**Nazwa przedmiotu:**

Electronics

**Koordynator przedmiotu:**

Bogdan Majkusiak

**Status przedmiotu:**

Obowiązkowy

**Poziom kształcenia:**

Studia I stopnia

**Program:**

Computer Science

**Grupa przedmiotów:**

Technical Courses

**Kod przedmiotu:**

EELE1

**Semestr nominalny:**

4 / rok ak. 2015/2016

**Liczba punktów ECTS:**

6

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

- attendance to lecture: 15 x 2 h = 30 h,
- attendance to classes: 15 x 1 h = 15 h,
- attendance to laboratory excercisess: 5 x 3 h = 15 h,
- preparation to lectures (reviewing lecture notes, reading the literature): 30 h
- preparation to classes (solutions to home tasks or projects): 30 h
- preparation to laboratory excercises (reading the manuals, preparation to entrance tests): 5 x 2h = 10 h
- completion or the laboratory reports: 5 x 2h = 10 h
- preparation to written class tests: 3 x 4 h = 12 h.
- participation in 3 consultations: 3 x 1h = 3 h
TOTAL: 155 h = 6 ECTS

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

30 h + 15 h + 15 h + 3 h = 63 h = 2 ECTS

**Język prowadzenia zajęć:**

angielski

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

15 h + 10 h + 10 h = 35 h = 2 ECTS

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

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

**Wymagania wstępne:**

Basic knowledge in physics and mathematics

**Limit liczby studentów:**

30

**Cel przedmiotu:**

Lecture: to present physical and technical bases of electronics, including physical fundamentals, rules and models of operation of basic semiconductor devices and their circuit applications.
Classes: to practice models of electron phenomena and devices as well as to consider their selected circuit applications
Laboratory: to examine experimentally rules and models of operation of selected semiconductor devices and their circuits

**Treści kształcenia:**

Introduction (2h): Electronics – definition, generations, characteristics.
Physical fundamentals (2h): Particle and wave representation of an electron, classical and quantum transport, energy spectrum of electrons in classical and quantum systems.
Solid state (2): Bonds, energy bands, kinds of solids, band diagrams, electrons and holes, intrinsic and extrinsic semiconductors. Transport processes in solids (3): Generation-recombination, conduction mechanisms and currents (drift, diffusion), dielectric relaxation, junction phenomena.
Semiconductor devices - physical structure, rules of operation, static model, small-signal model, switching characteristics, circuit applications (21h): Schottky diode, PN diode, Bipolar junction transistor, MOS capacitor, MOS field-effect transistor. Junction field-effect transistor,

Laboratory excercises:
L1. Fundamental phenomena in semiconductors
L2. Diodes
L3. Bipolar junction transistors
L4. MOS structure and MOS Field Effect Transistor
L5. Supply circuits

**Metody oceny:**

- three calculation tests assessed in the scale 0-5 points each,
- five laboratory excercises assessed in the scale 0-5 points each: the assessment includes the entrance test, practical activities, laboratory report,
- extra premium points for activity during lectures or classes.

Total number of points: Grade:
36 < ∑ 5
32 < ∑ ≤ 36 4.5
28 < ∑ ≤ 32 4
24 < ∑ ≤ 28 3.5
20 < ∑ ≤ 24 3
 ∑ ≤ 20 2

**Egzamin:**

nie

**Literatura:**

- B. Majkusiak, "Electronics - Lecture Notes", pdf tutorial available at the course website
- K. Kano, "Semiconductor Devices", Prentice Hall, Inc., 1998.
- R.T. Howe, C.S. Sodini, "Microelectronics - an Integrated Approach", Prentice-Hall Inc.
- M. Hassul, D. Zimmerman, "Electronic Devices and Circuits", Prentice-Hall
- Laboratory excercise manuals.

**Witryna www przedmiotu:**

https://studia.elka.pw.edu.pl

**Uwagi:**

## Efekty przedmiotowe

### Profil ogólnoakademicki - wiedza

**Efekt EELE1\_W01:**

A student has a basic knowledge on quantum-mechanical origins of the energy band structure of solids, their optical and electrical properties, transport mechanisms in solids and their junctions.

Weryfikacja:

- Class calculation test 1.
- Entrance test to the laboratory excercise L1.
- Assessment of the laboratory report L1.

**Powiązane efekty kierunkowe:** K\_W02

**Powiązane efekty obszarowe:** T1A\_W01, T1A\_W02, T1A\_W03, T1A\_W07

**Efekt EELE1\_W02:**

A student has a knowledge on rules of operation of basic semiconductor devices, their models and circuit applications: Schottky diode, PN diode, bipolar junction transistor, MOS field-effect transistor, junction field-effect transistor.

Weryfikacja:

- Class calculation tests 2 and 3,
- Entrance tests to laboratory excercises L2-L5
- Assessment of laboratory reports to L2-L5.

**Powiązane efekty kierunkowe:** K\_W03

**Powiązane efekty obszarowe:** T1A\_W02

### Profil ogólnoakademicki - umiejętności

**Efekt EELE1\_U01:**

A student has the ability to predict electrical response of basic semiconductor devices to changed conditions of the bias, temperature, and signal frequency,

Weryfikacja:

- Class calculation tests

**Powiązane efekty kierunkowe:** K\_U08

**Powiązane efekty obszarowe:** T1A\_U08, T1A\_U09