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| **Fundamentals of Relay Protection and Automation of Power Systems**SYLLABUS |
| **Code and name of the specialty** | 141 Electric power, electrical engineering and electromechanics | **Institute / faculty** | **Institute of Education and Science in Power Engineering, Electronics and Electromechanics** |
| **Name of the program** | Fundamentals of Relay Protection and Automation of Power Systems | **Department** | Department of engineering electrophysics |
| **Program type** | **Educational and professional** | **Language of study** | **English** |
| **Teacher** |
| ***Full name, e-mail yevhen.honcharov@kpi.kharkov.ua*** |  |
|  | **General information – Ph.D., Associate Professor, Associate Professor of the Department of Engineering Electrophysics National Technical University “Kharkiv Polytechnic Institute”****The author of more than 75 scientific publications and 9 patents of Ukraine.****Basic courses: “Fundamentals of Relay Protection and Automation of Power Systems”, “Power equipment of Electric Power Plants”, “Electrical Engineering and Electromechanics”, “Electrical Engineering, Electronics and Microprocessor Technology”, “Fundamentals of Electronic, Electrical Equipment”****Scopus Author ID 55370907400** |
| **General information about the course** |
| **Summary** | The course "Fundamentals of Relay Protection and Automation of Power Systems" is special (professional) for electrical engineering education, including for the field of methods of relay protection in electrical circuits. |
| **Course goals** | Formation of students' competence and learning outcomes in the field of electrical engineering and fundamentals of relay protection and automation of power systems, by providing them with a base of theoretical and practical training. |
| **Format** | Lectures 32 hours, practical classes 16 hours, consultations. Final control - exam |
| **Semester** | 7 |

**Learning achievements**

It prepares students to master special disciplines and develops skills that help to further solve engineering problems using electrical approaches in the sphere of electrical engineering and relay protection and automation of power systems, in modern fields of science, technology and industry in which students specialize.

**Topics covered**

**Theme 1. Fundamentals of electric circuits.**

**Theme 2. Complex variables.**

**Theme 3. Phasor diagrams for sinusoidal quantities.**

**Theme 4. Three-Phase power system circuits, phasor diagrams for the balanced and Unbalanced mode.**

**Theme 5. Magnetic circuits.**

**Theme 6. Protective relaying: principles and applications.**

**Form and methods of teaching**(description of teaching methods is provided)

Methods of organization and implementation of training:

1. *Lecture.* The lecture uses various methods of oral presentation of information: maintaining attention for a long time, activating the thinking of listeners; techniques that provide logical memorization: persuasion, argumentation, evidence, classification, systematization, generalization, etc.

2. *The method of discussion of educational material and discussion* is used in lectures and practical classes. Discussion allows you to significantly deepen and systematize knowledge, understanding of a problem, to verify the basis of the conclusions reached by students during the study of a particular topic. The method of discussion develops in them the ability to defend their views and beliefs. The discussion helps to identify, logically and critically comprehend different points of view, scientific concepts and approaches to the issues considered. The organization and support of the discussion is achieved through the use of the following techniques: asking questions (basic, additional, leading, etc.), discussing the answers and opinions of students, adjusting the answers and formulating conclusions.

3. *Visual and practical teaching methods.* Illustration and demonstration are used among visual teaching methods. Illustration - showing students posters, maps, graphs, sketches on the board. Demonstration of lecture materials by multimedia means.

4. *Practical classes.* When performing practical tasks, the method is used: do as I do. When discussing the results obtained during the practical tasks, the method of sequential assimilation of the material is used during the discussion.

**Control methods**

(description of control methods is provided)

1. Current control: surveys, speeches at seminars and practical classes, tests, individual tasks, tests.

2. Semester control: is carried out in the form of a test with an assessment in accordance with the curriculum in the amount of educational material defined by the curriculum and within the time limits set by the curriculum.

**Distribution of points that students receive**

The distribution of student evaluation scores is calculated individually for each subject, taking into account the features and structure of the course. The current amount of points that a student can gain per one semester can be as high as possible and lower with the points awarded for the exam or pass.

The tables 1 and 2 give an example of the items succeeded by a student who can gain these points, these points may differ and are considered individually for a particular subject.

Table 1. - Points distribution for student achievement evaluation for passing

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Control work | Laboratory works | Course works (Course projects) | Computational graphic tasks | Individual tasks | Others | Passing | Sum |
| … | … | …. | … | … | …. | \* | … |

Table 2. - Points distribution for student achievement evaluation for exam

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Control work | Laboratory works | Course works (Course projects) | Computational graphic tasks | Individual tasks | Others | Passing | Sum |
| 40 | … | …. | … | 40 | 20 | \*\* | 100 |

\* Scoring is not required. Passing test can be obtained by accumulating points.

\*\* It is necessary to allocate points for the exam (the number of points individually for each discipline at the discretion of the teacher)

**Criteria and system for assessing students' knowledge and skills.**

According to the guidelines of ECTS, an assessment system should be understood as a set of methods (written, oral and practical tests, examinations, projects, etc.) used in assessing the achievement of the expected learning outcomes by the students.

Successful assessment of learning outcomes is a precondition for awarding credits to a person under study. Therefore, statements of learning outcomes of programme components should always be accompanied by clear and appropriate **assessment criteria** for awarding credits. This makes it possible to state that the learner has acquired the necessary knowledge, understanding, competences.

**Assessment criteria** are descriptions of what a person who is learning is expected to do in order to demonstrate the achievement of a learning outcome.

The main conceptual statements of the student's knowledge and skills assessment system are:

1. Improving the quality of training and competitiveness of specialists by stimulating independent and systematic work of students during an academic semester, establishment of constant feedback from teachers to each student and timely correction of his/her learning activities.

2. Improving the objectivity of students' knowledge assessment takes place through monitoring during a semester with the use of a 100-point scale (Table 2). Grades are necessarily translated into the national scale (with the state semester grades "excellent", "good", "satisfactory" or "unsatisfactory") and the ECTS scale (A, B, C, D, E, FX, F).

Table 3 - Knowledge and skills assessment scale: national and ECTS rating

|  |  |  |  |
| --- | --- | --- | --- |
| **Rating****Assessment, points** | **ECTS assessment and its definition** | **National assessment** | **Evaluation criteria** |
| **positive** | **negative** |
| **1** | **2** | **3** | **4** | **5** |
| 90-100 | А | Excellent  | - **Deep knowledge** of the educational material of the module contained in the **main and additional literature sources**;- **ability to analyze** the phenomena being studied in their relationship and development;- **ability to** perform **theoretical calculations;****- answers** to questions **are clear, concise, logically consistent;****- ability to solve complex practical problems.** | Answers to questions may contain **minor inaccuracies** |
| 82-89 | В | Good | - **Deep level of knowledge** in the amount of **required material** provided by the module;- ability to give **reasonable answers** to questions and perform **theoretical calculations**;- ability to solve **complex practical problems**. | Answers to the questions contain **certain inaccuracies**; |
| 75-81 | С | Good | - **Strong knowledge** of the studied material and its **practical application**;- ability to give **reasonable answers** to questions and perform theoretical calculations;- ability to solve **practical problems**. | - Inability to use theoretical knowledge to solve **complex practical problems.** |
| 64-74 | D | Satisfactory | - **Knowledge of the basic fundamental provisions** of the studying material, and their **practical application**;- the ability to solve simple **practical problems**. | Inability to give **well-reasoned answers** to the questions;- inability to **analyse** the material presented and **perform** **calculations**;- Inability to solve **complex practical problems**. |
| 60-63  |  Е | Satisfactory | - Knowledge of **the basic fundamental provisions** of the module material,- ability to solve the simplest **practical problems.** | Ignorance of **individual (non-principled)** **questions** from the module material- inability to make a **coherent and well-reasoned** opinion;- inability to apply theoretical statements in solving **practical problems** |
| 35-59 | FХ (потрібне додаткове вивчення) | Fail | **Additional study** of the module material can be performed **in the time provided by the educational curriculum.** | Ignorance of the **basic fundamentals** of the module- **significant errors** in answering questions;- inability to solve **simple practical problems**. |
| 1-34 |  F  (потрібне повторне вивчення) | Fail |  - | - Complete **lack of knowledge** of a considerable part of the module's study material;- **significant mistakes** in answering the questions;-ignorance of the main fundamentals;- inability to orient while solving **simple practical tasks** |

**Basic Literature:** (A list of literature that provides this subject)

|  |  |
| --- | --- |
| 1 | J. Lewis Blackburn Protective Relaying Principles and Applications − NY: CRC Press, 2006. |
| 2 | Eric H. Glendinning, Norman Glendinning Oxford English for Electrical and Mechanical Engineering, − Oxford Press, 1995. |
| 3 | Navy Electricity and Electronics Training Series. Edition Prepared by ETCS(SW) Donnie Jones, 1998. |
| 4 | John Bird Electrical Circuit Theory and Technology. − Oxford Revised: Newnes, 2003, − 984 p. |
| 5 | A First Course in Electrical and Computer Engineering By Louis Scharf. CONNEXIONS**,** Rice University, Houston, Texas, 2009, − 313 p. |
| 6 | Tony R. Kuphaldt Fundamentals of Electrical Engineering and Electronics, SDL, 2011. |

**Structural-logical scheme of education subject study**

Table 4. - List of subjects

|  |  |
| --- | --- |
| The study of this subject is based directly: | The results of the study of these subjects are based directly on: |
| Higher mathematics | Theory of automatic control of technological processes |
| Physics | Fundamentals of occupational safety and human health |

**Lead Lecturer:**

**Associate Professor of the Department**

**of Engineering Electrophysics**

**Honcharov Yevhen Viktorovych \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

(position, title, full name) (signature)