# STUDY MODULE DESCRIPTION FORM

| Name of the module/subject | Code |
|---|---|
| **Electric materials** | **1010341731010311578** |

| Field of study | Profile of study (general academic, practical) | Year /Semester |
|---|---|---|
| **Mathematics in Technology** | **(brak)** | **2 / 3** |
| Elective path/specialty | Subject offered in: | Course (compulsory, elective) |
| **-** | **Polish** | **obligatory** |

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

| No. of hours | No. of credits |
|---|---|
| Lecture: **30** Classes: **-** Laboratory: **30** Project/seminars: **-** | **5** |

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

| Education areas and fields of science and art | ECTS distribution (number and %) |
|---|---|
| | |

## Responsible for subject / lecturer:

Jarosław Gielniak
email: jaroslaw.gielniak@put.poznan.pl
tel. 61-665-2797
Electrical Engineering
Piotrowo 3A, 60-965 Poznań

## Prerequisites in terms of knowledge, skills and social competencies:

| | | |
|---|---|---|
| 1 | **Knowledge** | Basic knowledge of mathematics (arithmetic mean, standard deviation of the arithmetic mean, t-distribution), physics and chemistry. |
| 2 | **Skills** | The student is able to perform the measuring system; is able to perform measurements of basic physical quantities, and to make a statistical analysis of test results. The student is able to work in a group. |
| 3 | **Social competencies** | The student is aware of the need to expand their skills and competences. Understands the importance of teamwork. |

## Assumptions and objectives of the course:

Obtaining knowledge about the basic materials used in electrical engineering, occurring phenomena and properties which characterize them. Understanding modern techniques and research methods

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

### Knowledge:

1. Can define the key terms used to describe the properties of materials and understand their physical meaning. He has knowledge of the basic properties of materials. He knows the mechanisms of aging characteristic of electrotechnical materials. - [K_W16, K_W17, K_W18]

2. He knows the technology sourcing of raw materials and the types of materials processing. Versed in the latest trends and research areas of modern solutions in the field of electrical materials science. - [K_W18, K_W20]

### Skills:

1. The student is able to select the appropriate method and use the measuring equipment (analog and digital) to measure basic quantities characterizing the materials used in electrical engineering - [K_U22, K_U26, K_U27]

2. Student can prepare the documentation of the task research, discuss and interpret the results - [K_U28, K_U29, K_U32]

### Social competencies:

1. The student is aware of the importance and understand the different aspects and effects of activities in electrical engineering, including the impact on the environment and the associated responsibility for decisions - [K_K04]

2. The student is aware of the rapid development of materials technology and arising from that necessity of continual self-education - [K_K01]

## Assessment methods of study outcomes

Lectures:

- assessment of knowledge and skills in written and oral exams

Laboratory:

- tests, continuous evaluation for each course
- evaluation of the knowledge and skills associated with the implementation of the practice tasks, the assessment of exercise report.

## Course description

Insulating materials ? gases (air, nitrogen, SF6, hydrogen, freon, mixtures), liquids (vegetable, mineral and synthetic oils), fibrous materials (cellulose, glass, carbon and fibres), elastomers (natural and synthetic rubbers), thermoplastics, hardening plastics, inorganic dielectric (mica, glass, ceramics) - conductivity in dielectrics. Methods for testing the mechanical, electrical and chemical properties of materials - hardness test, impact resistance, tensile strength, electric polarization, volume and surface resistivity, complex permittivity, humidity, acidity, polymerisation degree.

Magnetic materials - theory of magnetism, ferromagnetic, paramagnetic, ferri- and antiferrimagnetic materials, materials magnetically soft and hard. Conductive materials - theory of conduction, scattering centres, conductive and resistive materials. Superconductors - the theory of superconductivity, classic, mixed and high temperature superconductors, cryogenics. Semiconductors - types, applications.

Update 2017:

new electro-insulating liquids, in particular biodegradable synthetic and natural liquids, their mixtures and nanofluids based on these liquids

Applied methods of education:

lectures - lecture with multimedia presentation (including: drawings, pictures) supplemented with examples given on the board and presentation of samples of discussed materials. Theory presented in close connection with practice

laboratories - team work, detailed review of lab reports and discussion of comments

## Basic bibliography:

1. Celiński Z., Materiałoznawstwo elektrotechniczne, Wydawnictwo Politechniki Warszawskiej,1998

2. Florkowska B., Furgał J., Szczerbiński M., Włodek R., Zydroń P., Materiały Elektrotechniczne, Podstawy teoretyczne i zastosowania, Wyd. AGH, Kraków 2010

3. Kolbiński K., Słowikowski J., Materiałoznawstwo Elektrotechniczne, WNT, Warszawa, 1988

4. Gielniak J. - red. Ćwiczenia laboratoryjne z inżynierii materiałowej w elektrotechnice, Wydawnictwo Politechniki Poznańskiej, Poznań 2009

## Additional bibliography:

1. Mościcka-Grzesiak H., Inżynieria wysokich napięć w elektroenergetyce, Wydawnictwo Politechniki Poznańskiej, tom I - 1996, tom II - 1999

2. Flisowski Z., Technika wysokich napięć, WNT W-wa, 2005

3. Gielniak J., Przybyłek P., Mościcka-Grzesiak H.,Wytrzymałość elektryczna nanomodyfikowanych dielektryków ciekłych, Przegląd Elektrotechniczny, ISSN 0033-2097, R. 91 NR 2/2015

## Result of average student's workload

| Activity | Time (working hours) |
|---|---|
| | |

## Student's workload

| Source of workload | hours | ECTS |
|---|---|---|
| Total workload | 125 | 5 |
| Contact hours | 66 | 2 |
| Practical activities | 75 | 3 |