The syllabus of the discipline
Electrodynamics

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Field name	Detailed content, comments
Name of the faculty	Faculty of Infocommunications
Level of higher education	First (bachelor's)
Code and name of the specialty	172 Telecommunications and radio engineering
Type and name of educational program	EPP "Information and Network Engineering"
Name of the discipline	Electrodynamics
Number of ECTS credits	4
Discipline structure (distribution by types and hours of study)	24 hours - 12 lectures, 8 hours - 4 practical classes, 16 hours - 4 laboratory classes, 8 hours - 4 consultations, 64 hours - homework, **type of control**: exam
Schedule (terms) of studying the discipline	2nd year, III semester
Prerequisites for studying the discipline	Basic concepts of disciplines: Higher Mathematics, Physics, Theory of Electrical Circuits and Signals.
Competences, knowledge, skills, understanding, which is acquired by the applicant in higher education in the learning process	The discipline is used to form the following competencies: FC3 Ability to use basic methods, methods and means of obtaining, transmitting, processing and storing information; FC-8 Willingness to promote the introduction of advanced technologies and standards; FC-9 Ability to accept and develop new equipment in accordance with current regulations; FC-10 Ability to carry out installation, adjustment, adjustment, experimental verification of testing and commissioning of telecommunications facilities, means and equipment and willingness to promote the introduction of advanced technologies and standards for new generations of technologies; FC 15 Ability to perform calculations in the process of designing structures and means of information and telecommunication networks, telecommunication and radio systems, in accordance with the terms of reference using both standard and self-created methods, techniques and software tools for design automation
The quality of the educational process	Educational-methodical and material-technical resource provision of the educational program, within the framework of which the discipline is studied, meets the licensing requirements and accreditation conditions of the educational activity of the university. Annual monitoring and revision of the curriculum of the discipline in accordance with the requirements and recommendations of the Ministry of Education and Science, state certification of acquired competencies of graduates, standards of cooperation with employers to ensure a competitive level of training. Adherence to the principles of academic integrity (https://lib.nure.ua/plagiat). Contains public information on the requirements, competencies, level of education within the current educational program

<h1 style="text-align:center">Description and content of the discipline</h1>

The position of electrodynamics is based on many disciplines to be studied in the training of specialists in the field of telecommunications. Electrodynamics is an integral part of the foundation of both basic and applied disciplines of the bachelor's cycle. The provisions of electrodynamics indicate the physical principles and basis of methods of information transmission due to the propagation of the electromagnetic field in the form of a wave through media of various natures.

<h1 style="text-align:center">Content</h1>

Content module 1. Basic concepts and terms of electrodynamics
Topic 1. The concept of electromagnetic field. Sources and vectors of the electromagnetic field.
Topic 2. Fundamentals of field theory Maxwell's equation.
Topic 3. Classification of environments. Material equations.
Content module 2. The concept of electromagnetic waves
Topic 1. The method of complex amplitudes. Maxwell's equation in complex form.
Topic 2. Electromagnetic field energy. Vector poiting.
Topic 3. Electromagnetic waves. Flat electromagnetic wave. Polarization of an electromagnetic wave.
Content module 3. Propagation of radio waves and guides of the system
Topic 1. Radiation Guiding systems of electromagnetic waves. Types of guide systems and guide waves. Wave in coaxial cable. Attenuation in guide systems.
Topic 2. Radiation of electromagnetic waves. Elementary electric emitter. The field of an elementary electric emitter. Power, resistance, radiation pattern of an elementary electric emitter.
Topic 3. Elementary magnetic emitter. The field of an elementary magnetic emitter.
Content module 4. The concept of antennas and radio line
Topic 1. The principle of equivalence. Huygens principle. Antenna parameters.
Topic 2. Propagation of electromagnetic waves. Snelius' laws.Fresnel coefficients.
Topic 3. Calculation of the current value of the field. The concept of suppression multiplier. The basic equation of a radio line.

<h1 style="text-align:center">Learning outcomes of higher education</h1>

As a result of studying the discipline, students must:

- **know:** the concept of electromagnetic field, its properties and basic characteristics; methods of vector analysis and basics of field theory; the concept of electromagnetic field energy and the relationship of electrical and magnetic phenomena; formulation and purpose of Maxwell's equations and material equations of the environment; concepts and properties of electromagnetic waves; the concept of electromagnetic wave propagation and the impact of the environment on it; the concept of elementary emitters of the electromagnetic field; basic characteristics and basics of construction of antenna devices;
- **be able to:** formulate the conditions of tasks in the framework of electrodynamics; apply Maxwell's equations and material equations of the environment in the process of

solving problems; use the method of complex amplitudes in solving problems; calculate the parameters of the electromagnetic wave;

- **to own:** PRN1. Knowledge of theories and methods of basic and general engineering sciences to the extent necessary to solve specialized problems and practical problems in the field of professional activity; PRN3. Ability to apply knowledge in the field of informatics and modern information technologies, computer and microprocessor technology and programming, software for solving specialized problems and practical problems in the field of professional activity; PRN4.Ability to participate in the creation of application software for elements (modules, blocks, nodes) of telecommunication systems, infocommunication, telecommunication networks, radio systems and television and radio broadcasting systems, etc .; PRN5. Ability to calculate elements of telecommunication systems, infocommunication and telecommunication networks, radio systems and television and radio broadcasting systems, according to the terms of reference in accordance with international standards, using design automation tools, including created independently; PRN7. Ability to participate in the design of new (modernization of existing) telecommunication systems, infocommunication, telecommunication networks, radio systems and television and radio broadcasting systems, etc .; PRN8. Ability to apply modern achievements in the field of professional activity in order to build advanced telecommunication systems, infocommunication, telecommunication networks, radio systems and television and radio broadcasting systems, etc .; PRN9. Ability to administer telecommunication systems, infocommunication and telecommunication networks; PRN10. Ability to test telecommunication systems, infocommunication, telecommunication networks, radio systems and television and radio broadcasting systems in accordance with technical regulations and other regulations.

Assessment system according to each task for passing the test / exam

To evaluate the student's work during the semester, the final rating Q_{sem} is calculated as the sum of grades for different types of classes and control activities.

Type of lesson / control measure	Rating
Lb № 1, 2	$(6…10)×2 = 12…20$
Pr №1	$(6…10)×1 = 6…10$
Individual testing task 1	9…15
Control point 1	27…45
Lb № 3, 4, 5	$(6…10)×3 = 18…30$
Pr № 2	$(6…10)×1 = 6…10$
Individual testing task 2	9…15
Control point 2	33…55
Total for the semester	60…100

The combined exam is used as a form of final control for the discipline. With this type of control, the final grade Pp is calculated by the formula:

$$Pp = 0.6×Q_{sem} + 0.4×Q_{isp},$$

where Q_{sem} - grade for the semester in a 100-point system,

Q_{isp} - grade for the exam in a 100-point system.

The ticket for the exam consists of two theoretical questions and a task. Theoretical questions are evaluated at 30 points each, and the task - at 40 points (in total - 100 points).

Qualitative evaluation criteria in the national scale and ECTS

Satisfactory, D, E (60-74). Show the required minimum of theoretical knowledge. Know the ways and methods of solving practical problems and be able to use them in practice.

Well, C (75-89). Firmly know a minimum of theoretical knowledge. Demonstrate the ability to solve a practical problem and justify all stages of the proposed solution.

Excellent, A, B (90-100). Show complete knowledge of basic and additional theoretical material. Unmistakably solve a practical problem, explain and justify the chosen method of solution.

Assessment scale: national and ECTS

The sum of points for all types of educational activities	ECTS assessment	Score on a national scale	
		for exam, course project (work), practice	for offset
90 – 100	**A**	perfectly	credited
82-89	**B**	fine	
74-81	**C**		
64-73	**D**	satisfactorily	
60-63	**E**		
35-59	**FX**	unsatisfactory with the possibility of reassembly	not credited with the possibility of re-assembly
0-34	**F**	unsatisfactory with mandatory re-examination	not credited with compulsory re-study of the discipline

Methodical support

Basic literature
1. Baskakov S.Y. Elektrodynamyka y rasprostranenye radyovoln [Tekst]. – M.: Vyshch. shk., 1992. – 416 s.
2. Volman V.Y., Pymenov Yu.V. Tekhnycheskaia elektrodynamyka [Tekst]. – M.: Sviaz, 1971. – 487 s.
3. Pymenov Yu.V. ,Volman V.Y., Muravtsov A.D. Tekhnycheskaia elektrodynamyka [Tekst]: Ucheb. posobye dlia vuzov / Pod red. Yu.V. Pymenova. – M.:

Radyo y sviaz, 2000. – 536 s.

4. Shokalo V.M., Pravda I.V., Usin V.A., Vuntesmeri V.S., Hretskykh D.V. Elektrodinamika ta poshyrennia radiokhvyl. Ch.1. Osnovy teorii elektromahnitnoho polia [Tekst]: Pidruchnyk dlia studentiv VNZ / za zah. red. V.M Shokalo ta I.V. Pravdy. Kharkiv:KhNURE; Kolehium, 2009. 286 s.

5. Shokalo V.M., Pravda I.V., Usin V.A., Vuntesmeri V.S., Hretskykh D.V. Elektrodinamika ta poshyrennia radiokhvyl. Ch.2. Vyprominiuvannia ta poshyrennia elektromahnitnykh khvyl [Tekst]: Pidruchnyk dlia studentiv VNZ / za zah. red. V.M Shokalo ta I.V. Pravdy. Kharkiv:KhNURE; Kolehium, 2010. 435 s.

6. Sbornyk zadach po kursu «Elektrodynamyka y rasprostranenye radyovoln» / Pod red. S.Y. Baskakova S.Y. [Tekst]. – M.: Vyshch. shk., 1981. – 195 s.

Supporting literature

1. Bredov M.M., Rumiantsev V.V., Toptyhyn Y.N. Klassycheskaia elektrodynamyka [Tekst]: Ucheb. posobye dlia vuzov / Pod red. Y.N. Toptyhyna. – SPb.: Lan, 2003. – 400 s.

2. Vainshtein L.A. Elektromahnytnye volny [Tekst]. – M.: Radyo y sviaz, 1988. - 440 s.

3. Markov H.T., Petrov B.M., Hrudynskaia H.P. Elektrodynamyka y rasprostranenye radyovoln [Tekst]. – M.: Sov. radyo,1979. – 374 s.

4. Petrov B.M. Elektrodynamyka y rasprostranenye radyovoln [Tekst]: Ucheb.dlia vuzov. – M.: Radyo y sviaz, 2000. – 550 s.

5. Cherenkov V.S., Yvanytskyi A.M. Tekhnycheskaia elektrodynamyka [Elektronnyi resurs]: Kons. Lektsii dlia studentov, obuchaiushchykhsia po napravlenyiu «Telekommunykatsyy». – Odessa: ONAZ ym. A.S. Popova, 2006. – 160 s. Rezhym dostupa: www/URL: https://metod.onat.edu.ua/ru/metods/category/116/10 – Zahl. s э ekrana.

Methodical instructions for different types of classes

1. Metodychni vkazivky do laboratornykh robit z dystsypliny "Tekhnichna elektrodynamika" dlia studentiv spetsialnostei napriamu – Telekomunikatsii [Tekst] / uporiad. V.I. Yeliseiev; MONMS Ukrainy, KhNURE. – Kh. : KhNURE, 2011. – 40s.

2. Metodychni vkazivky do samostiinoi roboty z dystsypliny " Tekhnichna elektrodynamika" dlia studentiv spetsialnostei napriamu pidhotovky 6.050903 "Telekomunikatsii" [Tekst] / uporiad.V.I. Yeliseiev; MON Ukrainy, KhNURE. – Kh.: KhNURE, 2013. –72s.

Information support

1. Mathematical software package MathCad 2000 Pro.
2. Electronics WorkBench 5.12 Pro design software package