NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE Material Science and Material Technology Department

"APPROVED" Faculty of Design and Engineering

"_10__"___06____ 2025

CURRICULUM OF ACADEMIC DISCIPLINE

"Technology of construction materials"

Field of knowledgeG Engineering, manufacturing and building industrySpecialtyG11 Mechanical engineering (for specializations)Academic programmeMechanical engineeringFacultyDesign and EngineeringAuthor(s):Associate professor, PhD. Svyatoslav GNYLOSKURENKO,

Description of the discipline

The course "Technology of construction Materials" is a comprehensive discipline that contains basic information about methods of obtaining metals from ores, technologies for obtaining blanks, and methods of their physicochemical and mechanical processing in order to give them the specified properties and design parameters necessary in mechanical engineering technology.

Field of knowledge, specialty, a	academic programme, academ	lic degree		
	D1 - 1			
Academic degree	Bachelor			
Specialty	G11 Mechanical engineering	(for specializations)		
Academic programme	Mechanical engineering			
Chara	acteristics of the discipline			
Туре	compu	lsory		
Total number of hours	18	0		
Number of ECTS credits	6			
Tumber of modules 6				
Course project (work) (if any)	-			
Form of assessment	exam/credit			
Ind	licators of the discipline			
for full-time and	l part-time forms of university	y study		
	Full-time	Part-time		
Year of study	1,2	1,2		
Semester	2/3	2/3		
Lectures	<i>30/15</i> hours.	2/6 hours.		
Practical classes and seminars	-			
Laboratory classes	<i>15/15</i> hours.	2/8 hours.		
Self-study	<i>60/45</i> hours.	-/356 hours.		
Number of hours per week for full- time students	<i>3/2</i> hours.	<i>13/14</i> hours.		

1. Purpose, competencies and program outcomes of the academic discipline

The work program of the course "Technology of Structural Materials" is designed for students of engineering faculties with mechanical engineering specialties.

The purpose of the discipline is the general technological training of a future specialist in the field of structural materials and their hot and cold processing, as well as acquiring skills in materials science and laying the foundation for studying the disciplines: "Machine Parts", "Lifting and Transport Machinery", "Tractors and Automobiles", "Agricultural and Reclamation Machinery", "Machine Reliability and Repair".

Acquisition of competencies:

Integral competence (IC): The ability to solve complex specialized tasks and solve practical problems in the field of mechanical engineering using 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 competences (GC):

GC5. Ability to generate new ideas (creativity).

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 engineering, to use various types and forms of physical activity for active recreation and leading a healthy lifestyle;

GC14. Ability to make decisions and act in accordance with the principle of nonacceptance of corruption and any other manifestations of dishonesty.

special (professional) competencies of the specialty (SC):

*SC*6. Ability to assess 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.

*SC*9. Ability to carry out commercial and economic activities in the field of mechanical engineering.

Program Learning Outcomes (PLN) :

PLN1. Knowledge and understanding of the principles of technological, fundamental and engineering sciences that underlie mechanical engineering in the relevant industry.

PLN2. Knowledge and understanding of mechanics and mechanical engineering and the prospects for their development.

PH6. Find the necessary scientific and technical information in available sources, in particular, in a foreign language, analyze and evaluate it.

PLN6. Understand appropriate methods and have the skills to design typical assemblies and mechanisms in accordance with the task.

PLN10. Understand the problems of occupational safety and legal aspects of engineering activities in mechanical engineering, skills in predicting the social and environmental consequences of implementing technical tasks.

PLN13. Understand the structure and services of mechanical engineering enterprises.

	acture					~ - r -							
		Number of hours											
Names of content		da	ay un	ifor	m			С	orres	pond	ence f	form	
modules and topics	weeks	total			includ	ling		total		i	nclud	ing	
			1	n	lab	ind	s.r.		1	n	lab	ind	s.r.
1	2	3	4	5	6	7	8	9	10	11	12	13	14
	2nd semester												
	Module №. 1. Ferrous Metallurgy												
Topic 1. Course		-									-		
objectives and tasks.	1	6	2	-	2	-	2	4	2	-	2	-	-
Methods of obtaining													
metals from ores.													
Topic 2. Metallurgy													
of blast furnace irons.	2	4	2	-	-	-	2	-	-	-	-	-	-
Topic 3. Blast	3	6	2	-	2	-	2	-	-	-	-	-	-
furnace products and													
their use.													

2. Program and structure of the academic discipline

				1		1	-	1		r		1	
Topic 4. Steel	4	4	2	-	-	-	2	-	-	-	-	-	-
metallurgy.	~	6	2		2								
Topic 5. The	5	6	2	-	2	-	2	-	-	-	-	-	-
influence of the													
method of steel													
production on its													
quality. Steel													
deoxidation													
processes.	6	4	-										
Topic 6. Steel	6	4	2	-	-	-	2	-	-	-	-	-	-
production in electric													
furnaces. Special													
methods for													
obtaining high-													
quality steels.													
Topic /. Steel	7	6	2		2								
casting. Structure of	1	6	2	-	2	-	2	-	-	-	-	-	-
steel ingots.			1.1		0				-				
Total by module 1		36	14	-	8	-	14	4	2	-	2	-	-
	M. d.	1. Nr. O. N	f			- 4 - 11	4		_				
	Modu	le №. 2. f	NONI	erre	ous m	etanu	rgy te	cnnology	7	1	1	ł	1
Topic I. Nonferrous	0	4	2										
metallurgy. Copper.	8	4	2	-	-	-	2	-	-	-	-	-	-
The essence of the													
process of obtaining													
copper from ores.													
Topic 2. Obtaining	0	-			•								
and refining raw	9	6	2	-	2	-	2	-	-	-	-	-	-
copper. Marking and													
use of copper in													
technology.													
Topic 3. Aluminum.													
Electrolysis of	10	4	2	-	-	-	2	-	-	-	-	-	-
alumina, aluminum													
refining.													
Topic 4. Titanium-													
magnesium	11	6	2	-	2	-	2	-	-	-	-	-	-
metallurgy.													
Production of													
refractory metals.													
Production of nickel.													
Together by content	2	20	8	-	4	-	8	-	-	-	-	-	-
module 2													
	Module	e №. 3. F i	unda	me	ntals	of po	wder 1	netallurg	gy				
Topic 1. Introduction]	12	4	2	-	-	-	2	-	-	-	-	-
to powder metallurgy													
Topic 2. Methods of	1	3	11	4	-	3	-	4	-	-	-	-	-
obtaining powder													
products													

Topic 3	1/ 15	1	2				2						
Classification	14-15	4	2	-	-	-	2	-	-	-	-	-	-
Labeling of poyndard													
and their employetion													
in machanical													
in mechanical													
Tatal has use data 2	1	<u>^</u>	0		2		0						
Total by module 3	1	9	8	-	3	-	8	-	-	-	-	-	-
	1	Module		+. F (ounar	y pro	aucu	on CA			0		50
Topic 1. Introduction.	1	4	2		2			54	2		2		50
Methods of making													
castings and types of													
casting molds.			2		2			50			-		50
Topic 2. Casting,	2	6	3		3			52			2		50
knocking out molds													
and cores, cleaning													
and cutting off													
castings.		4	2		-			50					50
Topic 3. Special	3	4	2		2			50					50
methods of													
manufacturing													
castings.													
feetures													
reatures of													
manufacturing													
allow													
Total modulo 4	1	1	7		7			156	2		1		150
	1	T	3	ard s	, emest	er		150	2		т		150
М	odule No	5 Press	ure f	rea	tment	t of m	etals	and ALI	OVS				
Topic 1. Physical and	4	4	2		2			54	2	, 	2		50
technological	ľ	•			2			51			2		50
foundations of metal													
deformation													
Methods of													
increasing the													
plasticity of metals													
and allovs													
Topic 2.	5	4	2		2			50					50
Classification of													
pressure processing													
methods.													
Total modulo 5	8		4		4			54	2	-	2	-	50
Module №. 6. Welding production technology													
Topic 1. Theoretical	6	6	2		2		2		2				50
foundations of													
welding. Chemical-													
metallurgical and													
physical phenomena													
in the welding zone				1	1	1		1	1	1	1	1	
e													
and their influence on													
and their influence on the structure of the													
and their influence on the structure of the surrounding zone.													

welding types.											
Topic 2. Electric arc	7-8	7	2	2	3				2		
and gas welding.											
Total modulo 6	1	3	4	4	5		2		2		116
Total hours	180		45	30	105	374	8	-	10	-	356

3. Lecture topics

No.	Topic title	Q-ty,
1	Course objectives and tesling Methods of extracting metals	
1	from ores	Z
2	Metallurgy of blast furnace irons	2
3	Blast furnace products and their uses	2
<u> </u>	Steel metallurgy	2
5	Steel casting Structure of steel ingots	2
6	Nonferrous metallurgy Copper The essence of the process of	2
0	obtaining copper from ores	
7	Aluminum. Electrolysis of alumina, refining of aluminum.	2
8	Titanium-magnesium metallurgy. Production of refractory	2
	metals. Production of nickel.	
9	Introduction to powder metallurgy.	2
10	Methods of obtaining powder products	4
11	Classification, labeling of powders and their application in	2
	mechanical engineering.	
12	Introduction. Methods of making castings and types of casting	2
	molds.	
13	Pouring, knocking out molds and cores, cleaning and cutting	2
	off castings.	
14	Special methods of manufacturing castings. Technological	2
	features of manufacturing castings from various alloys	
15	Physico-technological foundations of metal deformation.	2
	Methods for increasing the plasticity of metals and alloys	
16	Classification of pressure processing methods.	2
17	Theoretical foundations of welding. Chemical-metallurgical	2
	and physical phenomena in the welding zone and their	
	influence on the structure of the surrounding zone.	
	Classification of welding types.	
18	Electric arc and gas welding.	2

4. Topics of laboratory classes

No.	Topic name	Number				
salary		hours				
	2nd semester					
1	Study of blast furnace production starting materials	2				
2	Blast furnace products	2				
3	Study of the features of the use of non-ferrous metal alloys	2				

	in various operating conditions			
4	Determination of properties of metal powders	2		
5	Powder metallurgy products and their applications	2		
6	Determining the properties of molding materials	1		
7	Design of the technological process for manufacturing	4		
	castings			
Total for 2 semesters				
	3rd semester			
1	The effect of cold plastic deformation on the properties and	2		
	structure of steel			
2	Studying the effects of sintering and recrystallization	2		
3	Design of the technological process for manufacturing steel	4		
	forgings			
	Features of obtaining and using bent profiles	2		
5	Construction of the characteristics of an electric welding	2		
	transformer			
6	Determination of modes and technological coefficients in	2		
	electric arc welding			
8	Methods of researching weld defects and methods of its	1		
	control			

5. Topics for independent work

No. of	Topic name	Number
the		of hours
company		
1	What are the industrial methods of extracting metals from	5
	ores? Their disadvantages and advantages.	
2	Technologies for producing machine-building cast irons	10
3	Describe the technologies of special casting methods	10
4	Main technological characteristics of casting alloys	10
5	Alloys subject to pressure treatment and	10
6	Obtaining blanks by pressure processing methods	10
7	Advantages and disadvantages of methods of obtaining	15
	blanks by casting and pressure processing	
8	Features of electron beam welding	10
9	Advantages and disadvantages of welding methods with	10
	consumable and non-consumable electrodes	
10	Features of welding in different environments	10

6. Methods and means of diagnosing learning outcomes:

- exam;
- test
- module tests;
- defense of laboratory and independent works;
- test work.

7. Teaching methods:

- verbal method (lecture, interview);
- practical method (laboratory, educational mechanical and technological practice);
- visual method (illustrations and demonstrations);
- work with educational and methodological literature (note-taking, theses, annotations);
- video method (remote, multimedia, web-based);
- independent work (completion of tasks);
- individual research work of higher education students.

8. Assessment methods:

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*.

Type of educational activity	Learning outcomes	Evaluation				
M	Module 1. Ferrous Metallurgy					
Lecture 1	PH1, PH2, PH6, PH8, PH10, PH13	-				
Laboratory work 1.	Know the methods of obtaining and	10				
Independent work 1	enriching the raw materials necessary	20				
Lecture 2	for smelting ferrous metals.	-				
Independent work 2	Be able to distinguish the starting	20				
Lecture 3	materials of metallurgical production	-				
Laboratory work 2.		30				
Lecture 4		-				
Lecture 5		-				
Modular test 1.						
Total by module 1		100				
Module 2. Nonferrous metallurgy technology						
Lecture 6	PH1, PH2, PH6, PH8, PH10, PH13	-				
Independent work 3	Know the methods of obtaining and	25				
Lecture 7	enriching the raw materials necessary	-				
Lecture 8	for smelting non-ferrous alloys.	-				
Laboratory work 3.	Be able to distinguish the areas of use of	20				
Independent work 4	non-ferrous metal alloys	25				
Modular test 2.		30				
Total by module 2		100				
Module No. 3	3. Fundamentals of powder metallurgy					
Lecture 9	PH1, PH2, PH6, PH8, PH10, PH13	-				
Laboratory work 4.	Know the methods of obtaining metal	35				
Lecture 10	powders	-				
Laboratory work 5.	Be able to apply technological	35				
Lecture 11	processes for sintering powder	-				
	metallurgy products					
Modular test 3.		30				
Total by module 3		100				

8.1. Distribution of points by types of educational activities

Mod	ule No. 4. Foundry production	
Lecture 12	PH1, PH2, PH6, PH8, PH10, PH13	-
Laboratory work 6.	Know the methods of obtaining blanks	20
Independent work 5	by casting methods	20
Lecture 13	Be able to apply technological	-
Laboratory work 7.	processes of foundry technologies	20
Lecture 14		-
Independent work 6		10
Modular test work 4.		30
Total modulo 4		100
Educational work		70
Test		30
Total per semester		100
Module No. 5. P	ressure treatment of metals and ALLOY	S
Lecture 15	PH1, PH2, PH6, PH8, PH10, PH13	-
Laboratory work 8.	Know the methods of obtaining blanks	10
Laboratory work 9.	using pressure processing methods	10
Independent work 7	Be able to apply technological	20
Lecture 16	processes of metal pressure processing	-
Laboratory work 10	technologies	10
Laboratory work 11		10
Independent work 8		10
Modular test work 5.		30
Total modulo 5		100
Module N	O. 6. Welding production technology	
Lecture 17	PH1, PH2, PH6, PH8, PH10, PH13	-
Laboratory work 12	Know how to weld metals and alloys	10
Laboratory work 13	Be able to apply welding modes in	10
Independent work 9	accordance with production	20
Lecture 18	requirements	-
Laboratory work 14		10
Independent work 10		20
Modular test 6.		30
Total modulo 6		100
Educational work		70
Exam		30
Total per course		100

8.2. Scale for assessing knowledge of a higher education applicant

Higher education applicant rating, points	Assessment according to the national system (exams/credits)
90-100	perfectly
74-89	good
60-73	satisfactorily
0-59	unsatisfactorily

8.3. Evaluation Policy

Deadline and	The student must Submit assignments within the deadlines
resubmission policy:	set by the instructor. Assignments submitted after the
	deadlines without good reason will be given a lower grade.
	Modules can be retaken with the instructor's permission if
	there are good reasons (for example, sick leave).
Academic Integrity	Cheating during tests and exams is prohibited (including
Policy:	using mobile devices). Term papers and essays must have
	correct text references to the literature used.
Visitation Policy:	The student is required to attend all classes every day
	according to the established schedule, not be late, and have
	an appropriate appearance. For objective reasons (for
	example, illness, international internship), training may
	take place individually (online, in agreement with the dean
	of the faculty).

9. Educational and methodological provision

- Electronic training course in the discipline "Technology of construction materials https://elearn.nubip.edu.ua/course/view.php?id=1174
- Lecture notes and presentations;
- Textbooks, study guides, workshops;
- Methodological guidelines for performing laboratory work;
- Stands, posters;
- End-to-end internship program

10. Recommended sources of information

- 1. 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.
- 2. Сологуб М.А., Рожнецький І.О., Некоз О.І., Горпенюк М.А., Прейс Г.О., Технологія конструкційних матеріалів; за ред. Сологуба М.А. – 2-ге вид., перероб. і допов. – К.:Вища шк., 2002. – 374 с.
- 3. 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.
- 4. Афтанділянц Є.Г., Зазимко О. В., Лопатько К.Г., Іванова О. В. Технологія конструкційних матеріалів. Навчальний посібник в 2-х книгах. Книга 1. К.:НУБіП України, 2016. 511 с.
- 5. Афтанділянц Є.Г., Зазимко О. В., Лопатько К.Г., Технологія конструкційних матеріалів і матеріалознавство. Курс лекцій. Частина 1. Металургія. Київ, НАУ, 2005.- с.115.
- 6. Хільчевський В.В. та ін., Матеріалознавство і технологія конструкційних матеріалів, К: Либідь, 2002, 326с.
- 7. Бялік О.М., Металознавство, К: Політехніка, 2002, 383с.

- 8. Виробництво чавуну <u>https://www.youtube.com/watch?v=WCJSdp6lhZo</u>
- 9. Виробництвочавунуісталіhttps://www.youtube.com/watch?v=uzwnfQ6krV8

10.Виробництво сталі - <u>https://www.youtube.com/watch?v=tYTazquHXfY</u>

11.Порошкова металургія: <u>https://www.youtube.com/watch?v=LnALTU4BEgQ</u>

12.Виробництво міді: <u>https://www.youtube.com/watch?v=M2hjv6FS67g</u>

13.Виробництво алюмінію: <u>https://www.youtube.com/watch?v=JBso28su0G4</u>