**SYLLABUS OF THE ACADEMIC DISCIPLINE**
**«ELECTRICAL MATERIALS»**

| | |
|---|---|
| **Academic degree** | Bachelor |
| **Specialty** | 141 Electrical energetics, electrical engineering and electromechanics |
| **Academic program** | Electrical energetics, electrical engineering and electromechanics |
| **Period of study** | 2 semester (4 term) |
| **Total workload** | 3 credits ECTS (90 hours) |
| **Classroom workload:** | |
| lectures: | 2 hours |
| laboratory works: | 2 hours |
| **Language of study** | English |

**Course page in E-learning platform of DniproTech:**
https://do.nmu.org.ua/course/view.php?id=5793

**Teaching department** Electrical Engineering (EE)


**Instructor:**

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## 1. About this course

Within the discipline of **Electrical materials**, physical phenomena occurring in electrical materials under the action of electromagnetic fields are studied. The classification of materials is given, their properties and some technological processes of production are studied. Electrical materials are essential in the design of a variety of electrical devices and apparatus. Given the trend in modern electrical engineering to increase voltages and capacities, reduce the size and weight of machines and devices and increase reliability, the role of electrical materials is becoming significant.

## 2. Aim and objectives

**The aim of the course** – formation of competencies in the operation of electrical materials.

**Course objectives:**

- gaining knowledge and acquaintance with the types of electrical materials; understand the processes arising in electrical materials that are in the electric field;
- formation of abilities and skills to use the acquired knowledge at installation of electrotechnical materials in power installations and at measurement of various sizes.

## 3. Learning outcomes

Disciplinary learning outcomes:

- analyze processes in electric power, electrotechnical and electromechanical equipment, relevant complexes and systems, taking into account the properties of dielectric, conductive and magnetic materials;
- calculate the parameters of dielectric, conductive and magnetic materials used in the elements of electric power, electrotechnical and electromechanical complexes and systems.

## 4. Course structure

| LECTURES |
|---|
| **1. Dielectric materials** |
| Polarization of dielectric materials in a constant electric field |
| Electrical conductivity of dielectrics |
| Electrical breakdown of dielectrics |
| Thermal properties of dielectrics |
| Some dielectric materials |
| Application of dielectric materials in electrotechnical devices |
| **2. Conductive and magnetic materials** |
| Physical processes and phenomena in conductive materials |
| Metals of high electrical conductivity |
| Superconductors |
| Metals of high electrical resistance |
| Metals for various purposes |
| Non-metallic conductive materials and products |
| Physical processes and phenomena in magnetic materials |
| Some magnetic materials |
| **LABORATORY CLASSES** |
| Study of the properties of electrical insulating materials |
| Determination of electrical strength of liquid dielectrics |
| Determination of volume and surface resistivities of solid dielectrics |
| Investigation of dielectric polarization |
| Study of the properties of magnetic materials |
| Investigation of the properties of magnetic materials using an oscilloscope |
| Determination of the specific magnetic resistance of ferromagnets |
| Investigation of magnetic properties of plate samples using a ferrometer |

## 5. Technical equipment and/or software

| № works (code) | Lab title | Tools, equipment and software used in the work |
|---|---|---|

| | | |
|---|---|---|
| ETM-1.1 | Study of the properties of electrical insulating materials | Box with prototypes of electrical materials |
| ETM-1.2 | Determination of electrical strength of liquid dielectrics | Installation of АДІ-70<br>Dielectric gloves<br>Dielectric boots<br>Fuses |
| ETM-1.3 | Determination of bulk and surface specific resistance of solid dielectrics | Samples of dielectric materials<br>Theraometer |
| ETM-1.4 | Investigation of dielectric polarization | Samples of dielectric materials<br>AC bridge<br>Electrodes |
| ETM-2.1 | Study of the properties of magnetic materials | Box with prototypes of magnetic materials |
| ETM-2.2 | Investigation of the properties of magnetic materials by using an oscilloscope | Sample of magnetic materials<br>Integrator<br>Oscillograph |
| ETM-2.3 | Determination of the specific magnetic resistance of ferromagnets | Compensator<br>Measuring instruments<br>A sample of a ferromagnet<br>Oscillograph |
| ETM-2.4 | The study of magnetic properties of the plate samples by using ferometra | Plate sample and<br>Ferrometer easuring instruments |

## 6. Evaluation system and requirements

**6.1. The academic achievements of higher education applicants** based on the results of the completion of the course will be evaluated on the scale below:

| **Rating** | **Institutional** |
|---|---|
| 90 – 100 | Excellent |
| 74 – 89 | Good |
| 60 – 73 | Satisfactory |
| 0 – 59 | Fail |

The general criteria for achieving the learning outcomes correspond to the descriptions of the 6th qualification level of the NQF.

**6.2** Applicants for higher education can receive **a final grade** in this course based on the formative assessment of their knowledge, provided that the total number of points gained from the formative testing and independent work will be at least 60 points.

Maximum rating:

| Theoretical part | The laboratory part | | Bonus | **Total** |
|---|---|---|---|---|
| | in time turn-ins | late turn-ins | | |
| 65 | 30 | 20 | 5 | **100** |

The theoretical part is evaluated by the results of passing the test, which contains at least 40 questions.

**1 hour** is allotted for answering the questions of test control work

Laboratory works are accepted on control questions to each of work.

**6.3. Criteria for evaluating the final work.** At least 40 test tasks with four answer options, 1 correct answer is evaluated in 1 or 2 points depending on the difficulty (a total of 65 points). The test is conducted using Microsoft Office 365 technology.

**6.4. Criteria for evaluating laboratory work.** From each laboratory work the applicant of higher education can receive 5 points. The arithmetic mean of laboratory work is multiplied by 6.

## 7. Course policy

**7.1. Policy on academic integrity.** The academic integrity of higher education applicants is an important condition for mastering the learning outcomes of the course and obtaining satisfactory grades in formative and summative assessments. Academic integrity is based on the condemnation of the practices of cheating (writing with the involvement of external sources of information other than those authorized for use), plagiarism (reproduction of published texts of other authors without proper attribution), fabrication (inventing data or facts used in the educational process). The policy on academic integrity is regulated by the Regulation on system of prevention and detection of plagiarism at the Dnipro University of Technology (https://www.nmu.org.ua/ua/content/activity/us_documents.pdf)

If a higher education applicant violates academic integrity (cheating, plagiarism, fabrication), the assignment is graded unsatisfactory and must be repeated. In this case, the instructor reserves the right to change the topic of the assignment.

**7.2. Communication policy.** Applicants for higher education must have an activated corporate university email.

All written questions to the instructors regarding the course should be sent to the university email.

**7.3. Policy on retakes.** Assignments that are submitted late without valid reasons will be evaluated at a lower grade. Retakes of the summative assessment are allowed with the permission of the dean's office if there are valid reasons (e.g., sick leave).

**7.4. Class attendance.** Attendance at classes is mandatory for full-time applicants for higher education. Valid reasons for absence from classes are illness, participation in university events, and academic mobility, which must be confirmed by documents. A higher education applicant must notify the instructor either personally or through the leader of the academic group about the absence from class and the reasons for the absence.

For objective reasons (e.g. international mobility), studies may take place online with the consent of the course instructor.

**7.5 Evaluation appeal policy**. If a higher education applicant does not agree with the evaluation of his/her knowledge, he/she may appeal the grade assigned by the instructor in a prescribed manner.

**7.6. Bonuses**

Upon completion of the course the instructor can add up to **5 bonus points** to a total grade for the course for personal activity during lectures and laboratory classes , participation in scientific-technical conferences , seminars and other university activities.

## 8 Recommended readings


1. Electrical materials science: textbook / Oleksandr Aziukovskyi, Dmytro Tsyplenkov, Andrii Kolb. Ministry of education and science of Ukraine Dnipro university of technology – Dnipro: DniproTech, 2022. – 184 p.
2. Zhuravlyova LV, Bondar VM Electromaterials: Textbook. - K .: Charter, 2006. – 312 p.
3. Handbook of electrical materials. In 3 volumes / Ed. Yu.V. Koritsky, V.V. Pasynkova, B.M. Tareeva. - M .: Energoatomizdat, 1986. - 368 p .; 1987. - 464 p.; 1988. - 728 p.
4. Collection of methodical materials for laboratory work on discipline "Electrical Materials" (Section “Dielectric materials”) for students studying specialty 141 “Electrical Power Engineering, Electrical Engineering and Electromechanics” / Kolb AA; Dnipro University of Technology – D.: DniproTech, 2021. – 32 p.
5. Collection of methodical materials for laboratory work on discipline "Electrical Materials" (Section “Magnetic materials”) for students studying specialty 141 “Electrical Power Engineering, Electrical Engineering and Electromechanics” / Kolb AA; Dnipro University of Technology – D.: DniproTech, 2021. – 37 p.