**Nazwa przedmiotu:**

Ionics and Photovoltaics

**Koordynator przedmiotu:**

Michał Marzantowicz,PhD

**Status przedmiotu:**

Obowiązkowy

**Poziom kształcenia:**

Studia I stopnia

**Program:**

Electric and Hybrid Vehicles Engineering

**Grupa przedmiotów:**

Obowiązkowe

**Kod przedmiotu:**

1050-PE000-ISA-0130

**Semestr nominalny:**

3 / rok ak. 2022/2023

**Liczba punktów ECTS:**

3

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

1. contact hours: presence at the lectures 30h
2. literature studies: 10h
3. preparation for lectures: 10h
4. preparation for exam: 10h
5. contact hours: presence at the laboratories 15h
6. preparation for laboratories: 10h
7. laboratory reports: 10h
Cummulative student workload: 60 + 35 =95h (3 ECTS points)

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

presence at the lectures 30h, presence at the laboratories 15h, which corresponds to 2 ECTS points

**Język prowadzenia zajęć:**

polski

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

Presence at the laboratories 15h, which corresponds to 1 ECTS point

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

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

**Wymagania wstępne:**

Physics 1, Physics 2 - lectures

**Limit liczby studentów:**

According to the Rector regulations

**Cel przedmiotu:**

After the course, the student should have basic knowledge about solid state physics, physical properties of semiconductors and ionic conductors, electrical and transport properties of those materials. The student should understand the principles of operation of devices based on those materials: diodes, transistors, photovoltaic cells, galvanic cells, supercapacitors and fuel cells. The student should understand and apply the main parameters which characterize photovoltaic and galvanic cells, as well as devices based on these cells. The student should be able to select proper methods of investigation of those devices.

**Treści kształcenia:**

1) Introduction to solid state physics, atomic bonds, crystal lattices
2) Band theory of solids, metals, insulators, semiconductors.
3) The electrical conductivity of semiconductors. Doped semiconductors.
4) Properties of p-n junction. Semiconductor devices. Principle of operation and characteristics of the diode. Photodiodes and light-emitting diodes
5) Solar cells - construction, efficiency and the use of photovoltaics.
6) Materials for photovoltaic cells. Methods of characterization of materials and photovoltaic cells.
7 ) Metal contact voltage; thermocouple and Peltier devices.
8) Ions and ionic conductors. Defects and their impact on the physical properties of crystalline electrolytes; polycrystals. Amorphous solid electrolytes, polymers and glasses.
9) Electrical properties of solid electrolytes, diffusion and ion mobility; Arrhenius and VTF type dependence. Mixed conductivity
10) The galvanic cell. Construction of cells, electrode reactions. Batteries. Electroplated coating. Corrosion .
11) Electrode materials for rechargeable cells and fuel cells. Intercalation processes. Properties of electrolyte/electrode interface. Polarization effects, the reversibility of electrodes.
12) Supercapacitors - principle of operation, electrode materials and reactions, electrolyte materials. Design and performance of supercapacitor devices.
13) Flow batteries - cell reactions, principles of operation. Electrolytes and cell stacks, Stationary energy storage devices.
14) Electrochemical characterization of solid electrolytes. Transference numbers measurement methods. Characterization of electrochemical cells.

**Metody oceny:**

Tests from photovoltaics and ionics, each one hour
One test from calculation of measurement uncertainty
Entry tests and reports from the laboratories

**Egzamin:**

nie

**Literatura:**

1. Solid State Ionics for Batteries Editors: Editor-in-chief: Minami, T.Tatsumisago, M., Wakihara, M., Iwakura, C., Kohjiya, S., Tanaka, I. (Eds.) Springer 2005
2. Practical Handbook of Photovoltaics (Second Edition) Fundamentals and Applications Author(s): Augustin McEvoy, Tom Markvart and Luis Castaner ISBN: 978-0-12-385934-1 Elsevier 2012
3. Applied Photovoltaics, Stuart R. Wenham, Earthscan, 2007

**Witryna www przedmiotu:**

http://adam.mech.pw.edu.pl/~marzan/

**Uwagi:**

Brak

## Efekty przedmiotowe

### Profil ogólnoakademicki - wiedza

**Efekt Wpisz opis:**

Wpisz opis

Weryfikacja:

**Powiązane efekty kierunkowe:**

**Powiązane efekty obszarowe:**