SYLLABUS OF THE ACADEMIC DISCIPLINE

"THEORETICAL FUNDAMENTALS OF ELECTRICAL ENGINEERING"

Academic degree: bachelor
Educational program: 141"Electric Power, Electrical Engineering and Electromechanics"
Training studies: 2, 3 and 4 semesters
3 quarter:
Lectures – 1 academicals hour;
Laboratory Work – 1 academicals hour;
Practical Training: 0 academicals hour;
4 quarter:
Lectures – 2 academicals hour;
Laboratory Work – 1 academicals hour.;
Practical Training: 1 academicals hour;
5 quarter:
Lectures – 2 academicals hour;
Laboratory Work – 2 academicals hour.;
Practical Training: 1 academicals hour
6 quarter:
Lectures – 2 academicals hour;
Laboratory Work – 2 academicals hour;
Practical Training: 1 academicals hour
7 quarter:
Lectures – 2 academicals hour;
Laboratory Work – 2 academicals hour;
Practical Training: 1 academicals hour
Number of hours (credits): 300 (10)
Languages of instruction: English

Course page on the distance learning site of NTU "DP":
https://do.nmu.org.ua/course/view.php?id=2632

Lecturer:

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Professor, Professor, Doctor of Technical Sciences

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1. Absract

The fundamental discipline "Theoretical Foundations of Electrical Engineering" (TFEE) belongs to the list of independent choice of the university disciplines at the educational level "bachelor", offered in the cycle of general and professional training of students within the educational program 141 "Electricity, Electrical Engineering and Electromechanics". It provides students with the formation of research professional-oriented competencies.

The TFEE discipline structurally consists of two parts: the theory of electric circuits and the theory of the electromagnetic field - these are two fundamental theories that form the basis used in all applied fields of electrical engineering, namely in power engineering, electric machines, electric drives, automatic control systems, microcircuit technique and power electronics, means of communication and measuring devices, non-stationary processes in power supply systems and in all other electrotechnical devices.

To facilitate the mastery of the material of the discipline in the theory of electric circuits are divided into sections: stationary DC circuits; single-phase and three-phase harmonic current circuits; circuits of inharmonic currents; circles with concentrated and distributed parameters. The modes of operation of circuits are analyzed both in stationary and non-stationary modes, when there are transients that are associated with changes in the accumulated electromagnetic energy; for two-port and passive filters the frequency properties of electric circuits are investigated.

In the theory of the electromagnetic field, the following sections are distinguished: electrostatic fields in dielectric and conductive media, magnetostatic fields, which are induced by direct currents, and alternating electromagnetic fields in stationary media.

2. The purpose and objectives of the discipline

The purpose – is to form a theoretical and practical basis for the analysis of processes in electric circuits and electromagnetic fields, which allows to acquire the necessary competencies for effective professional activity of a specialist in the field of power engineering, electrical engineering and electromechanics.

The discipline objectives:

The main objectives of the discipline "TFEE" are the analysis of electromagnetic phenomena and the creation of adequate mathematical models, theoretical and experimental study of the features of such phenomena that reflect the essential

aspects of physical processes and the choice of methods of analysis of characteristic of electromagnetic processes.

3. Learning outcomes

The student must know:

- equvalent circuits and parameters of electric power sources;
- properties of active and reactive impedances;
- modes of operation of power sources and loads;
- resonant phenomena in electric circuits of single-phase, three-phase and inharmonic currents
- steady state and transient processes in electrical circuits;
- properties of linear and nonlinear circles;
- circles with concentrated and distributed parameters;
- features of analysis of electromagnetic fields in inhomogeneous and homogeneous media.

Be able:

– make balances of currents, voltages and powers;
– analyze electromagnetic processes in electric circuits of direct, single-phase, three-phase and inharmonic currents;
– use methods of analysis and calculation of electrical circuits;
– to build vector diagrams of voltages, currents and powers for visualization of processes in harmonic current circuits;
– calculate the electromagnetic fields according to the Laplace and Poisson equations for homogeneous media and Maxwell's equations for inhomogeneous media.

Get skills:

– assembly and research of electric circuits of direct, single-phase, three-phase and inharmonic currents;
– tuning of current, voltage, power control devices.

4. Discipline structure

LECTURES
1. Linear DC circuits at steady state mode
2. Linear circuits of single-phase current at steady state mode

3. Magnetically coupled linear circuits of single-phase current at steady state mode
4. Linear circuits of three-phase current at steady state mode
5. Linear circuits of polyharmonic current at steady state mode
6. Classical and operator methods of analysis of transients in linear circles with lumped parameters
7. Nonlinear DC circuits at steady state mode
8. Nonlinear AC circuits at steady state mode
9. Methods of analysis of transients in nonlinear circles
10. Fundamentals of the theory of two-port circuits
11. Passive electrical filters
12. Circuits with distributed parameters
13. Electrostatic field in a dielectric medium
14. DC magnetic field
15. Alternating electromagnetic field in a stationary medium
Laboratory works
Learning the Lab Table and Experimental Researches of Electrical Circuits by the Method of Equivalent Resistance
Experimental Research of power Transfer from Active to Passive One-port Circuits by the Method of Equivalent Generator
Experimental Study of Series, Parallel and Mixed Connections of Resistive and Reactive Elements under AC
Experimental study of resonance phenomena in electrical circuits
Series and parallel connection of magnetically coupled coils
Symmetrical three-phase source and symmetrical load at symmetrical and asymmetrical wye-connection
Symmetrical three-phase source and symmetrical load at symmetrical and asymmetrical delta-connection
Experimental study of a three-phase circuit with a nonsymmetrical power supply
Experimental study of a circuit under a non-sinusoidal single-phase power

supply
Experimental study of a circuit under a non-sinusoidal three-phase power supply
The experimental analysis of transient processes in the circuit connection with inductance to DC source
The experimental analysis of transient processes in the circuit connection with capacitance to DC source
The experimental analysis of transient processes in the circuit connection with inductance and capacitance to DC source
The experimental analysis of steady state processes in the DC circuit connection with nonlinear element
The experimental analysis of steady state processes in the AC circuit connection with iron core coil
The experimental analysis of the phenomenon of voltage ferroresonance in series circuit
The experimental analysis of the phenomenon of relaxation self-excited oscillations in nonliear circuit
Parameters of an asymmetric two-port circuit
Homogeneous long line
Practical Classes
1. Linear DC circuits at steady state modes
2. Linear AC circuits at steady state modes
3. Magnetically coupled linear circuits of single-phase current at steady state modes
4. Linear circuits of three-phase current at steady state modes
5. Linear circuits of polyharmonic current at steady state modes

6. Classical and operator methods of analysis of transients in linear circles
7. Nonlinear DC circuits at steady state modes
8. Nonlinear AC circuits at steady state modes
9. Fundamentals of the theory of two-port circuits
10. Passive reactive filters
11. Circles with distributed parameters at steady state modes

5. Hardware and / or software

Gadgets with cellular internet are a must in lectures.

University mail account activated (student.i.p.@nmu.one) at Office365.

6. Evaluation system and requirements

6.1. The academic achievements of applicants based on the results of the course will be assessed on the scale below:

The sum of points for the academic achievements of the applicant	Score on a national scale
90 – 100	perfectly
75-89	fine
60-74	satisfactorily
0-59	unsatisfactorily

6.2. Degree-seeking students can receive a **final grade** in the discipline on the basis of current assessment of knowledge, provided that the number of points scored in the current testing and independent work will be at least 60 points.

Maximum rating:

The theoretical part	The practical part		Bonus	**Total**
	With timely delivery of work	In case of late delivery of works		
66	30	20	4	**100**

Final control takes the form of written work.
The ticket contains 6 questions, of which 5 - tests, 1 task.

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

6.3. Criteria for evaluating the final work:

5 test tasks with four answer options, 1 correct answer is evaluated in 3 points. The test is conducted using MicrosoftFormsOffice 365 technology.

Correctly solved problem is estimated at 5 points, and:

– 5 points - compliance with the standard, with units of measurement;

– **4 points** - compliance with the standard, without units of measurement or errors in calculations.

– 3 points - minor errors in formulas, without units of measurement.

– **2 points** - there are significant errors in the decision

– **1 poin**t - the given formulas do not completely correspond to the standard.

– 0 points - no solution is given.

6.4. Criteria for evaluating practical work:

From each practical work the applicant receives 5 questions from the list of control questions. The number of correct answers determines the number of points obtained.

7. Course policy

7.1. Academic Integrity Policy. Academic integrity of degree-seeking students is an important condition for mastering the results of training in the discipline and obtaining a satisfactory grade from the current and final controls. Academic integrity is based on condemnation of the practices of copying (writing with external sources other than those allowed for use), plagiarism (reproduction of published texts by other authors without attribution), fabrication (fabrication of data or facts used in the educational process). The policy on academic integrity is regulated by the Regulation "Regulations on the system of prevention and detection of plagiarism at the National Technical University" Dnieper Polytechnic **".**http://www.nmu.org.ua/ua/content/activity/us_documents/System_of_prevention_and_detection_of_plagiarism.pdf.

In case of violation by degree-seeking student the academic integrity (copying, plagiarism, fabrication), the work is evaluated unsatisfactorily and must be repeated. The teacher reserves the right to change the topic of the task.

7.2. Communication policy.

Degree-seeking students must have activated university mail.

All written questions to teachers regarding the course should be sent to the university e-mail.

7.3. Reassembly policy.

Works that are submitted in violation of deadlines without good reason are evaluated at a lower grade. Relocation takes place with the permission of the dean's office if there are good reasons (for example, sick leave).

7.4 Evaluation protest policy. If the degree-seeking student does not agree with the assessment of his knowledge, he may protest the assessment given by the teacher in the prescribed manner.

7.5. Attending classes.

Attendance is mandatory for full-time students. Good reasons for not attending classes are illness, participation in university events, student mobility, which must be documented. The student must inform the teacher either in person or through the headmaster about the absence from class and the reasons for absence.

For objective reasons (for example, international mobility) training can take place online in consultation with the course leader.

7.6. Bonuses. At the end of the course and before the start of the session, the degree-seeking student will be asked to fill in anonymously electronic questionnaires (MicrosoftFormsOffice 365), which will be sent to your university mailboxes. Completing the questionnaires is an important component of your learning activity, which will allow you to evaluate the effectiveness of the teaching methods used and take into account your suggestions for improving the content of the discipline "Theoretical Fundamentals of Electrical Engineering". The student receives 4 points for participating in the survey.

8 Recommended sources of information

1.Khilov V.S. Theoretical fundamentals of electric engineering. Textbook. / B. C. Хілов – Дніпро, НГУ, 2018. 467 с.

2. Хілов В.С. Теоретичні основи електротехніки. Підручник. / В. С. Хілов – Київ, Каравела, 2021. 468 с.

3. Alexander, C. Fundamentals of Electric Circuits. McGraw-Hill Companies. 2013. 995 p.

4. Aidala J.B., L.Katz. Transients in Electric Circuits. Englewood Cliffs, NJ: Prentice Hall, 1980. 318 p.

4. Angerbaur G.J. Principles of DC and AC Circuits. 3rd ed. Albany, NY: Delman Publishers, 1989. 524 p.
5. Bansal, R. (ed). Handbook of Engineering Electromagnetics. Marcel Dekker, Inc. New York. 2004. 690 p.
6. Caperhart, B.L. (ed). Encyclopedia of Energy Engineering and Technology in 3 volumes. Taylor & Francis Group, LLC. 2007. 1708 p.
7. Johnson D.H. Fundamental of Electrical Engineering. Connexions, Houston, Texas. 2013. 292 p.
8. Bakshi, U.A., Bakshi V.U. Basic Electrical Engineering. Technical Publication. Pune, India. 2009. Circuits. New 625 p.
9. Boctor, S.A. Electric circuit analysis. 2nd ed. Englewood Cliffs, NJ: Prentice Hall, 1992. 324 p.
10. Chares, K. Alexander, Matthew N.O. Sadiku. Fundamentals of Electric Crcuits. Mcgraw-Hil Companies. 2001. 940 p.
11. Lorrain P. Electromagnetic Fields and Waves Including Electric circuits. W/H/Freeman and Company. New York. 1988. 383 p.
12. Maxfield C. Electrical Engineering. Elsevier Inc. 2008. 1126 p.
13. Russer, P. Electromagnetics, Microwave Circuits and Antenna Design for Communications Engineering. Artech House, Inc. London. 2006. 757 p.
14. Sharma, S. Basic Electrical Engineering. I.K. International Publishing House Pvt. Ltd. New-Delhi, India. 2007. 598 p.