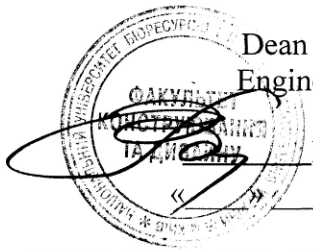
The National University of Life and Environmental Sciences of Ukraine

Faculty of Design and Engineering

Department of Material Technology and Material Science (MTMS)

APPROVE:
Dean of Design and
Engineering Faculty



Ruzhylo Z. V.
«___» _____2020

REVIEWED AND CONSIDERED
at a meeting of the MTMS department

Protocol № 16 of "19" 05 2020
Chief of Department
I. Aftandiliants

WORK PROGRAM OF THE EDUCATIONAL DISCIPLINE

" Technology of construction materials "

For ED "Bachelor"

Knowledge area 13 "Mechanical engineering "

Speciality 133 "Sectoral mechanical engineering"

Faculty of Design and Engineering

Developer: Aftandiliants I., Head of Department, professor.

Kiev – 2020

1. Description of the discipline
Technology of construction materials

(title)

Areas of knowledge, direction of training, speciality, education and qualification level		
For ED	Bachelor	
Knowledge area	13 "Mechanical engineering "	
Speciality	133 "Sectoral mechanical engineering" -	
Specialization	-	
Discipline characterization		
Type	Obligatory	
Total number of hours	163	
Number of credits ECTS	6	
Number of thematic modules	6	
Form of control	*test /examination*	
Indicators of the discipline for daily and distance learning		
	daily learning	distance learning
Year of study (course)	2	1/2
Semester	2/3	2/3
Lectures	*30/15* hours.	*2/6* hours.
Practical, seminar classes	-	-
Laboratory lesson	*15/15* hours.	*2/8* hours.
Independent study	*30/15* hours.	*-/356* hours.
Individual work	- hours.	- hours.
Number of weekly classroom hours for daily learning	*3/2* hours.	*13/14* hours.

2. The purpose and objectives of the course

Purpose 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:

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

A result of studying of discipline the student should:

know:

- The basis of technology of obtaining construction materials (metal alloys)
- The basic of recycling technological processes of metals and alloys in billet and finished products by casting, welding, processing by pressure.

the main connections between the composition, structure and properties of metals and alloys, as well as patterns and changes in these properties under thermal, chemical or mechanical stress.

be able to:

based on knowledge of the working conditions to work of the machine parts to select of the construction material for their production, type of hardening ore softening treatment for obtaining of the certain the properties of parts and billets.

acquisition of competencies:

general competencies (GC):

professional (special) competencies (PC): The discipline lays the knowledge base of students of theoretical material in manufacture technologies necessary in engineering, as a means of educating future industrial engineers skills in scientific generalizations, the ability to use basic knowledge in solving problems in engineering. The discipline lays the knowledge base for students for further study of a number of professional disciplines of technical and technological direction.

3. The program and structure of discipline for

-full term daily/distance learning first year students in 2 and 3 semesters 2019/2020 academic year

Title of thematic modules and themes	Hour numbers												
	Daily learning							Distance learning					
	Weeks	Total	Including					Total	Including				
			l	p	lab	ind	i.s.		l	p	lab	ind	i.s.
1	2	3	4	5	6	7	8	9	10	11	12	13	14
The thematic module 1. Metallurgy of ferrous metals													
Theme 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	-	-
Theme 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	-	-	-	-	-	-
Theme 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	-	-	-	-	-	-
Theme 4. Steel metallurgy. The source materials for steel production, steel melting furnaces and steel melting technological processes.	4	4	2	-	-	-	2	-	-	-	-	-	-

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

Preparation of powders to the formation.													
Theme 2. Pressing, rolling, extrusion, slip casting. Sintering, additional and finishing treatment of powder products.	14-15	8	4	-	4	-	3	22	-	-	2	-	20
Theme 3. Classification, marking powders and their applications in engineering.	14-15	4	2	-	-	-	2	-	-	-	-	-	-
Total for thematic module 3	19		8	-	3	-	8	-	-	-	-	-	-
The thematic module 4. Foundry													
Theme 1. Introduction. Technological scheme of casting manufacture. Methods of manufacturing castings and kinds of molds.	1	4	2		2			54	2		2		50
Theme 2. Pouring, knocking out mould and cores, clearing and cutting of castings.	2	6	3		3			52			2		50
Theme 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 thematic module 4	14		7		7			156	2		4		150
The thematic module 5. Treatment of metals and alloys by pressure													
Theme 1. Physical and technological bases of metal deformation. Temperature interval of steel treatment by pressure. Methods of	4	4	2		2			54	2		2		50

heating and heating furnaces													
Theme 2. Classification of treatment methods by pressure. The processes forging, drawing, pressing of steel billet. Hot and cold volumetric sheet stamping.	5	4	2		2			50					50
Total for thematic module 5	8		4		4			54	2	-	2	-	50
The thematic module 6. The welding technology													
Theme 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
Theme 2. Electric arc and gas welding	7-8	7	2		2		3				2		56
Total for thematic module 6	13		4		4		5		2		2		116
Total of hours	419		45		30		45	374	8	-	10	-	356

4. Lecture themes

№	Theme title	Hour numbers
2 semester		
1	The purpose and objectives of the course. The source materials in metallurgy and obtaining methods metals from ores.	2
2	Manufacture of the cast iron in the blast furnace	2
3	Products of the blast furnace manufacture, their classification and using	2
4	The source materials of the steel making	2
5	The steel making. The technological processes of steel making in converters.	2
6	The technological processes of steel making in open hearth and electric furnaces.	2
7	Special methods of manufacture of high quality steels	2
8	Secondary steel making	2
9	Steel pouring	2
10	Copper manufacture	2
11	Aluminum manufacture	2
12	Titanium-Magnesium metallurgy and its features	2
13	Methods of powder receiving (mechanical, chemical). Preparation of powder charge.	2
14	Billet formation. Pressing, rolling, extrusion, slip casting. Sintering.	2

15	Classification, marking powders and their applications in engineering.	2
3 semester		
1	Technological scheme of manufacture castings. Casting production of in temporary mold. Gating system. Molding and core materials, their composition, properties and preparation. Pattern equipment.	2
2	Pouring, mold and core knock out, casting cleaning and cutting.	2
3	Special methods of casting manufacture.	2
4	Physical and technological bases of metal deformation. Temperature range of steel treatment by pressure. Heating furnaces and heating methods	2
5	Classification of treatment methods by pressure. The processes forging, drawing, pressing of steel billet. Hot and cold volumetric sheet stamping.	2
6	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.	2
7	Electric arc and gas welding	2
8	Special methods welding (electroslag, plasma, electron beam, mechanical friction, ultrasound, explosion, welding in protective gases and under water).	1

5. Laboratory work themes

№	Theme title	Hour numbers
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

6. Test questions and test sets for determine of the level assimilation of knowledge by students.

1	Technology of construction materials is …
2	Powder metallurgy is …
3	Acid fluxes is
4	Complex ores contain
5	Basic fluxes is
6	Agglomeration is the sintering of

7	Magnetite base is
8	Charge is a mixture of
9	Segregation is
10	Red iron base is
11	Gas bubbles are allocated at
12	Non-metallic inclusions
13	Technology of construction materials" consists of the following major sections:..
14	The ore consists of …
15	Main iron reducer in blast furnace is
16	Shrinkage cavity forms in
17	Ironstone is
18	Slag is
19	The ingot structure of killed steel consists of
20	Siderite is
21	Metallurgy industry is…
22	Metals are in minerals in the states …
23	Blast-furnace products are
24	Steel pouring into the iron mold
25	For increasing of metallurgical productivity of raw ore is
26	Cast irons divided into
27	Ladle can be
28	Refractory materials are melting point
29	Blast furnace slag is material which are formed by
30	Foundry is…
31	Iron ore can content ….
32	High fire resistance refractory materials are melting point
33	Blast furnace slag is used as
34	Acidic refractories are
35	Steel is an alloy of
36	Basic refractories are
37	Steel content carbon between
38	The converter is
39	Treatment of metals by pressure is…
40	Manganese ores consist of …
41	Neutral refractories are
42	Cast iron is alloy of iron and carbon with carbon mass portion
43	Deoxidation is
44	Cast iron produced by reduction of ores by
45	Main deoxidizers are
46	Siderite is
47	Welding is…
48	Metals are called …
49	Waste rock consists of ..
50	Higher fire resistance refractory materials are melting point
51	Metals are divided …
52	Impurities are …
53	Steel content carbon between
54	Ferrous metals are …
55	Helpful impurities of iron ore are …
56	Nonferrous metals are …
17	The harmful impurities of iron ore are …

58	Metallurgical fuel divided into …
59	Metals are extracted from ores the following methods: …
60	Coke obtained by …
61	Pyrometallurgical or fire method is …
62	Black oil is ….
63	Hydrometallurgical method is …
64	Natural gas is …
65	Electro melting method is …
66	Coke oven gas is …

7. Education methods.

1) Verbal:
   -Lectures;
2) Visual:
   -Slides, video, visual material (perts, charts, stands).
3) Practical:
   - Laboratory work;
   - Training and factory practices;
   - Independent work.

8. Forms control.

- control work;
- module control work;
- test;
- examination.

9. Distribution points that receive students. The student evaluation done in accordance with the provision «Про екзамени та заліки у НУБіП України» від 27.12.2020 р. протокол № 5 з табл. 1.

EVALUATION POLICY

Deadline and retake policy:	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).
Academic Integrity Policy:	Write-offs during tests and exams are prohibited (including the use of mobile devices). Course papers, abstracts must have correct text references to the literature used
Visiting 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)

STUDENT EVALUATION SCALE

Student rating, points	Evaluation results on national exam tests	
	Exams	tests
90-100	Excellent	Accepted
74-89	Good	
60-73	Satisfactory	
0-59	Unsatisfactorily	Not accepted

The student rating (listener) of the discipline $\mathbf{R_{ДИС}}$ (up to 100 points) to determine as sum rating received at attestation $\mathbf{R_{AT}}$ (up to 30 points) and the student (listener) rating for educational work $\mathbf{R_{НР}}$ (up to 70 points):

10. Methodical provision

- Textbooks and manuals;
- Guidelineses for laboratory works;
- Stands, posters;
- Equipment and various device.

11. Recommended Literature

- Main:

1. Афтанділянц Є.Г., Зазимко О. В., Лопатько К.Г. Технологія конструкційних матеріалів і матеріалознавство. Частина I (А-О). Російсько – англійсько – український термінологічний словник. К.: Вид. Центр НАУ, 2005. - 346 с.

2. Афтанділянц Є.Г., Зазимко О. В., Лопатько К.Г. Технологія конструкційних матеріалів і матеріалознавство. Частина II (П-Я). Російсько – англійсько – український термінологічний словник. К.: Вид. Центр НАУ, 2005. - 282 с.

3. Афтанділянц Є.Г., Зазимко О. В., Лопатько К.Г. Технологія конструкційних матеріалів і матеріалознавство. Курс лекцій. Частина II. Металознавство. Київ, НАУ, 2010.- с.356.

4. 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.

5. 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.

6. 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.

– ancillary:

1. 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.

2. Сологуб М.А. “Технологія контрукційних матеріалів”, К:Вища школа, 2002, 373с.
3. Хільчевський В.В. та ін. “Матеріалознавство і технологія конструкційних матеріалів”, К:Либідь, 2002, 326с.
4. Попович В. Технологія конструкційних матеріалів і матеріалознавство. Книга І. Львів. 2000.-с.264.
5. Гуляєв А.П. ,,Металознавство”, 1985 р.
6. Усова Л.Ф. ,,Технологія металів та матеріалознавство”, 1987 р.

12. Information Resources

1. Reference book.
2. Atlases.
3. Internet library.
4. Magazines.