MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
NATIONAL TECHNICAL UNIVERSITY
KHARKIV POLYTECHNICAL UNIVERSITY

METHODICAL INSTRUCTIONS FOR THE PERFORMANCE OF CONTROL WORK IN THE DISCIPLINE "FUNDAMENTALS OF ENGINEERING TRAINING": FOR PART-TIME STUDENTS SPECIALTY IN 263 "CIVIL SECURITY"

Kharkiv 2024

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Methodical instructions for the performance of control work in the discipline "Fundamentals of engineering training": for part-time students specialty in 263 "Civil Security"

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Reviewer O. I. Ilinska

Department of Occupational and Environmental safety

INTRODUCTION

The strategic position of each state in the world economy is determined by the level of development of machine-building, which is the basis of technical re-equipment of the entire economy.

The system of training specialists in the field of machine-building in Ukraine is now gaining national importance. At the stage of formation of specialists in maintenance of machine-building productions it is necessary to help future young specialists to understand bases of technological essence of process of manufacturing of products on the basis of that rich heritage which for several generations was created by domestic scientists, designers, technologists and machine-building workers. At the same time, first of all, it is necessary to understand that the term "engineer" means a specialist with higher technical education.

The role of engineering and technical workers in the field of labor protection of mechanical engineering is important. The future engineer must know well - what consists of his activities in the enterprise, engineering heritage, the ratio of scientific and technical activities and other issues. The course "Fundamentals of Engineering Training" will help him in this.

The purpose of teaching the discipline is to form in future specialists knowledge about the achievements of science and practice in the field of mechanical engineering; mastering the principles and basic laws of production processes in machine-building production; formation of engineering and technological base in the organization and management of machine-building production; safety of production processes in machine-building production.

The essence of the discipline - the history of science and technology-mechanics, basics of labor protection, stages of creation of machines, the emergence of engineering, engineering and experiment, engineering practice, theoretical training, invention, design, technology and organization of production, engineering research, design, testing, commissioning , operation and evaluation of technical systems.

1. GENERAL PROVISIONS

The discipline "Fundamentals of Engineering Training" is studied for 2 semesters and is designed for students of the 1st year (second semester) and 2nd year (third semester) of the correspondence form of higher education. This discipline is part of the educational and professional training program for bachelors in the specialty 263 "Civil Security" educational program 263-1 - Park Protection "Occupational Safety" and belongs to the cycle of professional and practical training of occupational safety specialists.

These guidelines establish the full scope of independent work of the student in the study of the discipline, **the purpose** of which is:

- formation of future specialists' knowledge about the achievements of science and practice in the field of machine-building;

- mastering the principles and basic laws of production processes in machine-building production;

- formation of engineering and technological base in the organization and management of machine-building production;

- ensuring the safety of production processes in machine-building production.

2. PROGRAM OF THE COURSE “FUNDAMENTALS OF ENGINEERING TRAINING”

Part 1

Content module № 1

Topic 1. The purpose and objectives of mastering the discipline of the basics of engineering training

1.1 History of engineering development. 1.2 Engineering activities. 1.3 Purpose and objectives of mastering the discipline of the basics of engineering training (BET). 1.4 The place of discipline in the structure of the basics of labor protection. 1.5 Qualification requirements for the engineer-technologist of the production site. 1.6

Criteria for assessing the qualification of a technological engineer. 1.7 Activity-essence and content. 1.8 Types of activity.

Topic 2. Machine as an object of production

2.1 Basic concepts of machine-building production. 2.2 The essence of machines. 2.3 Classification of machines. 2.4 Classification of parts. 2.5 Requirements for machines and parts. 2.6 The machine and its official purpose. 2.7 Components of machines. 2.8 Accuracy of the machine, accuracy of its details. 2.9 Production and technological processes of machine manufacture. 2.10 Productivity and the cost of manufacturing the machine. 2.11 Types of production in mechanical engineering. 2.12 Technological preparation of production. 2.13 Technological discipline. 2.14 Manufacturability of machine designs. 2.15 Classification of parts. 2.16 Requirements for machines and parts. 2.17 Machine life cycles. 2.18 The most important blocks of machines. 2.19 Economic and social significance of machines.

Topic 3. Quality of machines

3.1 The impact of machine quality on the complexity and cost of their manufacture and operation. 3.2 Reliability of the machine, reliability indicators. 3.3 System of quality indicators for assessing the quality of machines: technical level; production and technological indicators; performance indicators; economic characteristics, aesthetic evaluation; environmental indicators; safety indicators.

Topic 4. Technical quality control of machines

4.1 General information on technical control. Basic terms and definitions. 4.2 Classification of types of technical control. 4.3 Assessment of the level of technical control, basic terms and definitions. 4.4 Assessment of economic efficiency of technical control. 4.5 Indicators of the level of technical control. 4.6 Methods of assessing the level of technical control.

Topic 5. Standardization in machine-building

5.1 Basic concepts in the field of standardization. 5.2 System of State Standards. 5.3 Standardization and interchangeability. 5.4 Selection of parametric series. 5.5 International standardization. 5.6 Standardization, creation and development of new equipment.

Topic 6. Fundamentals of interchangeability

6.1 Definitions and types of interchangeability. 6.2 Nominal and actual dimensions. 6.3 Limit dimensions. 6.4 Limit deviations. 6.5 Size tolerance. 6.6 Accuracy qualities. 6.7 Selection and assignment of tolerances and landings. 6.8 Schematic graphical representations of tolerance fields.

Topic 7. Product certification

7.1 General provisions. 7.2 Certification system. 7.3 Certification. 7.4 Obtaining a certificate of conformity by the manufacturer. 7.5 Recognition of foreign certificates of conformity. 7.6 Checking the status of production of certified products. 7.7 Product testing. 7.8 Supervision of certification and quality of certified products.

Topic 8. The concept of technical measurements

8.1 General information. 8.2 International System of Units. 8.3 Metrology - the scientific basis of measuring technology. 8.4 Basic metrological concepts. 8.5 Choice of measuring instruments. 8.6 Acceptance and accuracy of measurements.

Topic 9. Materials in machine-building

9.1 Basics of rational choice of materials for the manufacture of machine parts (mechanical and physicochemical properties of the material, operational, technological and economic requirements). 9.2 Methods and means of determining the mechanical properties of the material. General Information. 9.3 Metals. 9.4 Non-

metallic materials. 9.5 Choice of construction materials. 9.6 Physico-mechanical properties. 9.7 Marking. 9.8 Area of rational use of materials.

Topic 10. Main industries and industries, types of industries

10.1 Industries and production. Distribution of industries by economic purpose of manufactured products and signs of impact on the subject of labor. 10.2 Production and technological processes at the enterprises of the branch. 10.3 Types of production at the enterprises of the branch. 10.4 Raw materials and their types. 10.5 Waste and loss of raw materials.

Part 2

Content module № 1

Topic 11. Classification of technological processes and the basic laws of their development

11.1 The structure of the technological process. 11.2 The main parameters of any technological process. 11.3 Classification and technical and economic indicators of technological processes. 11.4 The main indicators of economic efficiency of the technological process. 11.5 Product quality and technology. 11.6 Development of technology as the main way to improve product quality.

Topic 12. General provisions for ensuring the safety of production processes

12.1 Basic legislative acts and normative documentation on ensuring healthy and safe working conditions at enterprises. 12.2 Dangerous and harmful production factors. 12.3 Basic means of protection.

Topic 13. General safety requirements for production processes

13.1 Training of workers in safe working methods and professional selection.

13.2 Control of the solution of safety problems in the design, implementation of production processes. 13.3 Determining the effectiveness of collective redress.

Topic 14. Machining of metals

14.1 Metal cutting. 14.2 Analysis and economic evaluation of metal cutting technologies. 14.3 Types of cutting. 14.4 Cutting modes. 14.4 Feasibility studies of the technological process variant. 14.5 Brief description of the main types of metal-cutting machines. 14.6 Product quality control. 14.7 Types of machining of metals. 14.8 Electrophysical, electrochemical processing methods (electroerosion treatment, electrochemical polishing, electrochemical dimensional treatment, ultrasonic treatment, radiation treatment, processing schemes, equipment, tools, devices). 14.9 Surface quality. 14.10 Occupational safety when processing materials by cutting.

Topic 15. Materials science and heat treatment

15.1 Structure, properties and classification of metals and alloys. 15.2 Theory of heat treatment of materials and its place among the technical sciences. 15.3 The main types of heat treatment of alloys (hardening, annealing, normalization). 15.4 Technological methods of hardening. 15.5 Heat treatment of low carbon steels: annealing, normalization, aging. 15.6 Heat treatment of medium carbon steels: annealing, hardening, high tempering, normalization. 15.7 Heat treatment of high-carbon tool steels: spheroidal annealing, hardening, low and medium tempering. 15.8 Heat treatment of low- and medium-alloy steels. 15.9 Features of heat treatment of high-alloy steels. 15.10 The main types of chemical and thermal treatment: cementation, nitriding, nitrocementation, boring, silicification, diffusion metallization. 15.11 The main types of equipment (furnaces, heating and cooling equipment). 15.12 Occupational safety in heat treatment of metals and alloys.

Topic 16. The concept of the processes of obtaining cast blanks - foundry production

16.1 General information about foundry production. 16.2 Foundry alloys and their technological properties. 16.3 Preparation and melting of cast alloys. 16.4 Technological processes of obtaining castings by different methods of casting. 16.5 Molding and rod mixtures, their preparation). 16.6 Product quality control. 16.7 Production of castings in sand molds (model set, molding and core mixtures, molding, pouring, knocking out, cutting, cleaning). 16.8 Fundamentals of the theory of foundry processes. 16.8 The essence of the method of casting. 16.9 Production of steels (open-hearth furnace, oxygen converter, electric furnace, melting technology, steel casting, crystallization and structure of ingots, ways to improve the quality of metal). 16.10 Special types of casting (in the chill mold, under pressure, centrifugal casting). 16.11 Production of castings in shell molds and smelting models. 16.12 Mechanization and automation of processes. 16.13 Casting for metallurgical equipment. 16.14 Casting for blast-furnace, steel-melting and rolling production. 16.15 Working conditions and reasons for failure of replaceable and repair cast parts of metallurgical equipment. 16.16 Equipment for foundry production. 16.17 Occupational safety in foundry production.

Topic 17. The concept of the processes of obtaining forged and stamped blanks

17.1 Technological process, basic operations and forging equipment. 17.2 The essence of the process and methods of hot volume stamping. 17.3 Processing of metals by pressure, its essence and types (cold and hot plastic deformation, rolling, pressing, drawing, forging, stamping). 17.4 Temperature regime and heating equipment (overflow, overheating, scale, chamber furnace, induction heating equipment). 17.4 Used equipment for obtaining forged and stamped blanks. 17.5 Occupational safety in the processing of metals by pressure.

Topic 18. Production of basic types of rolled products

18.1 The essence of the metal rolling process and rolling mills. 18.2 Production

of basic types of rolled products. 18.3 Rolling production, its essence. 18.4 Products of rolled products (assortment, special products). 18.5 Types of rolling. 18.5 Equipment and tools for rolling. 18.6 Production of pipes (seam and seamless rolling). 18.6 Pressing, its essence. 18.7 Pressing schemes (direct, reverse pressing). 18.8 Types of extruded profiles. 18.9 Equipment and tools for pressing (hydraulic presses, drags). Drawing, its essence. 18.10 Products of drawing production (pipes, wire, shaped profiles). 18.11 Forging, its essence. 18.12 Forging operations (sludge, drawing, stitching, cutting, bending, unrolling). 18.13 The equipment and the applied tool for forging (hammers, hydraulic presses, fights, mandrels, piercing, axes, underlying stamps). 18.14 Hot volume stamping, its essence (closed form, metal flow). 18.15 Equipment and tools for stamping (hammers, presses, forging machines, stamp, punch, die,). 18.16 Methods of stamping (open and closed stamping, direct and reverse extrusion). 18.17 Cold sheet stamping, its essence. 18.18 Sheet stamping operations (cutting, cutting, punching, bending, drawing, forming). 18.19 The concept of cutting material (production waste). 18.20 Equipment and the tool for sheet stamping (presses, stamps of consecutive and combined action).

Topic 19. Fundamentals of welding production

19.1 General characteristics of welding production. 19.2 Physical bases of welding production. 19.3 Types of welding: contact; manual arc welding and surfacing; automatic, semi-automatic; electroslag; electron beam; diffusion; ultrasonic; friction welding; HDTV welding; plasma; gas welding and cutting of metals; ration. 19.4 Occupational safety in welding, surfacing, cutting, spraying and soldering of metals.

Topic 20. Advanced types of technologies

20.1. Sectoral features of technological development. 20.2 The essence and main directions of accelerating scientific and technological progress. 20.3 Mechanization and automation of production. 20.4 The role of science in ensuring the development of technologies. 20.5 The main ways to improve human performance.

After studying the topics of theoretical material in the discipline "Fundamentals of Engineering Training", students must complete an individual task.

3. REQUIREMENTS FOR PERFORMANCE OF THE INDIVIDUAL TASK

The individual task is performed in the 14th TimesNewRoman font in 1.5 intervals (A4 format) according to the options. The number of the option coincides with the ordinal number of the student on the list in the academic journal of the group and. The questions that need to be covered in the test should be chosen according to the options listed in table. 3.1.

An example of the design of the title page is given in application A.

The work should have the following parts:

- Title page;
- Contents with a list of issues under consideration;
- Text - the answer to the question of control work;
- Sources.

The table of contents includes all the listed questions which will be opened in work according to a task under a variant.

The text should reflect the main content of the questions, including such aspects as the object (subject), purpose, methods. The text of the answer can be divided into meaningful parts. When writing answers to the text, it is necessary to indicate references to sources of information in square brackets with the appropriate number.

Sources of information - contain bibliographic information of sources to which reference is made in the text and which were used in writing the test.

The total amount of control work should be within 20-30 pages of A4 format.

LIST OF QUESTIONS BY OPTIONS

The question number consists of two digits: the first is the topic number, and the second is the question number in that topic.

Table 3.1 - Questions by options

№ option	Question number	
	Part 1	Part 2
1	2.1; 3.1; 8.1	11.1; 18.1; 14.8
2	2.2; 3.2; 8.2	11.2; 18.2; 14.9
3	2.3; 3.3; 8.3	11.3; 18.3; 14.10
4	2.4; 4.1; 8.4	11.4; 18.4; 16.1
5	2.5; 4.2; 8.5	11.5; 18.5; 16.2
6	2.6; 4.3; 8.6	11.6; 18.6; 16.3
7	2.7; 4.4; 9.1	12.1; 18.7; 16.4
8	2.8; 4.5; 9.2	12.2; 18.8; 16.5
9	2.9; 4.6; 9.3	12.3; 18.9; 16.6
10	2.10; 5.1; 9.4	13.1; 18.10; 16.7
11	2.11; 5.2; 9.5	13.2; 18.11; 16.8
12	2.12; 5.3; 9.6	13.3; 18.12; 16.9
13	2.13; 5.4; 9.7	14.1; 18.13; 16.10
14	2.14; 5.5; 9.8	14.2; 18.14; 16.11
15	2.15; 5.6; 10.1	14.3; 18.15; 16.12
16	2.16; 6.1; 10.2	14.4; 18.16; 16.13
17	2.17; 6.2; 10.3	14.5; 18.17; 16.14
18	2.18; 6.3; 10.4	14.6; 18.18; 10.15
19	2.19; 6.4; 10.5	14.7; 18.19; 10.16

RECOMMENDED BOOKS

1 Fundamentals of mechanical engineering technology. : educational manual / OV Deribo - Vinnytsia: VNTU, 2014. - 125 p.

2 Technology of machine-building enterprises: a textbook / VL Dykan, YE Kalabukhin, NE Kalicheva, etc., for general. ed. VL Dikan. - Kharkiv: UkrDUZT, 2020. - 386 p.

3 Dobryansky, SS Technological foundations of mechanical engineering / SS Dobryansky, Yu. M. Malafeev; KPI them. Igor Sikorsky. - Kyiv: KPI named after Igor Sikorsky, 2020. - 379 p

4 Deribo OV Fundamentals of engineering technology: workshop. Part 1 / OV Deribo, Zh. P. Dusanyuk, SV Repinsky. - Vinnytsia: VNTU, 2017. - 106 p.

5 Boguslaev VO, Tsypak VI, Yatsenko VK Fundamentals of engineering technology: textbook. way. for students. higher textbook institutions. Zaporozhye: Motor Sich, 2013. 336 p.

6 Averyanov OI, Averyanova IO Fundamentals of engineering training. Textbook. manual - M. "MGIU", 2008 - 51p.

7 Technology of structural materials: Textbook / MA Sologub, IO Rozhnetsky, OI Nekoz, etc .; For the order. MA Sologuba. - 2nd ed., Revised. and add. - K .: Вища школа, 2012. - 374 с. - ISBN 966-642-033-3.

8 Berezutsky VV Basics of labor protection. Science. manual. - H .: Fakt, 2008

9 State standards of Ukraine on labor protection.

10 Griban VG, Negodchenko OV Labor protection. Teaching way. 2nd ed.– K .: Center for Educational Literature, 2011. - 280 p.

11 Law of Ukraine "On labor protection". - From 21.11.2002, ed. from 27.02.2021

12 Fundamentals of labor protection: a textbook / V.I. Golinko; M-vo education and science of Ukraine; Nat. horn. un-t. - 2nd view. - D .: NGU, 2014. - 271 p

13 Life safety. Tutorial. Edited by Berezutsky VV - H .: Fakt, 2005. - 384p.

14 Workshop on the course "Life Safety" for students of higher educational institutions. Edited by Berezutsky VV - Kh .: Fact, 2005. - 168p.

15 Berezutsky VV Risk-oriented approach in labor protection / VV Berezutsky: LAP Lambert Academic Publishing, 2019. - 108 p.

16 Fundamentals of professional safety and human health: a textbook / VV Berezutsky [etc.]; ed. prof. VV Berezutsky. - Kharkiv: NTU "KhPI", 2018. - 553 p. K .: "Caravela", Lviv: "New World-2000", 2002. - 328 p.

17 Pistun IP Life safety: Textbook. way. - Sumy: "University. book », 1999. - 301 p

18 Kravets SV Theory of technical systems: textbook. way. / SV Kravets, AA Nechidyuk, OL Romanovsky. - Rivne: NUVGP, 2015. - 139 p

19 Engineering psychology: a course of lectures / KM Gorbunova, SB Litvinchuk, KA Taykhryb. - Mykolaiv: MNAU, 2016. - 203 p.

20 Skiba OP Engineering and computer graphics: lecture notes / OP Skiba, VI Kovbashin, AI Pik. - Ternopil: Ternopil National University. tech. Univ. I. Pulyuya, 2019. - 60 p. -
21 Baklitsky IO Psychology of labor: Textbook. 2nd ed., Lane. and ext. - K .: Knowledge, 2018. - 655 p.
22 Polishchuk, VA Design of blanks in mechanical engineering: textbook. manual / VA Polishchuk. - Mykolaiv: NUS, 2017. - 274 p.
23 Technology of foundry mold: textbook. way. to practice. classes and self. works for students of the field of knowledge 13 "Mechanical Engineering" special. 136 "Metallurgy" specialization "Foundry" / AM Fesenko; Donbas. state mechanical engineering. Acad., Dept. foundry technology and equipment. vir-va. - Kramatorsk: DSEA, 2017. - 112 p.
24 Kukui, DM Theory and technology of foundry production: In 2 parts / DM Kukui, VA Skvortsov, NV Adrianov. - Minsk: New knowledge; , 2015 - 384p.
25 Bodrova LG Technology of structural materials and materials science. Section "Materials Science": teaching method. way. / LG Bodrova, GM Kramar. - Ternopil: TNTU, 2016. - 120 p.
26 Technological processes in the specialty. Forging and stamping: a textbook / VV Kuhar, BS Kargin, OS Anishchenko, SB Kargin, AG Prysyazhny. - Mariupol: PDTU, 2017. - 144 p.
27 Integrated materials processing technologies: textbook / E.S. Gevorgyan, L.A. Timofeeva, VP Nerubatsky, OM Miller. I-73 - Kharkiv: UkrDUZT, 2016. - 238 p.
28 Shapoval SV Materials science: lecture notes / SV Shapoval. - H .: KhNUMG them. OM Beketova, 2017. - 122 p.
29 NPAOP 28.0-1.33-13 Rules of labor protection during forging and pressing works. Order of the Ministry of Energy and Coal Industry of Ukraine 12/19/2013 № 968.
30 Palivoda Yu. Ye Tool materials, cutting modes, technical rationing of machining: teaching method. way. / YE Palivoda, AE Dyachun, R. Ya. Leschuk. - Ternopil: Ternopil National University. tech. un-t. them. I. Pulyuya, 2019. - 240 p.
31 Shumilov AA Production of welded structures: lecture notes / AA Shumilov. - Zaporozhye: ZNTU, 2018. - 78 p. -
32 Production of castings textbook / OL Golubenko [etc.]; East Ukrainian National University named after Vladimir Dahl, Magdeburg University. Otto von Gurike. - Luhansk: V. Dahl National University, 2015. - 328 p.
33 Workshop on the theory of foundry alloys and processes: textbook. way. for students. higher textbook institutions that study in the field of training. "Engineering Mechanics" / [G. A. Bialik and others]; Zaporizhia. nat. tech. un-t. - Zaporizhzhia

Application A

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

NATIONAL TECHNICAL UNIVERSITY
KHARKIV POLYTECHNICAL INSTITUTE

Department of "Occupational Safety and Environment"

Control work

on the subject "Fundamentals of engineering trainang"

Option №___

Completed:
student gr.____
Name of the student

Checked:
Name of the teacher

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