## SYLLABUS OF AN ACADEMIC DISCIPLINE «<u>Technology of construction materials</u>»

Academic degree - Bachelor's Specialty <u>133-«Sectoral mechanical engineering»</u> Academic programme - «Bachelor» Year of study – 1, <u>2</u>, semester – 2, <u>3</u> Form of study full-time Number of ECTS credits - 4 Language(s) of instruction - English

Lecturer of the discipline Lecturer's contact information (e-mail) URL of the e-learning course on the NULES elearning portal

## Aftandiliants I.

<u>aftyev@yahoo.com</u> https://elearn.nubip.edu.ua/course/view.php?id=1174

### ACADEMIC DISCIPLINE DESCRIPTION

(up to 1000 symbols)

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.

#### **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 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):**

ELO3. To know and understand the systems of automatic management of objects and processes of industrial engineering, to have skills in their practical use.

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

ELO8. Understand the relevant methods and have the skills to design typical assemblies and mechanisms in accordance with the task.

Торіс	Hours (lectures/laboratory,	Learning outcomes	Tasks	Assessment
	practical, seminars)	2 semester		
	The module 1. M	etallurgy of ferrous i	metals	
Topic 1.				
Purpose and objectives of the course. The source materials in metallurgy and obtaining methods metals from ores.	2/1/2	Student should be		5
<b>Topic 2</b> . Metallurgy of the pig iron. Materials for the production of cast iron. Preparation ores. The structure and work of the blast furnace.	2/1/2	<i>know</i> : the main connections between the composition, structure and properties of source materials in metallurgy.	Submitting a laboratory work.	5
<b>Topic 3</b> . Blast furnace products and their using. Blast furnace cast iron classification. Blast furnace gas and slag and their using.	2/1/2	Student should be able to based on knowledge of the working of blast furnace To analyze of steel melting technological processes.	Completing tests. Writing independent works. Self-study (Performing laboratory and independent	5
<b>Topic 4</b> . Steel metallurgy. The source materials for steel production, steel melting furnaces and steel melting technological processes.	2/1/2	To understand the influence of production method on steel quality. To distinguish between processes of deoxidizing steel. To apply special	work in "Elearn"). Problem solving of steel metallurgy.	5
<b>Topic 5</b> . The influence of method of production on steel quality. Processes of deoxidizing steel. Steel production in open hearth furnaces and oxygen converters.	2/1/2	methods of obtaining high- quality steels.		5

# ACADEMIC DISCIPLINE STRUCTUREINE

<b>Topic 6</b> .				
electric furnaces				
Special methods of	2/1/2			5
obtaining high-				
quality steels				
Topic 7				
Pouring steel				
Structure steel				
ingots Prospects	2/1/2			5
for the				•
development of				
steel production				
	The module 2. Techn	ology of nonferrous 1	netallurøv	
Topic 8		Student should be	lietuniun gy	
Nonferrous		know: the		
metallurgy		Nonferrous		
Copper The		metallurgy		
essence of the	2/1/2	Student should <i>be</i>		5
process of		able to based on		0
obtaining copper		knowledge of the		
from ore Matte		working conditions	Submitting a	
receiving		to work of the	laboratory	
Topic 9		machine parts to	work.	
Obtaining and		select of the	Completing	
refining of blister		technology for	tests.	
copper Marking	2/1/2	production of	Writing	5
and using copper in		nonferrous	independent	
technics		materials	works.	
Topic 10		To analyze of	Self-study	
Aluminium		alumina	(Performing	
Aluminum		electrolysis and	laboratory and	
receiving of ores	2/1/2	aluminum refining	independent	5
Alumina		To understand	work in	0
electrolysis and		the titanium-	"Elearn").	
aluminum refining		magnesium	Problem	
		metallurgy.	solving of	
Topic 11.		To distinguish	nonterrous	
Titanium-		between carbon	metallurgy.	
magnesium		steels and cast		
metallurgy.	2/1/2	irons.		5
Production of		To apply		-
refractory metals		production of		
and nickel.		refractory metals		
		and nickel.		
The module 3. The powder metallurgy basics				
Topic 12.		Student should be	Submitting a	
Introduction to		know:	laboratory	
powder metallurgy.		the preparation of	work.	
Obtaining powders.	4/2/2	powders to the	Completing	5
Preparation of		formation.	tests.	
powders to the		Student should	Writing	
formation.		be able to based on	independent	
Topic 13.	2/1/4	knowledge of the	works.	_
Pressing, rolling,	2/1/4	working conditions	Self-study	5

extrusion, slip casting. Sintering, additional and		to work of the machine parts to select sintering	(Performing laboratory and independent	
finishing treatment		additional and	work in	
of powder		finishing treatment	"Elearn").	
products.		of powder	Problem	
		products.	solving of	
		To analyze of	powder	
		classification,	metallurgy.	
		marking powders		
		and their		
		applications in		
Topic 14.		engineering.		
Classification,		the structure and		
marking powders	2/1/2	composition of		5
and their	2/1/2	powders		5
applications in		To distinguish		
engineering.		between pressing		
		rolling, extrusion		
		and slip casting.		
		To apply the		
		finishing treatment		
		of powder		
		products		
Total for 2 semester	ſ			70
Examination				30
	•			100
1 otal for 2 semester	· · · · · · · · · · · · · · · · · · ·	3 comostor		200
1 otal for 2 semester	The ma	3 semester odule 4. Foundry		
Topic 1.	The me	3 semester odule 4. Foundry Student should be		
Topic 1. Introduction.	The mo	3 semester odule 4. Foundry Student should be <i>know</i> : the main		
Topic 1. Introduction. Technological	The me	3 semester odule 4. Foundry Student should be <i>know</i> : the main technological		
Topic 1. Introduction. Technological scheme of casting	The mo	3 semester odule 4. Foundry Student should be <i>know</i> : the main technological schemes of casting		
Topic 1. Introduction. Technological scheme of casting manufacture.	2/2/2	3 semester odule 4. Foundry Student should be <i>know</i> : the main technological schemes of casting manufacture.	Submitting a	10
Topic 1. Introduction. Technological scheme of casting manufacture. Methods of	<b>The m</b> 2/2/2	3 semester odule 4. Foundry Student should be <i>know</i> : the main technological schemes of casting manufacture. Student should	Submitting a laboratory	10
Topic 1. Introduction. Technological scheme of casting manufacture. Methods of manufacturing	2/2/2	3 semester odule 4. Foundry Student should be <i>know</i> : the main technological schemes of casting manufacture. Student should <i>be able to</i> based on	Submitting a laboratory work.	10
Topic 1. Introduction. Technological scheme of casting manufacture. Methods of manufacturing castings and kinds	<b>The m</b>	3 semester odule 4. Foundry Student should be <i>know</i> : the main technological schemes of casting manufacture. Student should <i>be able to</i> based on knowledge of the	Submitting a laboratory work. Completing	10
Topic 1. Introduction. Technological scheme of casting manufacture. Methods of manufacturing castings and kinds of molds.	2/2/2	3 semester odule 4. Foundry Student should be <i>know</i> : the main technological schemes of casting manufacture. Student should <i>be able to</i> based on knowledge of the methods of	Submitting a laboratory work. Completing tests.	10
Topic 1. Introduction. Technological scheme of casting manufacture. Methods of manufacturing castings and kinds of molds. Topic 2.	2/2/2	3 semester odule 4. Foundry Student should be <i>know</i> : the main technological schemes of casting manufacture. Student should <i>be able to</i> based on knowledge of the methods of manufacturing	Submitting a laboratory work. Completing tests. Writing	10
Topic 1. Introduction. Technological scheme of casting manufacture. Methods of manufacturing castings and kinds of molds. Topic 2. Pouring, knocking out mould and	2/2/2	3 semester odule 4. Foundry Student should be <i>know</i> : the main technological schemes of casting manufacture. Student should <i>be able to</i> based on knowledge of the methods of manufacturing castings and kinds of molds	Submitting a laboratory work. Completing tests. Writing independent works	10
Topic 1. Introduction. Technological scheme of casting manufacture. Methods of manufacturing castings and kinds of molds. Topic 2. Pouring, knocking out mould and cores, clearing and	2/2/2 3/3/2	3 semester odule 4. Foundry Student should be <i>know</i> : the main technological schemes of casting manufacture. Student should <i>be able to</i> based on knowledge of the methods of manufacturing castings and kinds of molds.	Submitting a laboratory work. Completing tests. Writing independent works. Self-study	10
Topic 1. Introduction. Technological scheme of casting manufacture. Methods of manufacturing castings and kinds of molds. Topic 2. Pouring, knocking out mould and cores, clearing and cutting of castings	2/2/2 3/3/2	3 semester odule 4. Foundry Student should be <i>know</i> : the main technological schemes of casting manufacture. Student should <i>be able to</i> based on knowledge of the methods of manufacturing castings and kinds of molds. To analyze of special methods of	Submitting a laboratory work. Completing tests. Writing independent works. Self-study (Performing	10
Topic 1. Introduction. Technological scheme of casting manufacture. Methods of manufacturing castings and kinds of molds. Topic 2. Pouring, knocking out mould and cores, clearing and cutting of castings.	2/2/2 3/3/2	<b>3 semester</b> <b>odule 4. Foundry</b> Student should be <i>know</i> : the main technological schemes of casting manufacture. Student should <i>be able to</i> based on knowledge of the methods of manufacturing castings and kinds of molds. To analyze of special methods of manufacture	Submitting a laboratory work. Completing tests. Writing independent works. Self-study (Performing laboratory and	10
Topic 1. Introduction. Technological scheme of casting manufacture. Methods of manufacturing castings and kinds of molds. Topic 2. Pouring, knocking out mould and cores, clearing and cutting of castings.	2/2/2 3/3/2	<b>3 semester</b> <b>dule 4. Foundry</b> Student should be <i>know</i> : the main technological schemes of casting manufacture. Student should <i>be able to</i> based on knowledge of the methods of manufacturing castings and kinds of molds. To analyze of special methods of manufacture castings.	Submitting a laboratory work. Completing tests. Writing independent works. Self-study (Performing laboratory and independent	10
Topic 1. Introduction. Technological scheme of casting manufacture. Methods of manufacturing castings and kinds of molds. Topic 2. Pouring, knocking out mould and cores, clearing and cutting of castings. Topic 3. Special methods of	2/2/2 3/3/2	3 semester odule 4. Foundry Student should be know: the main technological schemes of casting manufacture. Student should be able to based on knowledge of the methods of manufacturing castings and kinds of molds. To analyze of special methods of manufacture castings. To understand	Submitting a laboratory work. Completing tests. Writing independent works. Self-study (Performing laboratory and independent work in	10
Topic 1. Introduction. Technological scheme of casting manufacture. Methods of manufacturing castings and kinds of molds. Topic 2. Pouring, knocking out mould and cores, clearing and cutting of castings. Topic 3. Special methods of manufacture	2/2/2 3/3/2	3 semester odule 4. Foundry Student should be <i>know</i> : the main technological schemes of casting manufacture. Student should <i>be able to</i> based on knowledge of the methods of manufacturing castings and kinds of molds. To analyze of special methods of manufacture castings. To understand the structure and	Submitting a laboratory work. Completing tests. Writing independent works. Self-study (Performing laboratory and independent work in "Elearn").	10
Topic 1. Introduction. Technological scheme of casting manufacture. Methods of manufacturing castings and kinds of molds. Topic 2. Pouring, knocking out mould and cores, clearing and cutting of castings. Topic 3. Special methods of manufacture castings. Tashnological	2/2/2 3/3/2	3 semester odule 4. Foundry Student should be know: the main technological schemes of casting manufacture. Student should be able to based on knowledge of the methods of manufacturing castings and kinds of molds. To analyze of special methods of manufacture castings. To understand the structure and composition of	Submitting a laboratory work. Completing tests. Writing independent works. Self-study (Performing laboratory and independent work in "Elearn"). Problem	10
Topic 1. Introduction. Technological scheme of casting manufacture. Methods of manufacturing castings and kinds of molds. Topic 2. Pouring, knocking out mould and cores, clearing and cutting of castings. Topic 3. Special methods of manufacture castings. Technological features costings	2/2/2 3/3/2	3 semester odule 4. Foundry Student should be know: the main technological schemes of casting manufacture. Student should be able to based on knowledge of the methods of manufacturing castings and kinds of molds. To analyze of special methods of manufacture castings. To understand the structure and composition of steels and cast	Submitting a laboratory work. Completing tests. Writing independent works. Self-study (Performing laboratory and independent work in "Elearn"). Problem solving of	10
Topic 1. Introduction. Technological scheme of casting manufacture. Methods of manufacturing castings and kinds of molds. Topic 2. Pouring, knocking out mould and cores, clearing and cutting of castings. Topic 3. Special methods of manufacture castings. Technological features castings manufacture from	2/2/2 3/3/2 2/2/2	3 semester odule 4. Foundry Student should be <i>know</i> : the main technological schemes of casting manufacture. Student should <i>be able to</i> based on knowledge of the methods of manufacturing castings and kinds of molds. To analyze of special methods of manufacture castings. To understand the structure and composition of steels and cast irons.	Submitting a laboratory work. Completing tests. Writing independent works. Self-study (Performing laboratory and independent work in "Elearn"). Problem solving of foundry.	10
Topic 1. Introduction. Technological scheme of casting manufacture. Methods of manufacturing castings and kinds of molds. Topic 2. Pouring, knocking out mould and cores, clearing and cutting of castings. Topic 3. Special methods of manufacture castings. Technological features castings manufacture from various alloys (cast	The me     2/2/2     3/3/2     2/2/2	3 semester odule 4. Foundry Student should be know: the main technological schemes of casting manufacture. Student should be able to based on knowledge of the methods of manufacturing castings and kinds of molds. To analyze of special methods of manufacture castings. To understand the structure and composition of steels and cast irons. To distinguish	Submitting a laboratory work. Completing tests. Writing independent works. Self-study (Performing laboratory and independent work in "Elearn"). Problem solving of foundry.	10
Topic 1. Introduction. Technological scheme of casting manufacture. Methods of manufacturing castings and kinds of molds. Topic 2. Pouring, knocking out mould and cores, clearing and cutting of castings. Topic 3. Special methods of manufacture castings. Technological features castings manufacture from various alloys (cast iron_steel_non-	The me   2/2/2   3/3/2   2/2/2	3 semester odule 4. Foundry Student should be know: the main technological schemes of casting manufacture. Student should be able to based on knowledge of the methods of manufacturing castings and kinds of molds. To analyze of special methods of manufacture castings. To understand the structure and composition of steels and cast irons. To distinguish between pouring,	Submitting a laboratory work. Completing tests. Writing independent works. Self-study (Performing laboratory and independent work in "Elearn"). Problem solving of foundry.	10
Topic 1. Introduction. Technological scheme of casting manufacture. Methods of manufacturing castings and kinds of molds. Topic 2. Pouring, knocking out mould and cores, clearing and cutting of castings. Topic 3. Special methods of manufacture castings. Technological features castings manufacture from various alloys (cast iron, steel, non- ferrous metals and	The me     2/2/2     3/3/2     2/2/2	3 semester odule 4. Foundry Student should be know: the main technological schemes of casting manufacture. Student should be able to based on knowledge of the methods of manufacturing castings and kinds of molds. To analyze of special methods of manufacture castings. To understand the structure and composition of steels and cast irons. To distinguish between pouring, knocking out	Submitting a laboratory work. Completing tests. Writing independent works. Self-study (Performing laboratory and independent work in "Elearn"). Problem solving of foundry.	10

allova		algoring and		
anoys).				
		cutting of castings.		
		To apply special		
		methods of		
		manufacture		
		castings.		
		0		
Th	e module 5. Treatmer	t of metals and allow	s hv nressure	
Topic 4		Student should be		
Physical and		know.		
tochnological bases		the main physical		
of motol		and technological		
of metal		and technological		
deformation.		bases of metal	~	
Temperature	2/2/2	deformation.	Submitting a	10
interval of steel		Student should	laboratory	
treatment by		be able to based on	work.	
pressure. Methods		knowledge of the	Completing	
of heating and		working conditions	tests.	
heating furnaces		to work of the	Writing	
		machine parts to	independent	
		select the methods	works.	
		of heating and	Self-study	
		heating furnaces	(Performing	
		To analyze of	laboratory and	
		alogification of	independent	
Topic 5.		treatment mathed		
Classification of		treatment methods	WORK IN	
treatment methods		by pressure.	"Elearn").	
by pressure. The		To understand	Problem	
processes forging		the processes	solving of	
drawing processing	2/2/2	forging, drawing,	classification,	10
of steel billet. Het		pressing of steel	structure and	
of steel billet. Hot		billet.	composition of	
		To distinguish	treatment	
volumetric sneet		between hot and	methods by	
stamping.		cold volumetric	pressure.	
		sheet stamping.	L	
		To apply the		
		processes forging		
		drawing pressing		
		of steel billet		
	The module 6	The welding technol	l	I
Topic 6 Student should be Submitting a				
Theoretical basis of		know.	laboratory	
welding		the main	work	
Metallurgical and		theoretical basis of	Completing	
chemical physical		welding	tasts	
nhonomono in the		Student chevild	USIS.	
phenomena in the	2/2/2	be able to be a l	writing	10
weiding zone and		<i>be able to</i> based on	independent	
their influence on		knowledge of the	WORKS.	
the structure of		working conditions	Self-study	
ambient zone. The		to work of the	(Performing	
welding		machine parts to	laboratory and	
classification.		select the electric	independent	
Topic 7.	2/2/3	arc and gas	work in	10

Total for course			100
Examination			30
Total for 3 semester			70
	welding.		
	electric arc and gas		
	To apply		
	arc and gas welding		
	between electric		
	To distinguish		
	irons.		
	steels and cast		
	composition of		
	the structure and		
	To understand		
	ambient zone		
	the structure of		
	their influence on		
	phenomena in the	gas welding.	
	chemical-physical	electric arc and	
	metallurgical and	solving of	
welding	To analyze	Problem	
Electric arc and gas	welding.	"Elearn").	

# ASSESSMENT POLICY

Deadlines and exam retaking 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
Acadomio	Write offs during tests and avams are prohibited (including the use of mobile).
Integrity	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	National grading of exams and credits		
points	exams	credits	
90-100	Excellent		
74-89 Good		Accepted	
60-73	Satisfactory		
0-59	Unsatisfactorily Not accepted		

#### **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 II (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 II. 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 <u>https://metinvest-smc.com/ua/articles/chto-takoe-chugun-kharakteristiki-metalla-osobennosti-proizvodstva-i-primeneniya/</u>

 15.
 Сплави
 кольорових
 металів

 https://uk.wikipedia.org/wiki/%D0%A1%D0%BF%D0%BB%D0%B0%D0%B2%D0%B8\_%D
 0%BA%D0%BE%D0%B8%D1%8C%D0%BE%D1%80%D0%BE%D0%B2%D0%B8%D1%8
 0%BA%D0%BE%D0%B8%D1%80%D0%BE%D0%B8%D1%8
 0%BA%D0%B5%D1%82%D0%B0%D0%B8%D1%96%D0%B2
 0%BA%D0%B5%D1%82%D0%B0%D0%B5%D1%96%D0%B2
 0%BA%D0%B5%D1%82%D0%B0%D0%B2
 0%BA%D0%B5%D1%82%D0%B0%D0%B2
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0
 0</td

16.Керамічніматеріалиhttps://www.pharmencyclopedia.com.ua/article/3477/keramichni-materialiматеріали

17. Композиційні матеріали <u>https://mozok.click/1786-kompozicyn-materali.html</u>

18. Теплоізоляційні матеріали <u>https://molokienewir/voo kompolicyn materianim</u>

<u>thermaflex/?gclid=EAIaIQobChMI15zGpYzl8QIVHQCiAx0gKg9iEAAYASAAEgJj1vD\_BwE</u> 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/