National University of Life and Environmental Sciences of Ukraine

Department of Material Technology and Material Science (MTMS)

"APPROVED"
Dean of Faculty Design and Engineering

Zinoviy RUZHYLO
«___» _____2024

"APPROVED"
at a meeting of the department MTMS
Minutes № 15 of "14"05 2024
Head of Department
Kostiantyn LOPATKO

"REVIEWED "
Guarantor of the "Sectoral mechanical engineering"
Volodymyr BULGAKOV

CURRICULUM OF ACADEMIC DISCIPLINE
"Technology of construction materials "

Field of knowledge 13 " Mechanical engineering "
Speciality 133 "Sectoral mechanical engineering"
Academic program Sectoral mechanical engineering
Faculty of Design and Engineering

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Kyiv – 2024

Description of the discipline
"Technology of construction materials"

Academic degree, specialty, academic programme		
Academic degree	*Bachelor's*	
Speciality	133 "Sectoral mechanical engineering"	
Academic program	Sectoral mechanical engineering	
Characteristics of the discipline		
Type	Obligatory	
Total number of hours	120	
Number of credits ECTS	4	
Number of thematic modules	6	
Form of assessment	*Exam* *Credit*	
Indicators of the discipline for full-time and part-time forms of university study		
	Full-time	Part-time
Year of study (course)	1,2	1/2
Semester	2/3	2/3
Lectures	*30/15* hr.	*2/6* hr.
Practical, seminar classes	-	-
Laboratory classes	*15/15* hr.	*2/8* hr.
Self-study	*30/15* hr.	*-/356* hr.
Individual assignments	- hr.	- hr.
Number of hours per week for full-time students	*3/2* hours.	*13/14* hr.

1. Aim, objectives, competences and expected learning outcomes of the discipline

Aim is skills of Technology of construction materials 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 of studying the discipline is to study:

- the methods of obtaining metals and alloys;
- the structure, properties and destination of metals and alloys;

Acquisition of competencies:

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 of the specialty (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):

ELO03. To know and understand the systems of automatic management of objects and processes of industrial engineering, to have skills in their practical use.

ELO04. Carry out engineering calculations to solve complex problems and practical problems in industrial mechanical engineering.

ELO08. Understand the relevant methods and have the skills to design typical assemblies and mechanisms in accordance with the task.

2. The program and structure of the discipline for

– full-time (part-time) form of study;

– reduced full-time (part-time) form of study.

Modules and topics	**Number of hours**												
	Full-time							**Part-time**					
	Weeks	Total	Including					Total	Including				
			l	p	lab	ind	s.st		l	p	lab	ind	s.st
1	2	3	4	5	6	7	8	9	10	11	12	13	14
The module 1. **Metallurgy of ferrous metals**													
Topic 1. Purpose and objectives of the course. The source materials in metallurgy and obtaining methods metals from ores.	1	6	2	-	2	-	2	4	2	-	2	-	-
Topic 2. Metallurgy of the pig iron. Materials for the production of cast iron. Preparation ores. The structure and work of the blast furnace.	2	4	2	-	-	-	2	-	-	-	-	-	-
Topic 3. Blast furnace products and their using. Blast furnace cast iron classification. Blast furnace gas and slag and their using.	3	6	2	-	2	-	2	-	-	-	-	-	-
Topic 4. Steel metallurgy. The source materials for steel production, steel melting furnaces and steel melting technological	4	4	2	-	-	-	2	-	-	-	-	-	-

processes.													
Topic 5. The influence of method of production on steel quality. Processes of deoxidizing steel. Steel production in open hearth furnaces and oxygen converters.	5	6	2	-	2	-	2	-	-	-	-	-	-
Topic 6. Steel production in electric furnaces. Special methods of obtaining high-quality steels.	6	4	2	-	-	-	2	-	-	-	-	-	-
Topic 7. Pouring steel. Structure steel ingots. Prospects for the development of steel production.	7	6	2	-	2	-	2	-	-	-	-	-	-
Total for module 1	36		14	-	8	-	14	4	2	-	2	-	-
The module 2. **Technology of nonferrous metallurgy**													
Topic 1. Nonferrous metallurgy. Copper. The essence of the process of obtaining copper from ore. Matte receiving.	8	4	2	-	-	-	2	-	-	-	-	-	-
Topic 2. Obtaining and refining of blister copper. Marking and using copper in technics.	9	6	2	-	2	-	2	-	-	-	-	-	-
Topic 3. Aluminium. Aluminum receiving of ores. Alumina electrolysis and aluminum refining.	10	4	2	-	-	-	2	-	-	-	-	-	-
Topic 4. Titanium-magnesium metallurgy. Production of refractory metals and nickel.	11	6	2	-	2	-	2	-	-	-	-	-	-
Total for module 2	20		8	-	4	-	8	-	-	-	-	-	-
The module 3. **The powder metallurgy basics**													
Topic 1. Introduction to powder metallurgy. Obtaining powders. Preparation of powders to the	12-13	8	4	-	4	-	2	22	2	-	-	-	20

formation.													
Topic 2. Pressing, rolling, extrusion, slip casting. Sintering, additional and finishing treatment of powder products.	14-15	8	4	-	4	-	3	22	-	-	2	-	20
Topic 3. Classification, marking powders and their applications in engineering.	14-15	4	2	-	-	-	2	-	-	-	-	-	-
Total for module 3	19		8	-	3	-	8	-	-	-	-	-	-
The module 4. **Foundry**													
Topic 1. Introduction. Technological scheme of casting manufacture. Methods of manufacturing castings and kinds of molds.	1	4	2		2			54	2		2		50
Topic 2. Pouring, knocking out mould and cores, clearing and cutting of castings.	2	6	3		3			52			2		50
Topic 3. Special methods of manufacture castings. Technological features castings manufacture from various alloys (cast iron, steel, non-ferrous metals and alloys).	3	4	2		2			50					50
Total for module 4	14		7		7			156	2		4		150
The module 5. **Treatment of metals and alloys by pressure**													
Topic 1. Physical and technological bases of metal deformation. Temperature interval of steel treatment by pressure. Methods of heating and heating furnaces	4	4	2		2			54	2		2		50
Topic 2. Classification of treatment methods by	5	4	2		2			50					50

pressure. The processes forging, drawing, pressing of steel billet. Hot and cold volumetric sheet stamping.												
Total for module 5	8		4		4			54	2	-	2	-	50
The module 6. **The welding technology**													
Topic 1. Theoretical basis of welding. Metallurgical and chemical-physical phenomena in the welding zone and their influence on the structure of ambient zone. The welding classification.	6	6	2		2		2		2				50
Topic 2. Electric arc and gas welding	7-8	7	2		2		3				2		56
Total for module 6	13		4		4		5		2		2		116
Total hours	419		45		30		45	374	8	-	10	-	356

3. Topics of laboratory classes

№	Topic title	Hour
2 semester		
1	Study of the source materials of the blast furnace manufacture	2
2	Blast furnace products	2
3	The source materials of the steel making	2
4	The steel making products	2
5	Rolled-formed sections	2
6	The source materials and products of nonferrous metallurgy	2
7	Determination of the properties of властивостей metallic powders	2
8	Hardness determination of the steel and alloys	2
3 semester		
1	Determination of properties of molded materials	2
2	Designing of the technological process of casting manufacturing	3
3	Designing of the technological process of manufacturing steel forgings	2
4	The influence of cold plastic deformation on properties and structure of steel	2
5	Construction of the characteristics of the electrical welding transformer	2
6	Determination of the regimes and technological coefficients at electric arc welding	2
7	Welded seam defects and control methods	2

4. Topics for self-study

№	Topic title	Number of hours
1	Powder metallurgy	2
2	Acid fluxes	2
3	Basic fluxes	2
4	Charge	2

5	Non-metallic inclusions	2
6	Shrinkage cavity	2
7	Slag	2
8	The ingot structure	2
9	Blast-furnace products	2
10	Steel pouring	2
11	Cast irons	2
12	Refractory materials	2
13	Treatment of metals by pressure	3
14	Deoxidation	2

5. Tools for assessing expected learning outcomes:

- exam;
- credit;
- module tests;
- presentation of laboratory works

6. Teaching methods.

1) Verbal:
   -lectures;
2) Visual:
   -slides, video, visual material (perts, charts, stands).
3) Practical:
   - laboratory work;
   - training and factory practices;
   - self-study.

7. Assessment methods

- exam;
- credit;
- module tests;
- control works;
- presentation of laboratory works.

8. Distribution points that receive by students.

The assessment of students' knowledge and skills is conducted by means of a 100-point scale and is converted into national grades according to Table 1 of the current *Exam and Credit Regulations at NULES of Ukraine*.

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

To determine a student's rating in the discipline $\mathbf{R_{DIS}}$ (up to 100 points), the received assessment rating $\mathbf{R_A}$ (up to 30 points) is added to the academic performance raiting $\mathbf{R_{AP}}$ (up to 70 points): $\mathbf{R_{DIS} = R_{AP} + R_A}$.

9. Teaching and learning aids

e-learning course of the discipline «Technology of construction materials» (https://nubip.edu.ua/sites/default/files/u374/1_z_eng_robocha_programa_tkm_2023_0.pdf)
- lectures and presentations (in electronic form);
- textbooks and manuals;
- guidelines for studying a discipline by full-time and part-time students;
- stands, posters;
- equipment and various device.

10. Recommended sources of information

1. Construction materials engineering. Tutorial/Y. Aftandilyants, O. Zazymko, O. Ivanova, K. Lopat'ko //Kyiv: NULES of Ukraine, 2017.-p. 523
2. Афтанділянц Е. Г., Зазимко О.В., Лопатько К. Г., Іванова О. В. Технологія конструкційних матеріалів: Навчальний посібник в 2-х книгах. Книга 1. К.: НУБіП, 2016.- с. 511
3. Афтанділянц Є.Г., Зазимко О. В., Лопатько К.Г. Технологія конструкційних матеріалів і матеріалознавство. Частина І (А-О). Російсько – англійсько – український термінологічний словник. К.: Вид. Центр НАУ, 2005. - 346 с.
4. Афтанділянц Є.Г., Зазимко О. В., Лопатько К.Г. Технологія конструкційних матеріалів і матеріалознавство. Частина ІІ (П-Я). Російсько – англійсько – український термінологічний словник. К.: Вид. Центр НАУ, 2005. - 282 с.
5. Афтанділянц Є.Г., Зазимко О. В., Лопатько К.Г. Технологія конструкційних матеріалів і матеріалознавство. Курс лекцій. Частина ІІ. Металознавство. Київ, НАУ, 2010.- с.356.
6. 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.
7. 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, Гнилоскуренко В. В.// Херсон: Олді Плюс, 2013.-с. 500.
8. Матеріалознавство і технологія конструкційних матеріалів: Підручник (Гриф надано Міністерством освіти і науки України, лист №1/11-9794 від 10.06.2013р.)/Опальчук А.С., Афтанділянц Є.Г., Роговський Л.Л., Семеновський О.Є //Ніжин, ПП Лисенко М.М, 2013.- с 752.
9. Опальчук А.С., Котречко О.О., Роговський Л.Л. Лабораторний практикум з технології конструкційних матеріалів і матеріалознавства. Навч. посібник/ За ред. А.С. Опальчука. – К.: Вища освіта, 2006.- 287 с.: іл.
10. Сологуб М.А. "Технологія контрукційних матеріалів", К:Вища школа, 2002, 373с.
11. Хільчевський В.В. та ін. "Матеріалознавство і технологія конструкційних матеріалів", К:Либідь, 2002, 326с.
12. Попович В. Технологія конструкційних матеріалів і матеріалознавство. Книга І. Львів. 2000.-с.264.
13. Марки сталей і сплавів: властивості та характеристики https://metinvestholding.com/ua/products/steel-grades
14. Що таке чавун? Характеристики металу, особливості виробництва і застосування https://metinvest-smc.com/ua/articles/chto-takoe-chugun-kharakteristiki-metalla-osobennosti-proizvodstva-i-primeneniya/
15. Сплави кольорових металів https://uk.wikipedia.org/wiki/%D0%A1%D0%BF%D0%BB%D0%B0%D0%B2%D0%B8_%D0%BA%D0%BE%D0%BB%D1%8C%D0%BE%D1%80%D0%BE%D0%B2%D0%B8%D1%85_%D0%BC%D0%B5%D1%82%D0%B0%D0%BB%D1%96%D0%B2
16. Керамічні матеріали https://www.pharmencyclopedia.com.ua/article/3477/keramichni-materiali
17. Композиційні матеріали https://mozok.click/1786-kompozicyn-materali.html

18. Теплоізоляційні матеріали https://euroterm.com/brand-thermaflex/?gclid=EAIaIQobChMI15zGpYzl8QIVHQCiAx0gKg9iEAAYASAAEgJj1vD_BwE
19. Світлопрозорі конструкції. https://stroyrec.com.ua/sv%D1%96tloprozor%D1%96-konstrykc%D1%96%D1%97-ogliad-pol%D1%96mernih-sv%D1%96tloprozorih-mater%D1%96al%D1%96v/