



SYLLABUS OF AN ACADEMIC DISCIPLINE «Materials Science»

Academic degree - Bachelor's
Specialty 133-«Sectoral mechanical engineering»
Academic programme - «Bachelor»
Year of study – 2, semester – 3, 4
Form of study full-time
Number of ECTS credits - 4
Language(s) of instruction - English

Lecturer of the discipline
Контактна інформація
лектора (e-mail)
URL of the e-learning
course on the NULES e-
learning portal

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ACADEMIC DISCIPLINE DESCRIPTION

(up to 1000 symbols)

Purpose is skills of Materials Science and laying the basis for the study subjects: "Machine parts", "Hoisting machinery", "Tractors and cars", "Agricultural and meliorative machines", "The safety and repair of machines."

Objectives:

- Study methods of obtaining metals and alloys;
- Study of the structure, properties and destination of metals and alloys;
- Studying the basic theory of heat treatment of carbon and alloy steels, their technology heat and chemical-heat treatment, as well as specific details and working of agricultural machines;
- The study of the structure, properties and appointment of non-metallic construction materials.

Competencies of the discipline:

Integral competence(IC): The ability to solve complex specialized tasks and solve practical problems in the field of mechanical engineering using the theories and methods of modern science based on a systems approach and taking into account the complexity and uncertainty of the operating conditions of technological systems.

General competencies (GC):

- GC2. Ability to apply knowledge in practical situations.
- GC5. Ability to generate new ideas (creativity).
- GC8. The ability to act socially responsibly and consciously.
- GC13. The ability to preserve and multiply moral, cultural, scientific values and achievements of society based on understanding the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and in the development of society, technology and technologies, to use various types and forms of motor activity for active recreation and leading a healthy lifestyle.

Special (professional) competences (SC):

SC6. The ability to evaluate the technical and economic efficiency of typical systems and their components based on the application of analytical methods, analysis of analogues and the use of available data.

SC9. The ability to carry out commercial and economic activities in the field of mechanical engineering.

Expected Learning Outcomes (ELO):

ELO4. Carry out engineering calculations to solve complex problems and practical problems in industrial mechanical engineering.

ELO6. Search for the necessary scientific and technical information in available sources, in particular, in a foreign language, analyze and evaluate it.

ELO9. Choose and apply the necessary equipment, tools and methods.

ELO12. Apply means of technical control to evaluate the parameters of objects and processes in industrial mechanical engineering.

ACADEMIC DISCIPLINE STRUCTURE IN EINE

Topic	Hours (lectures/laboratory, practical, seminars)	Learning outcomes	Tasks	Assessment
3 semester				
The module 1. Metal science				
Topic 1. The theory of alloys	4/4/4	Student should be <i>know</i> : the main connections between the composition, structure and properties of steels and cast irons and changes in these properties under thermal, chemical or mechanical stress.	Submitting a laboratory work. Completing tests. Writing independent works. Self-study (Performing laboratory and independent work in "Elearn"). Problem solving, of classification, structure and composition of carbon steels and cast irons.	10
Topic 2. Carbon steels and cast irons	6/6/6	Student should <i>be able to</i> based on knowledge of the working conditions to work of the machine parts to select of the steels and cast irons for their production. To analyze of structure and composition of steels and cast irons. To understand the structure and composition of steels and cast irons. To distinguish between carbon steels and cast irons. To apply carbon steels and cast irons.		15
The module 2. Bases of heat treatment of metals and alloys				
Topic 3. The theory of heat treatment	6/6/6	To know the main connections between the composition, structure and properties of steels and cast irons and changes in these properties under thermal, chemical or mechanical stress.	Submitting a laboratory work. Completing tests. Writing independent works. Self-study (Performing laboratory and independent	12
Topic 4. Technology of heat treatment	6/6/6			13

		<p>To be able to base on knowledge of the working conditions to work of the machine parts to select of the steels and cast irons for their production.</p> <p>To analyze of technology of heat treatment.</p> <p>To understand the theory of heat treatment.</p> <p>To distinguish between types of heat treatment.</p> <p>To apply different types of heat treatment in industry.</p>	<p>work in "Elearn").</p> <p>Problem solving, of technology of heat treatment</p>	
The module 3. Alloyed steels and alloys				
Topic 5. The alloying theory	4/4/4	To know the main connections between the composition, structure and properties of alloying steels, non-ferrous metals and alloys.		10
Topic 6. Classification of alloy steels, marking and their use in agriculture	4/4/4	<p>To be able to base on knowledge of the working conditions to work of the alloying steels, non-ferrous metals and alloys</p> <p>To analyze of manufacture technology of alloy steels.</p> <p>To understand the alloy steels.</p> <p>To distinguish between types of alloying steels.</p> <p>To apply different types of alloy steels in industry.</p>	<p>Submitting a laboratory work.</p> <p>Completing tests.</p> <p>Writing independent works.</p> <p>Self-study (Performing laboratory and independent work in "Elearn").</p> <p>Problem solving of classification of alloy steels, marking and their use in agriculture</p>	10
Total for 3 semester				70
Examination				30
Total for 3 semester				100
4 semester				

The module 4. Steels and alloys with special properties				
Topic 1. Corrosion and heat resistant steels and magnetic alloys.	2/2/4	To know the main connections between the composition, structure and properties of corrosion and heat resistant steels and magnetic alloys.		10
Topic 2. Amorphous, bimetallic and composite materials and materials with shape memory	2/2/6	To be able to base on knowledge of the working conditions to work of the amorphous, bimetallic and composite materials. To analyze of manufacture technology of amorphous, bimetallic and composite materials. To understand the amorphous, bimetallic and composite materials. To distinguish between amorphous, bimetallic and composite materials. To apply different types of amorphous, bimetallic and composite materials in industry.	Submitting a laboratory work. Completing tests. Writing independent works. Self-study (Performing laboratory and independent work in "Elearn"). Problem solving of amorphous, bimetallic and composite materials	15
The module 5. Non-ferrous metals and alloys				
Topic 3. Copper, aluminum, titanium, magnesium and their alloys	4/4/6	To know the main connections between the composition, structure and properties of Copper, aluminum, titanium, magnesium and their alloys	Submitting a laboratory work. Completing tests. Writing independent works. Self-study (Performing laboratory and independent work in "Elearn").	15
Topic 4. Zinc, lead. Solders. Antifriction alloys	3/3/6	To be able to base on knowledge of the working conditions to work of the zinc, lead. solders. antifriction alloys. To analyze of manufacture	Problem solving of antifriction alloys	10

		<p>technology of the zinc, lead. solders. antifriction alloys.</p> <p>To understand the non-ferrous metals and alloys.</p> <p>To distinguish between types of the zinc, lead. solders. antifriction alloys.</p> <p>To apply different types of the zinc, lead, solders, antifriction alloys in industry.</p>		
The module 6. Nonmetallic construction materials				
Topic 5. Polymers and plastics. Rubber. Glue materials. Inorganic glass.	2/2/6	<p>To know the main connections between the composition, structure and properties of polymers and plastics.</p> <p>To be able to base on knowledge of the working conditions to work of the rubber.</p> <p>To analyze of manufacture technology of polymeric materials.</p> <p>To understand the paints.</p> <p>To distinguish between types of wood.</p> <p>To apply different types of insulating materials in industry.</p>		10
Topic 6. Paints and insulating materials. Wood.	2/2/2		<p>Submitting a laboratory work.</p> <p>Completing tests.</p> <p>Writing independent works.</p> <p>Self-study (Performing laboratory and independent work in "Elearn").</p> <p>Problem solving of tech insulating materials.</p>	10
Total for 4 semester				70
Examination				30
Total for the course				100

ASSESSMENT POLICY

<i>Deadlines and exam retaking policy:</i>	The student must submit the work within the time specified by the teacher. Works that are submitted in violation of deadlines without good reason are evaluated at a lower grade. Rearrangement of modules takes place with the permission of the lecturer if there are good reasons (for example, hospital).
<i>Academic Integrity</i>	Write-offs during tests and exams are prohibited (including the use of mobile devices). Course papers, abstracts must have correct text references to the

Policy:	literature used
Attendance policy:	The student is obliged to attend classes of all kinds every day in accordance with the established schedule, not to be late, to have the appropriate appearance. For objective reasons (for example, illness, international internship) training can take place individually (in online form in consultation with the dean of the faculty)

SCALE FOR ASSESSING STUDENTS 'KNOWLEDGE AND SKILLS

Student's rating, points	National grading of exams and credits	
	exams	credits
90-100	excellent	pass
74-89	good	
60-73	satisfactory	
0-59	unsatisfactorily	fail

RECOMMENDED SOURCES OF INFORMATION

1. Aftandilants Y., Stepanechko O., Zazymko O. Material Science: Textbook. Київ, НУБІП України, 2022.- с. 528.
2. Афтанділянц Є.Г., Зазимко О.В., Лопатько К.Г. Матеріалознавство: Підручник (Гриф надано Міністерством освіти і науки, молоді та спорту України, лист №1/11-18055 від 20 листопада 2012 р.). Херсон, Видавець Грінь Д.С., 2013.- с 612.
3. Практикум з матеріалознавства. Навчальний посібник. (гриф МОН (лист № 1/11-4472 від 27.02.2013 р.))/ Котречко О. О. Зазимко, К.Г. Лопатько, Є.Г. Афтанділянц, Гнилоскурєнко В. В.// Херсон: Олді Плюс, 2013.-с. 500.
4. Опальчук А.С., Афтанділянц Є.Г., Роговський Л.Л., Семеновський О.Є., Клендій М.Б., Біловод О.І., Дудніков І.А., Матеріалознавство і технологія конструкційних матеріалів: підручник для вищих навчальних закладів III-IV ступенів акредитації; за ред. А.С. Опальчука і О.Є. Семеновського. – Ніжин: Видавець ПП. Лисенко М.М., 2013. – 752 с.
5. Попович В., Голубець В., Технологія конструкційних матеріалів і матеріалознавство: Навчальний посібник для вищих навчальних закладів: У 2-х кн. Книга II. – Суми: ВТД «Університетська книга», 2002. – 260 с.
6. Афтанділянц Є.Г., Зазимко О. В., Лопатько К.Г., Технологія конструкційних матеріалів і матеріалознавство. Курс лекцій. Частина 1. Металургія. Київ, НАУ, 2005.- с.115.
7. Хільчевський В.В. та ін., Матеріалознавство і технологія конструкційних матеріалів, К: Либідь, 2002, 326с.
8. Бялік О.М., Металознавство, К: Політехніка, 2002, 383с.
9. Матеріалознавство і технологія металів. http://univer.nuczu.edu.ua/tmp_metod/924/MZTM_KONSP_LEK.pdf
10. Особливості хіміко-термічної обробки металів і сплавів. https://fizmat.7mile.net/materialoznavstvo/3_4_2-himiko-termichna-obrobka.html
11. Класифікація та обладнання нагрівальних печей. https://fizmat.7mile.net/materialoznavstvo/3_3_5-nagrivalni-pechi.html 4. Термічна обробка виробів із сталі. <https://www.youtube.com/watch?v=8UvkV92z2fI>
12. Термічна обробка і структури. <https://www.youtube.com/watch?v=7mpAt7h317c>