diodes and SiC transistors
3. DC / DC transformerless converters
- Buck converter
- Boost converter
- Buck-boost converter
- Bidirectional converter
4. DC / DC converters with HF transformer
- Topologies for uni- and bi- directional energy transfer
5. Voltage Source Converters
- Topologies of single and multi-phase inverters and rectifiers
- Modulation methods
6. Drive system with a DC motor
- Topologies of drive systems with a permanent magnet DC motor
- Speed control structure for DC drive
6. Voltage Source Inventers
- Topologies of single and multi-phase inverters
- Shaping the output current
- Shaping sinusoidal output voltage
- Control structures and example applications
7. Drive system with AC motor
- Topologies of drive systems with three-phase AC motor
- Scalar control for squirrel-cage motor
8. PWM rectifiers with a DC voltage intermediate circuit
- Topologies of single and multi-phase rectifiers
- Shaping the input current

LABORATORY:
1. Buck converter
2. Boost converter
3. Bidirectional converter
4. Modulation methods.
5. Speed control of DC drive
6. Voltage Source Inverter
7. Three-phase PWM rectifier

**Metody oceny:**

Exam, tests during the semester, Assessment in laboratory classes.

**Egzamin:**

tak

**Literatura:**

1. Holmes, D. Grahame, and Thomas A. Lipo, Pulse width modulation for power converters: principles and practice. Vol. 18. John Wiley & Sons, 2003.
2. Marian P. Kazmierkowski, Ramu Krishnan, and Frede Blaabjerg, Control in power electronics: selected problems. Eds. Academic press, 2002.
3. Leonhard, Werner, Control of electrical drives. Springer Science & Business Media, 2001.
4. Mohan, Ned. Power electronics: a first course. Wiley, 2012.
5. Mohan, Ned. Electric drives: an integrative approach. Mnpere, 2003.

**Witryna www przedmiotu:**

pwre.isep.pw.edu.pl

**Uwagi:**

Brak

## Efekty przedmiotowe

### Profil ogólnoakademicki - wiedza

**Efekt 1150-00000-ISP-0219:**

Student has knowledge and vocabulary in the field of power electronics and control theory allowing for self-education.

Weryfikacja:

Verification in the written exam and tests

**Powiązane efekty kierunkowe:** K\_W19

**Powiązane efekty obszarowe:** T1A\_W05

### Profil ogólnoakademicki - umiejętności

**Efekt 1150-00000-ISP-0219:**

Student can choose the right topology of the power electronic converter for a particular application.

Weryfikacja:

Verification in the written exam and tests.

**Powiązane efekty kierunkowe:** K\_U15, K\_U16

**Powiązane efekty obszarowe:** T1A\_U12, T1A\_U16, T1A\_U12, T1A\_U16