Syllabus selective component SC

(conditional designation OK in the educational program (EP)

Cast iron as a structural material

Subjects:	Cast iron as a structural material
Level of higher education:	the first (bachelor's)
Course page in Moodle:	https://dl2022.khadi-
	kh.com/course/index.php?categoryid=837
The scope of the educational	3 credits (90 hours)
component	
Final control form	Test
Consultations:	on schedule
Name of the department:	Department of Metal Technology and Materials
	Science
Teaching language:	Ukrainian
Course leader:	Iryna Vasylivna Doshchechkina, professor,
	candidate of technical sciences, associate professor
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Brief content of the educational component:

The goal isthe formation of a set of knowledge, abilities and skills in students to solve problems in materials science in the field of mechanical engineering at the stage of choosing material for products of various purposes, which would ensure an increase in resource due to more reliable and durable operation.

Subject: theoretical and methodological foundationsprocesses of production and processing of various types of cast ironforobtaining a complex of high service characteristics in the absence of its brittleness, which are in the greatest correlation with the operating conditions of a specific product made of this material and ensure its reliability and durability.

The main tasks of studying an academic discipline are: the ability to solve complex specialized tasks and practical problems of premature failure of products and involves increasing the set of properties of this product to ensure its reliability and durability in specific operating conditions, which requiresknowledge of technologies for processing cast irons without embrittlement of products during operation; the ability of the future specialist to correctly use in practice a reasoned rational choice of cast iron for products taking into accountoperational and economic requirements.

Prerequisites for studying the educational component: the discipline is studied after assimilation courses Technology of structural materials and materials science", "Materials science", "Educational practice"

Competencies acquired by the acquirer:

General competences:

Ability to find and use information from domestic and foreign sources.

Ability to make informed decisions in production conditions.

Knowledge and understanding of one's specialty.

Ability and readiness to implement modern technological processes of obtaining, processing materials, technologies for improving properties and restoring products in order to meet their production requirements.

The ability to analyze violations of the established technological process and the reasons for failure of parts and structures.

Special (professional) competences:

The ability to use in practice modern ideas about the influence of micro-macro- and nanostructure on the properties of materials, their interaction with the environment.

Willingness to participate in the development of technological processes of heat treatment of materials, various methods of surface strengthening and coating

The ability to perform a literary search of sources, including foreign ones, in the professional sphere and to use them in one's professional activity.

Knowledge of patterns of phase transformations in metals and alloys.

Knowledge of basic technologies of manufacturing, processing, testing of materials and products.

Learning outcomes according to the educational program:

Know the main types of modern metallic and non-metallic materials and the principles of their selection for specific products, taking into account the operating conditions.

To know the classification, marking, regimes of strengthening heat treatment, mechanical properties and areas of use of cast iron as a structural material of industry.

Know the regularities and practical methods of controlling the mechanical properties of metal alloys by changing their chemical composition and structure.

Use the understanding of the principles and regularities of phase transformations in metals and alloys under the influence of external factors.

Have a judgment about the rational and economical use of equipment and devices for processing and quality control of materials and products.

Thematic plan

Topic No				
	Let's name it (LK, PR, SR)			
	LK. General information about cast iron. White and graphitized			
	cast irons. Classification and structure of different types of cast	2		
	iron. Factors influencing the graphitization of cast iron.			
1	LW. Formation of the structure of white and gray cast irons.	2		
	InW.The difference in the structure and properties of two iron			
	castings of the same shape and size, cast at different cooling	6		
	rates (in sand-clay and metal molds).			
	LK. White and malleable iron: production, structure, properties,	2		
	application.			
2	LW.The formation of phosphide eutectics and the effect of	2		
2	phosphorus on the properties of cast iron.	2		
	InW. The influence of permanent impurities on the structure and	6		
	properties of cast iron.	0		
	LK. Gray cast iron cast iron: production, structure, properties,	2		
	labeling	۲		
3	LW. Modification of gray cast iron.	2		
	InW.The influence of the form of graphite inclusions on the	6		
	structure and properties of cast iron.	0		
4	LK. High strengthcast iron and cast iron with mermicular graphite:	2		
	production, structure, properties, labeling			
	LW. Investigation of the behavior of cast iron under compression			
	and torsion and determination of the main mechanical	2		
	characteristics of strength.			

	InW Easts offecting the behavior of east iron under different types					
	of load.	8				
5	LK. Alloyed cast irons, Influence of alloying elements on structure					
	and properties. Using.	2				
	LW. Types, structure and properties of graphiczed cast nons.					
	INV. Antimiction and special cast nons, their use.	0				
	LK. Preliminary neat treatment of cast Iron. Features of neat	0				
	treatment to improve the structural strength of cast iron of various	2				
	LW.Influence of alloying elements on critical points of the Fe-C					
6	diagram and structure formation in white and gray cast irons					
	InW. The influence of alloying elements on the type of Fe-C state					
	diagram. The influence of alloying elements on temperatures Mp					
	and Mk. Give an example with a diagram of isothermal					
	decomposition of austenite.					
	LK. Modification of the surface layer of cast iron products in order					
7	to increase reliability and durability in operation.					
/	LW. Heat treatment of cast iron.	2				
	InW. Chemical and thermal treatment of cast iron.	8				
	LK. The use of cast iron in mechanical engineering. Marking,	0				
	chemical composition and application of foreign cast irons					
8	I.W. Selection of the heat treatment mode of the HV 450-5 cast					
	iron body					
	InW. The use of cast iron in the automotive industry.	8				
	LK.	16				
Together	LW.	16				
	InW.	58				
Ι						

Individual educational and research task(if available): absent

Teaching methods:

1) verbal: 1.1 traditional: lectures, explanations.

1.2 non-traditional: electronic version, remote.

2) visual: method of illustrations, method of demonstrations

3) practical: 3.1 traditional classes

3.2 non-traditional stations

System assessment and requirements:

Current performance

1 The current success of applicants for the performance of educational types of work in training sessions and for the performance of independent work tasks is evaluated using a four-point rating scale with subsequent transfer to a 100-point scale. During the evaluation of the current academic performance, all types of work provided for by the educational program are taken into account.

1.1 Lecture classes are evaluated by determining the quality of performance of specified tasks.

1.2 Practical classes are evaluated by the quality of performance of a control or individual task, performance and design of practical work.

1.3 Laboratory classes are evaluated by the quality of reports on the performance of laboratory work.

1.4 Seminar classes are evaluated by the quality of individual assignment/abstract.

2 The current performance of higher education applicants is assessed at each practical

session (laboratory or seminar) on a four-point scale ("5", "4", "3", "2") and entered in the journal of academic performance.

- "excellent": the winner mastered the theoretical material flawlessly, demonstrates deep knowledge of the relevant topic or academic discipline, the main provisions;

– "good": the applicant has mastered the theoretical material well, has the main aspects from primary sources and recommended literature, presents it in an argumentative manner; has practical skills, expresses his thoughts on certain problems, but certain inaccuracies and errors are assumed in the logic of the presentation of theoretical content or in the analysis of practical ones;

- "satisfactory": the applicant has basically mastered the theoretical knowledge of the educational topic or discipline, orients himself in primary sources and recommended literature, but answers unconvincingly, confuses concepts, answers additional questions uncertainly, does not have stable knowledge; when answering questions of a practical nature, reveals inaccuracy in knowledge, does not know how to evaluate facts and phenomena, connect them with the future profession;

- "unsatisfactory": the applicant has not mastered the educational material of the topic (discipline), does not know scientific facts, definitions, hardly orients himself in primary sources and recommended literature, lacks scientific thinking, practical skills are not formed.

3 The final score for the current activity is recognized as the arithmetic mean sum of points for each lesson, for individual work, current test works according to the formula:

$$K^{nomov} = \frac{K1 + K2 + \dots + Kn}{n}$$

where K^{nomo_4} is the final assessment of success based on the results of current control;

 $K1, K2, \dots, Kn$ – evaluation of the success n of the current control measure;

n – number of ongoing control measures.

O prices are converted into points according to the calculation scale (table 1).

 Table 1 – Conversion of the average score for the current activity into a multi-point scale

4-point scale	100 points scale	4-ball scale	100 points scale	4-ball scale	100 points scale	4-ball scale	100 points scale
5	100	4.45	89	3.90	78	3.35	67
4.95	99	4.4	88	3.85	77	3.3	66
4.9	98	4.35	87	3.80	76	3.25	65
4.85	97	4.3	86	3.75	75	3.2	64
4.8	96	4.25	85	3.7	74	3.15	63
4.75	95	4.20	84	3.65	73	3.1	62
4.7	94	4.15	83	3.60	72	3.05	61
4.65	93	4.10	82	3.55	71	3	60
4.6	92	4.05	81	3.5	70	from 1.78 to 2.99	from 35 to 59
						reasser	mbly
4.55	91	4.00	80	3.45	69	from 0 to 1.77	from 0 to 34
4.5	90	3.95	79	3,4	68	repeated	study

Final assessment

1 A student of higher education receives a credit in the last lesson in the discipline based on the results of the current assessment. The average score for the current activity is converted into points on a 100 -point scale, according to the conversion table (table 1).

Applicants for higher education who have a current grade point average in the discipline lower than "3" (60 points) can increase their current grade by taking tests in the discipline in the last session.

Assessment of the knowledge of applicants through testing is carried out according to the following scale:

- "Excellent": at least 90% of correct answers;
- "Very good": 82% to 89% correct answers;
- "Good": from 74% to 81% of correct answers;
- "Satisfactory": from 67% to 73% of correct answers;
- "Fair enough": 60% to 66% correct answers;
- "Unsatisfactory": less than 60% of correct answers.
- **2** The condition for obtaining credit is:

- making up for all missed classes;

- the average current grade in the discipline is not lower than "3" (60 points).

3 For performing individual independent work and participation in scientific events, additional points are awarded to the winners.

3.1 Additional points are added to the sum of points scored by the student of higher education for the current educational activity (for disciplines for which the final form of control is a test), or to the final grade in the discipline for which the final form of control is an exam.

3.2 The number of additional points awarded for different types of individual tasks depends on their volume and importance:

 prizes in the discipline at the international / all-Ukrainian competition of scientific student works - 20 points;

- prize places in the discipline at the All-Ukrainian Olympiads - 20 points;

- participation in the international / all-Ukrainian competition of scientific student works - 15 points

 participation in international / all-Ukrainian scientific conferences of students and young scientists - 12 points;

- participation in all-Ukrainian Olympiads in the discipline - 10 points

- participation in olympiads and scientific conferences of the Khnadu in the discipline - 5 points;

- performance of individual scientific and research (educational and research) tasks of increased complexity - 5 points .

3.3 The number of additional points cannot exceed 20 points.

4 The learning result is evaluated (select the required one) :

- on a two- point scale (passed/failed) according to table 2;

- for 100 - point scale (for differentiated assessment) according to table 3.

The final grade together with additional points cannot exceed 100 points.

 Table 2 – Scale for transferring points to the national evaluation system

On a 100-point scale	On a national scale
from 60 points to 100 points	counted
less than 60 points	not counted

Table 3 – The scale for evaluating the knowledge of the students based on the results of the final control of the academic discipline

Score	Evaluation on a		Evaluation according to the ECTS scale			
IN points	national scale		Rating	Criteria		
pointo	examina tion	test				
90-100	Perfectly	Enrolled	A	The theoretical content of the course has been mastered in its entirety, without gaps, the necessary practical skills for working with the mastered material have been formed, all educational tasks provided for in the training program have been completed, the quality of their performance has been assessed with a number of points close to the maximum		
80–89 75-79	Okay	Okay olled		The theoretical content of the course has been mastered in its entirety, without gaps, the necessary practical skills for working with the mastered material have mainly been formed, all educational tasks provided for by the training program have been completed, the quality of most of them has been assessed with a number of points close to the maximum The theoretical content of the course has been mastered in its entirety, without gaps, some practical skills of working with the mastered material have not been formed enough, all educational tasks provided for by the training program have been completed, the quality of none of them has been assessed with a minimum number of points, some types of tasks		
67-74	ıctorily	ctorily	D	The theoretical content of the course is partially mastered, but the gaps are not of a significant nature, the necessary practical skills for working with the mastered material are basically formed, most of the educational tasks provided by the training program have been completed, some of the completed tasks may contain errors		
60–66	Satisfac		E	The theoretical content of the course has been partially mastered, some practical work skills have not been formed, many educational tasks provided by the training program have not been completed, or the quality of some of them has been assessed with a number of points close to the minimum.		

Score	e Evaluation on a national scale		Evaluation according to the ECTS scale		
in points			Rating	Criteria	
	examina tion	test			
35–59	Unsatisfactorily	counted	FX	The theoretical content of the course has been partially mastered, the necessary practical work skills have not been formed, most of the prescribed training programs of educational tasks have not been completed, or the quality of their implementation has been assessed with a number of points close to the minimum; with additional independent work on the course material, it is possible to improve the quality of the performance of educational tasks (with the possibility of retaking)	
0–34	Unacceptable	Not	F	The theoretical content of the course has not been mastered, the necessary practical work skills have not been formed, all completed educational tasks contain gross errors, additional independent work on the course material will not lead to any significant improvement in the quality of the performance of educational tasks (with a mandatory repeat course)	

Course policy:

- the course involves working in a team, the environment in the classroom is friendly, creative, open to constructive criticism;

- mastering the discipline involves mandatory attendance of lectures and practical classes, as well as independent work;

- independent work involves the study of individual topics of the academic discipline, which are presented in accordance with the program for independent study, or were considered briefly;

- all tasks provided by the program must be completed within the set time;

 if the student of higher education is absent from classes for a good reason, he presents the completed tasks during independent preparation and consultation of the teacher;

- the coursework must be protected no later than a week before the beginning of the examination session (indicated if available);

- while studying the course, students of higher education must adhere to the rules of academic integrity set forth in the following documents: "Rules of academic integrity of participants in the educational process of KhNAHU" (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz 67 01 dobroch 1.p df), "Academic integrity. Checking the text of academic, scientific and qualification papers for plagiarism"

(https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_85_1_01.pdf), "Moral and ethical code of participants in the educational process of KhNAHU (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_67_01_MEK_1.pdf) - in case of detection of plagiarism, the applicant receives 0 points for the task and must

repeat the tasks provided for in the syllabus;

- writing off during tests and exams is prohibited (including using mobile devices). Mobile devices are allowed to be used only during online testing.

Recommended Books:

1. Basic literature

1.1. Dyachenko S.S. Materials science: textbook / S. S. Dyachenko, I. V. Doshchechkina, A. O. Movlyan, E. I. Pleshakov. - Kharkiv: Khnadu Publishing House, 2007. - 440 p.

1.2. Dyachenko S.S. Materials for various purposes, their processing and properties: education manual / S.S. Dyachenko, I.V. Doshchechkina, I.V. Ponomarenko, S.I. Bondarenko. - Kharkiv: Khnadu, 2016. - 348 p.

1.3. Aftandilyants E.G. Materials science: a textbook / E.H. Aftandilyants, O.V. Zazymko, K.G. Shovel – Kherson: Oldi-plus; Kyiv: Lira-K, 2013. - 610 p.

2. Supporting literature

2.1. Aftandilyants E.G. Materials science: textbook / E.H. Aftandilyants, O.V. Zazymko, K.G. Shovel - K.: Higher education, 2012. - 548 p.

2.2.Garnets V.M. Materials science: textbook / V.M. handsome - K.:Condor, 2009.- 386p 3. Information resources

3.1.https://web.posibnyky.vntu.edu.ua/fmbt/shapovalova_materialoznavstvo/7.htmstudy of the structure and properties of cast iron

3.2.https://wikipage.com.ua/1x43.htmlinfluence of impurities on the structure and properties of cast iron.

3.3.https://wikipage.com.ua/1x43.htmlstructure and classification of cast irons

3.4.https://studfile.net/preview/8852674/page:2/influence of alloying elements on the properties of cast iron

3.5.https://stud.com.ua/73720/tehnika/termichna_obrobka_chavunuheat treatment of cast iron

Developer(s) syllabus of the educational discipline

signature

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