



**SYLLABUS OF AN ACADEMIC DISCIPLINE**  
Building material science and welding in construction

**Academic degree - Bachelor's**  
**Specialty 192-«Building and civil engineering»**  
**Academic programme «Bachelor»**

**Year of study 1, 2, semester 2, 3**  
**Form of study full-time** (full-time, part-time)  
**Number of ECTS credits 4**  
**Language(s) of instruction English** (Ukrainian, English, German)

**Lecturer of the discipline**  
**Lecturer's contact information (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)

*The course " Building material science and welding in construction " is a complex discipline that contains basic information about the methods of obtaining construction materials and methods of their physical, chemical and mechanical processing in order to give them the appropriate properties and formation necessary in construction.*

*The purpose of the discipline is the general technological training of a specialist in the field of construction, as well as the acquisition of skills in construction material science and the establishment of a base for studying the disciplines: "Reinforced concrete and stone structures", "Reliability of construction equipment", "Technology of construction production", "Wood structures and plastics", "Inspection and testing of buildings and structures".*

*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.

**Competences of the discipline:**

*Integral competence (IC): IC The ability to solve complex specialized construction and civil engineering tasks in the learning process, which involves the application of a complex of theories and methods for determining the strength, stability, deformability, modeling, strengthening of building structures; further safe operation, reconstruction, construction and installation of buildings and engineering structures; application of automated design systems in the field of construction.*

*General competences (GC): GC2 – Knowledge and understanding of the subject area and professional activity.*

*GC6 – Ability to search, process and analyze information from various sources.*

*GC7 – Interpersonal skills.*

*Special (professional) competences (SC): PCI – Ability to use conceptual scientific and practical knowledge in mathematics, chemistry and physics to solve complex practical problems in the field of construction and civil engineering.*

*PC4 – Ability to choose and use appropriate equipment, materials, tools and methods for designing and implementing technological processes of construction production.*

*SC7 – Ability to take responsibility for making and making decisions in the field of architecture and construction in unpredictable work contexts.*

*PC10 – Ability to ensure the organization and technology of construction production of agro-industrial, industrial, transport and civil facilities using modern energy-efficient technologies and construction materials.*

**Expected Learning Outcomes (ELO): PLO1 – Apply basic theories, methods and principles of mathematical, natural, social, humanitarian and economic sciences, modern models, methods and decision support software to solve complex construction and civil engineering problems.**

**PLO2 – Participate in research and development in the field of architecture and construction.**

PLO4 – Design and implement technological processes of construction production, using appropriate equipment, materials, tools and methods.

PLO7 – Collect, interpret and apply data, including through the search, processing and analysis of information from various sources.

PLO8 – Rationally use modern building materials, products and structures based on knowledge of their technical characteristics and manufacturing technology.

### ACADEMIC DISCIPLINE STRUCTURE

Topic	Hours (lectures/laboratory, practical, seminars)	Learning outcomes	Tasks	Assessment
<b>2 semester</b>				
<b>Module 1. Metal science</b>				
<b>Topic1</b> Classification, structure and composition of building materials	4/10/2	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. 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. To analyze of structure and composition of building materials. To understand the structure and composition of building materials. To distinguish between carbon steels and cast irons. To apply carbon 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 classification, structure and composition of building materials.	<b>10</b>
<b>Topic 2.</b> Carbon steels and cast irons	4/4/2			<b>15</b>
<b>Module 2. Heat treatment of building materials</b>				
<b>Topic 3.</b> The theory of heat treatment	1/2/1	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. To be able to base on	Submitting a laboratory work. Completing tests. Writing independent works. Self-study (Performing laboratory and independent	<b>10</b>
<b>Topic 4.</b> Technology of heat treatment	1/2/2			<b>15</b>

		<p>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>	
<b>Module 3. Alloy and non-ferrous alloys, inorganic and organic binders, aggregates, concretes, ceramic and polymeric materials</b>				
<b>Topic 5.</b> The alloying theory	4/6/2	<p>To know the main connections between the composition, structure and properties of alloying steels, non-ferrous metals and alloys.</p> <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 polymeric materials.</p> <p>To understand the non-ferrous metals and alloys.</p> <p>To distinguish between types of alloying steels.</p> <p>To apply different types of binders 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 alloying theory.</p>	<b>7</b>
<b>Topic 6.</b> Non-ferrous metals and alloys	2/2/2			<b>7</b>
<b>Topic 7.</b> Inorganic and organic binders, aggregates, concretes, ceramic and polymeric materials	14/4/4			<b>6</b>
<b>Total for 2 semester</b>				<b>70</b>
<b>Examination</b>				<b>30</b>
<b>Total for the course</b>				<b>100</b>
<b>3 Semester</b>				
<b>Module 4. Welding technology in construction</b>				

<b>Topic 8.</b> Formation of welded joints and weldability of metal. Classification of welding methods in construction	2/2/1	To know the formation of welded joints and weldability of metal. To be able to base on knowledge of the classification of welding methods in construction.	Submitting a laboratory work. Completing tests. Writing independent works. Self-study (Performing laboratory and independent work in "Elearn").	<b>5</b>
<b>Topic 9.</b> Arc welding: manual arc welding with a fusible electrode, automatic arc welding with a fusible electrode, arc welding in shielding gases, arc welding with a non-fusible electrode, special types of arc welding.	2/2/2	To analyze of manufacture technology of arc welding. To understand the manual arc welding with a fusible electrode. To distinguish between types of welding. To apply different types of welding in industry.	Problem solving, of inspection of welded joints.	<b>10</b>
<b>Topic 10.</b> Plasma welding. Electro slag welding. Gas welding.	2/2/2			<b>10</b>
<b>Topic 11.</b> Hot welding tools. Cold welding tools. Radiation welding. Inspection of welded joints	2/2/2			<b>10</b>
<b>Module 5. Welding in construction</b>				
<b>Topic 12.</b> Classification of welded structures. Features of welding of different types of metals. Basic types of welded joints. Operation of welded joints under different load conditions.	2/2/2	To know the classification of welded structures. To be able to base on knowledge of the features of welding of different types of metals. To analyze of manufacture technology of construction welded beams.	Submitting a laboratory work. Completing tests. Writing independent works. Self-study (Performing laboratory and independent work in "Elearn").	<b>5</b>
<b>Topic 13.</b> Construction	2/2/2	To understand the operation of welded	Problem solving, of construction	<b>10</b>

welded metal structures: frames of industrial buildings, welded beams, trusses and columns, sheet solid building structures		joints under different load conditions.. To distinguish basic types of welded joints. To apply	welded metal structures	
Topic 14. Machine-building welded structures and pipelines	2/2/2	To know the machine-building welded structures. To be able to base on knowledge of machine-building welded pipelines	Submitting a laboratory work. Completing tests. Writing independent works.	<b>10</b>
Topic 15. New technologies in construction.	1/1/2	To analyze of new technologies in construction. To understand the welded structures. To distinguish between new technologies in construction. To apply new technologies in construction.	Self-study (Performing laboratory and independent work in "Elearn"). Problem solving, of machine-building welded structures and pipelines	<b>10</b>
<b>Total for 2 semester</b>				<b>70</b>
<b>Examination</b>				<b>30</b>
<b>Total for the course</b>				<b>100</b>

### ASSESSMENT POLICY

<b><i>Deadlines and exam retaking policy:</i></b>	Works that are submitted late without valid reasons will be assessed with a lower grade. Module tests may be retaken with the permission of the lecturer if there are valid reasons (e.g. a sick leave).
<b><i>Academic integrity policy:</i></b>	Cheating during tests and exams is prohibited (including using mobile devices). Term papers and essays must have correct references to the literature used
<b><i>Attendance policy:</i></b>	Attendance is compulsory. For good reasons (e.g. illness, international internship), training can take place individually (online by the faculty dean's consent)

### 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	satisfactorily	
0-59	unsatisfactorily	fail

## RECOMMENDED SOURCES OF INFORMATION

1. Aftandilyants Y., Stepanechko O., Zazymko O. Material Science: Textbook. Київ, НУБІП України, 2022.- с. 528.
2. Construction materials engineering. Tutorial/Y. Aftandilyants, O. Zazymko, O. Ivanova, K. Lopat'ko //Kyiv: NULES of Ukraine, 2017.-р. 523
3. Афтанділянц Є.Г., Зазимко О.В., Лопатько К.Г. Будівельне матеріалознавство та зварювання в будівництві. Навчальний посібник. К.: НУБіП України, 2018.- с. 523.
4. Новомлинець, О. О. Будівельне матеріалознавство : навч. посіб. для здобувачів вищої освіти спец. 192 – Будівництво та цивільна інженерія / О. О. Новомлинець, М. М. Корзаченко, А. І. Сергеев. – Чернігів : НУ «Чернігівська політехніка», 2021. – 420 с.
5. Будівельне матеріалознавство. Лабораторний практикум для студентів спеціальності «Будівництво та цивільна інженерія» / С.М. Скрєбнева, В.В. Грабовчак, А.І. Глушаниця/ – К.: НАУ, 2019. – 88 с.
6. Афтанділянц Є.Г., Зазимко О. В., Лопатько К.Г. Технологія конструкційних матеріалів і матеріалознавство. Навчальний посібникІ. Металознавство. Київ, НУБіП України. 2020- с.334.
7. Афтанділянц Є.Г., Зазимко О. В., Лопатько К.Г. Технологія конструкційних матеріалів і матеріалознавство. Курс лекцій. Частина II. Металознавство. Київ, НУБіП України. 2020- с.356.
8. 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.
9. Спеціальні види бетонів: характеристика основних складів - <https://probud.in.ua/spetsialni-vidi-betoniv-harakteristika-osnovnih-skladiv.html>
10. Марки сталей і сплавів: властивості та характеристики <https://metinvestholding.com/ua/products/steel-grades>
11. Що таке чавун? Характеристики металу, особливості виробництва і застосування <https://metinvest-smc.com/ua/articles/chto-takoe-chugun-kharakteristiki-metalla-osobennosti-proizvodstva-i-primeneniya/>
12. 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](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)
13. Керамічні матеріали <https://www.pharmencyclopedia.com.ua/article/3477/keramichni-materiali>
14. Композиційні матеріали <https://mozok.click/1786-kompozicyn-materali.html>
15. Теплоізоляційні матеріали [https://euroterm.com/brand-thermaflex/?gclid=EA1aIQobChMI15zGpYzI8QIVHQCIAx0gKg9iEAAAYASAAEgJj1vD\\_BwE](https://euroterm.com/brand-thermaflex/?gclid=EA1aIQobChMI15zGpYzI8QIVHQCIAx0gKg9iEAAAYASAAEgJj1vD_BwE)
16. 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/>