MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

NATIONAL TECHNICAL UNIVERSITY
"KHARKIV POLYTECHNIC INSTITUTE"

METHODOLOGICAL INSTRUCTIONS

to the completion of the master's graduate project for foreign students

full-time and part-time

for students majoring in 131 Applied Mechanics and 136 Metallurgy

Kharkiv
NTU "KhPI"
2024

МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ

НАЦІОНАЛЬНИЙ ТЕХНІЧНИЙ УНІВЕРСИТЕТ
"ХАРКІВСЬКИЙ ПОЛІТЕХНІЧНИЙ ІНСТИТУТ”

МЕТОДИЧНІ ВКАЗІВКИ

до виконання дипломного проєкту магістра для іноземних студентів

денної та заочної форми

для студентів спеціальності 131 Прикладна механіка та 136 Металургія

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Department of foundry production

CONTENT

1. GENERAL POSITION

One of the forms of attestation – the graduate project is determined by the Regulation "On attestation of higher education applicants and the examination board" of NTU "KhPI", educational and professional program and educational plans.

The graduate project (GP) is a type of final qualification work, which is performed at a certain higher level education - master's degree Type of qualification work for educational professional programs establishes graduating department.

The second (master's) level of higher education involves the acquisition of the ability to solve problems of research and/or innovative character in certain industry professional activity

Diploma work is carried out in the following directions: scientific research, analysis and theoretical development, modeling and research processes and objects, economic, legal questions etc.

When performing the GP, the applicant of higher education systematizes and consolidates knowledge in the specialty; demonstrates the ability to apply them to practice when solving scientific and technical, economic and organizational issues tasks, and also raises level knowledge of development scientifically-technical documents

2. PROCEDURE FOR EXECUTION OF GRADUATE PROJECTS

The subject of GP is determined by the department. They should be relevant, correspond to the current state and prospects of the development of science and techniques. Titles of topics should be concise, clear and contain unambiguous interpretations.

GP topics are reviewed annually at the department meeting and updated if necessary. The topic can be accepted at the request of employers. The topics of final qualification papers are approved annually by order of the rector.

If necessary, topics can be adjusted or replaced. Name topic is re-approved by order of the rector on the basis of appropriate justification.

Applicants of higher education are given the right to choose the topic of the diploma project.

They can also propose their topic with necessary justification expediency its development

Subjects of GP for higher education seekers studying under the direction of enterprises (organizations), if possible, should correspond to specialization of these

enterprises (organizations).

Professors, associate professors, the most experienced senior lecturers, university researchers are appointed as the heads of the SE, and as well as highly qualified specialists of enterprises (organizations), candidates and doctors sciences and are approved by order rector

Before starting the implementation of the GP, the graduating department provides the student of higher education with methodical instructions regarding implementation GP from defined specialty

The graduate project is performed on the basis of a task, which is approved by the manager departments, with taking into account:

– actual material by summaries pre-diploma practices;
– scientific works departments;
– in-depth study of literature in a specialty that highlights the latest achievements of domestic and foreign science and technology, patent research;
– calendar plan implementation GP.

The head issues the assignment for the completion of the GP, which is based on the curriculum of the specialty, to the student of higher education within the terms established by the decision of the department. The calendar plan for the implementation of the GP form jointly the manager and the graduate education

Calendar plan GP masters in accordance to educational professional training programs involve the performance of in-depth tasks professional activity and accommodates special task innovative character.

During the implementation of the GP, the manager recommends the acquirer of higher education, the necessary sources of information, including regulatory documents, conducts the consultations provided for in the schedule, provides the necessary advice, checks the implementation of the calendar work plan (by stages and in general), including compliance with the requirements of this standard . Based on the results of the inspections, the manager determines the percentage of work performed in accordance with the approved plan. The results of inspections are published on department and by need are discussed at meetings department.

Within the set deadline, the student of higher education reports to the manager and head of the department, who record the degree of readiness of the diploma project.

Graduate project for a higher education student can perform both in a higher education institution and at enterprises, in scientific, design and construction institutes and in others organizations

If under time implementation diploma works are affected by force majeure

circumstances (introduction of martial law, natural cataclysms, activities quarantine order), When visiting university education seekers are limited or absent, all measures regarding of order implementation are carried out with using remote technologies.

GP allows students to familiarize themselves with modern technological processes and machine designs, their calculation and design methods for practical application in further work in the technological and design office, to study the current level and trends in the development of technology and design of foundry equipment.

During the GP, students get acquainted with the modernization and development of individual elements of the existing technological, transport and auxiliary equipment.

GOALS AND OBJECTIVES OF THE DIPLOMA PROJECT

The goal of the diploma project

Consolidate and deepen the knowledge obtained at the institute, supplement it with new summaries of advanced technology, equipment and automation of foundry production.

To acquire the initial practical experience necessary for independent engineering activities in the development of technological processes and the design of devices, equipment and machines, the economics of foundry production.

To gain experience of independent work in the profession and the ability to solve engineering problems in organizing the production of castings in various branches of the national economy; deepen and consolidate theoretical knowledge, supplement it with new summaries of new technology, automation and organization of modern production. GP is the final stage of the process of formation of an engineer, an active means of labor education.

Graduate project tasks

Acquire and consolidate skills in solving design, technological, technical-economic and organizational problems in the conditions of real production.

Get acquainted in more detail with all types of technical documentation, the order of its development, design and production use, starting with the design bureau of the foundry shop.

The study of the technological processes of the production of cast blanks at this

enterprise and the determination of the ways of their implementation on the basis of the achievements of science and technology, the cost-effectiveness of their application and their compliance with modern technical requirements.

The study of the arrangement of the workforce, standardized labor costs, scientifically based and progressive methods of increasing labor productivity and reducing the cost of production, the production planning system in a foundry depending on the serial production of products and the organization of hourly, variable and daily work schedules, basic technical and economic indicators of a foundry shop and the ability to analyze the work of the shop based on these indicators on a computer.

To study issues of labor protection, production organization and product quality management system at the enterprise.

Select the necessary materials for the development and implementation of a graduate project by specialty.

To study the rights and responsibilities of the master and design engineer in production.

Head and consultants of the diploma project

Doctors and candidates of sciences, the most experienced scientific workers of the University can be the leaders of the diploma project, according to the proposal of the head of the department, which takes part in the implementation of the educational and professional program of master's training.

Supervisors develop the topics of the graduate project and submit them to the meeting of the scientific and methodological committee of the department.

According to one scientist manager fixed to 5 acquirers higher education for educational a year.

Head of the graduate project obliged:

– to carry out leadership preparation of a diploma project;

– form together with acquirer higher education tasks for the preparation of a diploma project;

– control implementation acquirer higher education graphics preparation of a diploma project;

– analyze and control organization independent work acquirer higher education for the preparation of a diploma project;

– to provide assistance in drawing up a calendar plan for the entire period preparation of the diploma project;

– recommend literature, reference and archival materials, others sources for working on the topic of the diploma project;

– to conduct systematic consultations defined schedule and appointed as necessary.

Consultants from individual sections of the graduate project they can to be appointed teachers other departments. They provide help acquirer higher of education in the work on the relevant section, check quality its performance and put on the title page your signature.

At least once a month , getter higher education reports on the completion of the graduate project to the supervisor , who is based on analysis prepared materials fixes implementation of the calendar plan, about what serves information for the meeting departments . Head notes errors and inaccuracies in the materials works, indicates methods their elimination or the ways of the rational solution tasks.

Completed diploma the project, signed by consultants, the acquirer higher education submits for verification to the manager , who puts on her written feedback If diploma project, from the point of view manager , ready to defend before the exam commission (EC), appropriate recommendation given by him at the end feedback

Written response manager for graduate project illuminates level using acquirer higher education theoretical knowledge for solving tasks research , analysis of research methodology , evaluation quality solution tasks research , analysis and evaluation proposed a researcher activities , information about the shortcomings of the diploma project, general conclusions and assessment work Head evaluates graduate project and gives feedback

Head department reviews the work and certifies its by writing – "Admissible for protection", and in the case negative evaluation – "Defense is not allowed".

In the case of a negative conclusion regarding the admission of the acquirer higher of education for the defense of the diploma project, this question is submitted for consideration meeting department with the participation of scientific manager.

Preparation of the graduate project for defense

Organization and process control preparation of the graduate project depends on the manager department at which work is being done.

Diploma the project, along with the written one feedback manager submitted for consideration to the manager department, which decides the issue of the acquirer's admission higher education to protection and does so appropriate entry on the title page explanatory note and illustrative materials.

Graduate project approved by the manager department for protection, sent to the external review . Before reviewing are involved responsible workers production, specialists scientific and research institutions and establishments higher education. Circle of scientists and professionals interests reviewers has answer topics of the diploma project.

External review submitted in writing in any form and has to contain the following components:

– analysis compliance content of the graduate project its task;

– the importance of the topic of the graduate project for practice and its relevance;

– depth illumination acquirer higher education of the real state of affairs in the relevant industry;

– positive sides of the graduate project and her disadvantages , others questions at the discretion of the reviewer;

– assessment general impressions from the graduate project (design , style and literacy teaching etc.);

– conclusion and recommendation of opportunities acceptance of the graduate project for defense and, if desired , can be expressed comments and opinion about the assessment works according to the 100-point ECTS system and about assignment corresponding qualifications .

The reviewer has sign review from indication his own surname , first and patronymic , place work and position held by .

Review attached to the graduate project together with other documents.

Completed graduate project , signed by the author, together with the written one feedback manager and a review , submitted to the manager department , which decides question about the term protection.

Term submission – two weeks before defense.

At the request of the educational and professional guarantor programs possible organization scientific seminar the department at which are listening additional reviewing the graduate project and conducting it previous protection in presence manager.

Graduate project that does not meet requirements of content and design, written without compliance does not contain an approved plan materials of a specific study , substantiated offers, and also does not have feedback and reviews are not allowed to be defended.

3. CONTENT DIPLOMA PROJECT

By form graduate project – it kitdocuments

Documents GP are related to scientific and technical (scientifically-economic, etc.). They they can be textual and graphic.

Graduate project in general casecontain such documents:

1) title sheet;
2) notoriety documents (ND) graduate project;
3) task on diploma project;
4) explanatory note to graduate project;
5) design documents;
6) technological documents;
7) software documents, posters and illustrative materials (presentations).

4 REQUIREMENTS TO IMPLEMENTATION DIPLOMA DOCUMENTS PROJECT

The main ones requirements

SE documents must be executed, as a rule, in the Ukrainian language. Performance in any other language is permitted with permission department and institute based on corresponding justification.

GP documents must be completed in accordance with the requirements of regulatory documents: state standards, university standards and methodical instructions of the department.

Responsibility for compliance with the requirements of normative documents is borne by the persons who signed the document (the student of higher education, manager, consultants, head of the department).

Before submitting GP documents for approval to the head of the department, they must pass regulatory control for compliance with the requirements regulatory documents

It is recommended to entrust the standard control of documents to an independent person an expert from among the employees of the department (teacher, research assistant nickname engineer) with selection him corresponding working time

Title sheet

The title page of the GP is executed according to the form given in application A.

The GP cipher, which is placed on the title page, consists of the group number in accordance with the rules for numbering academic groups and number topics for by order, for example **МІТ-М223ин.е.05**.

Information of graduate project documents

All the documents completed in this document are recorded in the list of documents of the graduate project (hereinafter referred to as the list). work and are submitted to the examination commission (EC). The form of ND is given in application B, example implementation – in application C.

Record documents in data perform by sections:

– "Documents general";
– "Construction documents";
– "Technological documents";
– " Posters ";
– "Illustrative materials" (presentation);

If there is no type in the thesis documents, the section is excluded.

The first section "General documents" is mandatory. Tasks are recorded for him GP and explanatory a note to GP.

If a presentation is used during the defense of the GP, it is recorded in the "Illustrative materials" section.

Titles of sections are written in the column " Documents general " in the form of a title and emphasize.

Graphs data fill up such as follows:

– in the column "Name of the product, object or topic" for design and technological documents indicate the name of the product or object; for program documents – the name of the software product, for posters – the name of the poster. For illustrative material (presentation), the column indicates the subject of the GP;

– in count "Name document" indicate or view developed document for example, draftsman general species scheme electric principle, technological process, etc., or a type of illustration, for example, a table, graph, diagram, diagram, photograph, or the word "presentation", etc.;

– in the "Format" column, indicate the format in which the document was

executed. If the document is made on several sheets of different formats, then in this one columns are marked with an asterisk, and in the "Note" column, formats are listed, onwhose done document;

– in the "Quantity" column, indicate the number of sheets on which the document is made.

IN Counts the main inscription indicate (see addition B):

– in column 1 - topic of the work and type of document (Information of documents);

– in column 2 - the code of the graduate project and the code data documents VD (for example, **МІТ-М223ин.е.05 VD**);

– in count 3 – name or code of the establishment higher education and departments;

– in column 4 – type of work (Master's graduate project – MGP).

Task on graduate project

Task perform by form, given in application D.

In the task, the topic of the GP is specified by order of the KhPI National Technical University; the term of submission of completed GPs by the higher education applicant; raw data; a list of issues to be developed in the explanatory note; list graphic and illustrative material; the date issues task.

The task also indicates the consultants of individual sections of the explanation notes and calendar plan implementation stages GP.

Explanatory note to the graduate project

general position

Explanatory note to graduate project on essentially there are document, in which is provided report about implementation of the GP. Explanatory note – it textual document, What has scientifically- technical (economic, legal and another) nature.

Explanatory note contains successively such structural elements:

1) title sheet;
2) abstract;
3) content;
4) list of designations and abbreviations (by availability);
5) introduction;
6) the main part (sections explanatory note);

7) conclusions;
8) list sources information;
9) applications (by availability).

The structural elements of the explanatory note are performed accordingly to the requirements of STZVO-KhPI-3.01.

Title sheet explanatory notes

The title page is the first page of the explanatory note. It is included in the total number of pages, but the page number is not inserted.

Form titular sheet explanatory notes to graduate project is given in application I.

Abstract

The abstract is provided for viewing with an explanatory note. In accordance with DSTU 3008, it provides a concise summary of the content explanatory note, including object, purpose, methods and specific results work

The design of the essay must meet the requirements STZVO-KhPI-3.01.

In the explanatory note to the master's thesis, the abstract is performed by two in languages: Ukrainian and in English (in German, in french etc).

Pages essay not are numbered and in general numeric pages explanatory note are not counted.

Content

The design of the content must meet the requirements STZVO-KhPI-3.01.

The content presents the structural elements of the explanatory note in the following sequence: a list of symbols and abbreviations, an introduction, headings of sections and subsections of the main part, conclusions, a list of sources of information, applications with their titles.

Headlines elements explanatory notes write down lowercase letters from the first capital letter; headings of sections and subsections are recorded together with their ordinal numbers

Page numbers should be placed one below the other. The word "page" or its abbreviation is not written. Heading endings are separated from rooms pages scoring

List of designations and abbreviations

The execution of the list of signs and abbreviations must correspond requirements STZVO-KhPI-3.01.

Introduction

In the introduction, it is necessary to give a brief description of the modern the state of the scientific (technical) problem (question) to which the work is devoted, outline world trends, solutions to the tasks, note topicality, expected the results by task topics, that is being developed.

In the introduction to the GP, which is carried out according to the educational and scientific program the master's degree is allowed to state the purpose and tasks of the work, the object and the subject research, elements of scientific novelty, practical significance, methods scientific research, approbation of work results, without applying headings. In the presence of own scientific developments, a list of published articles and patents is provided in the introduction and the applicant's own contribution is indicated higher education in their creation.

Introduction to GP should occupy not more three pages.

The text of the introduction is not divided into paragraphs, it cannot contain headings, drawings, tables etc.

The main one part

The essence of the main part of the explanatory note is the presentation of information about the subject (object) of research or development, which is necessary and sufficient to reveal the essence of this work (theory, work methods, characteristics and (or) properties of the workshop, equipment, details, principles of operation equipment and basic principle decisions giving an idea of his device, etc.) and her results.

Content main parts explanatory notes has be established by the methodological instructions of the relevant department as determined specialty If there are relevant competencies in the standard of higher education in the specialty, they are added by the decision of the guarantor of the educational program sections on economic justification; labor and environmental protection environment; civilian protection

Designing the main part of the explanatory note (structure of the text: sections, subsections, points, subsections, as well as text elements: numbers and signs, units of physical quantities, formulas, tables, illustrations, link and notes) should answer requirements STZVO-KhPI-3.01.

The volume of the main part of the explanatory note should not exceed:

1) for GP master's degree – by specialty – 150 pages. Minimum amount text establishes appropriate chair.

The main part, which includes:

✓ **Chapter 1** – analysis of the production program of foundries of cast iron, steel and non-ferrous casting, depending on the topic diploma project:

To organize the production program, it is necessary to specify the list of all representative parts per product by weight group, the number of products produced per annual program, the number of all castings per main program and spare parts, the weight of each casting, the grade of alloy, and the percentage of possible defects.

Next, it is worth noting the equipment on which forms are made, the dimensions of the furnace and the number of castings in the furnace. It is also necessary to bring data on the rod department: the number of rods, their mass and size for one casting and for the annual program, dividing them by weight and size groups.

✓ **Chapter 2** is detailed analysis of the technological process of obtaining castings in one-time sand-clay foundry molds.

On this topic, they describe :

– the technology of making molds on machines (shaking, pressing, sandblasting and pressing, on automatic lines, etc.), paying attention to the essence of the mixture compaction mechanism. Special attention should be paid to the design of the models, the means of centering and fixing the models to the model plate, the use of quick-change and sliding equipment, which allows the implementation of flexible technology, means of pairing and fastening of half-forms (with staples, bolts, loading);

– means of producing rods on shaking, sandblasting machines, in heated equipment, HTS, etc., designs of rod boxes for various means of producing rods, types of frames and methods of their installation in the rod, methods of ventilation of rods, their strengthening;

– compositions of molding and rod mixtures for castings made of steel, cast iron and non-ferrous alloys, for the production of rods from HTS and heated equipment, means of preparation of molding and rod mixtures, their quality control;

– the technology of assembling forms and their preparation for pouring, the use of assembly templates; conductors, methods of installation of sprue funnels and bowls;

– construction of furnaces, devices of pins and chops, devices of drying plates and dryers;

– modes of drying forms and rods depending on the composition of the mixture and the size of the castings;

– types of defects, causes of formation and measures for their prevention, as well as means of correcting defects and lack of castings.

– The technology of making castings by special means.

When making castings in metal molds, it is necessary to describe: the construction of the mold, the rules for choosing the plane of separation, the means of mating and centering the parts of the mold, determining the thickness of the walls of the mold, the type and construction of rods and methods of removing them from the mold, the organization of ventilation of the molds, the composition of coatings and refractory paints, as well as means of their application, the temperature regime of the mold, the design and calculation of sprue systems.

In the production of pressure castings, it is necessary to study the design of the molds and the materials used for their manufacture, the devices of the sprue system, washers and ventilation channels, the means of pouring metal into the mold and removing the casting from it, preparing the mold for pouring.

When making castings based on heated models, it is necessary to study the construction of molds, the composition of modeling masses, the means of making models and assembling them into blocks, the composition and preparation of suspensions, the means of hydrolysis of ethyl silicate, the temperature regime of drying blocks and melting models from them, the temperature regime of firing shell molds and pouring them with metal, the construction of the sprue system, cleaning and heat treatment of the casting.

- ✓ **Chapter 3** – Development of model-casting equipment.

This section should describe :

– the methodology of developing technological processes, in particular, the choice of the position of the casting during forming, pouring and determining the surface of the parting of the mold and model. Selection of the number of rods and their boundaries. The structure of technological maps and the order of their filling. Selection of material for making models. The technology of manufacturing models, the sequence of their processing. Installation on a model plate. Tools for decorating and painting models.

Also, the third chapter describes **the design and operation of the melting units used in the workshop, as well as the metal melting technology** .

It is worth describing:

– the design of heating, means of cleaning the outgoing gases and their afterburning, granulation of slag, overheating of cast iron, preparation of the cupola for melting, methods of calculating the charge; design of arc furnaces, mode of steel melting in acidic and basic furnaces, quality control of metal during melting;

–the design of induction furnaces and the mode of metal melting in them;

–brands of used alloys, their chemical composition, mechanical and technological properties;

–means of improving the quality of metal by modification, alloying and refining.

– **Equipment of foundries** :

✓ Transport equipment of the shop. Design and operation of transport equipment (foundry conveyors, conveyors, chain suspended conveyors, pneumatic transport installations, etc.), bridge and other cranes that provide the main technological flows of molding materials and mixtures, molds and rods, metal, castings in the foundry shop .

✓ Equipment of the mixing department. Design and operation of used mixers, dispensers, conveyors, elevators, hoppers, etc. Schemes of preparation and transportation of molding and core mixtures, productivity and mode of operation of the equipment, automation of processing and preparation of molding and core mixtures, methods of combating dust and noise, etc., organization of operators' workplaces.

✓ Equipment of the forming department. Design, operation and layout of automatic and flow molding lines, their performance and mode of operation, design and operation of automatic molding machines and machines, foundry conveyors, edgers, assemblers and installers of half molds, installations for loading and unloading, equipment for filling molds and their cooling mode , equipment for separating forms, equipment for punching out forms, equipment for setting rods, auxiliary and transport equipment. Organization of workplaces of operators of automatic forming lines and quality control of forms. AFL schemes.

✓ Equipment of the core department. Design, operation and layout of rod automata and R SS, HTS installations. Productivity and mode of operation of the equipment. Production of complex rods, quality and size control. Organization of operators' workplaces. Schemes of rod automata.

✓ Equipment for cleaning castings. Anti-aircraft cameras and drums. Automatic lines and installations for abrasive cleaning of casting surfaces. Mechanization and automation of cleaning and felling works.

✓ Department for decorating and painting the surface of castings. The process of priming castings. Equipment for painting and drying castings. Productivity and mode of operation of the equipment.

✓ Organization of current, average and capital repair of equipment. Terms of service. The cost of installation and repair of the equipment. Measures to improve the quality of equipment repair and reduce its cost. Arrangement of schedules for

repair of equipment and types of repairs. Measures to increase machine productivity. Modernization of equipment. The cost of operating the foundry equipment.

✓ Measures regarding complex mechanization and automation of technological processes and their relationship with related operations. Production and economic effect of mechanization and automation of individual processes. Safety measures. Rules for operating foundry equipment.

✓ Equipment repair procedure. Mechanics section and job description. Organization of scheduled and preventive maintenance. Repair information. Calculation of spare parts. Passporting of the equipment and modernization of the foundry equipment of the plant.

✓ Organization of production and economic issues

To study the economics of production in a foundry. Describe in detail the calculation of the workshop cost of a ton of liquid metal and a ton of usable castings. To study the funds of production wages and workshop overhead costs of the workshop.

To study the cost of capital expenditures for the construction of a foundry, buildings and structures, equipment and its installation, tools, fixtures and inventory. Calculate the costs of all materials and types of energy per ton of suitable castings and their modern value.

The note should describe:

– Production structure of enterprise management.

– General characteristics of the plant's products and manufactured castings.

– General layout of the foundry shop. The location of individual plots, their relationship. Main cargo flows, introduction of flow methods of work.

– Mode of operation of the workshop and individual areas.

– The composition and performance of the main equipment.

– Scheme of organization of technical control of production.

– The structure of the shop and the management scheme of the foundry shop. Product cost, profit, profitability.

– Details of the main production equipment, its cost and depreciation allowances.

– Expenses on the main technological equipment of compressed air, electricity, water, gas, etc. List of main technical and economic indicators.

– **Standardization and quality control of products.**

It is necessary to describe: technical requirements for two or three basic castings and product quality control, ESKD, ESTD and the progress of their implementation

in production, the system of dispatching, rationing and accounting, the work of rationalizers and advanced teams of the shop, a complex system of improving the quality of products operating in the foundry workshop, types and causes of shortage of castings.

✓**4 Chapter –** Labor and environmental protection.

When writing this section, the student must describe the system of fire prevention measures adopted in the workshop, bring diagrams and give an analysis of the existing protective means on the main technological equipment, safety measures at two or three workplaces, study the existing ventilation devices, exhaust and mechanical ventilation and aeration, check the lighting of the operators' workplaces and compare it with the norms, give characteristics of artificial and natural lighting. Determine the noise level and familiarize yourself with measures to reduce it. Learn basic protective measures against electric shock. Familiarize yourself with the prevention of occupational diseases and the system of health measures.

Familiarize yourself with measures related to labor protection and the use of zero-waste technological processes in foundry production; with civil defense measures.

Conclusions (main work conclusions).

List of used sources (literature, resources network Internet, etc.);

Appendices (if necessary).

Conclusions

Conclusions should present concise results of the performed work work and proposals for its use, as well as this assessment of technical economic efficiency of the result work and its implementation.

In the presence of their own scientific developments, they reflect this fact in conclusions.

List sources information

The list of sources of information is compiled in accordance with the requirementsSTZVO-KhPI-3.01.

In the presence of their own scientific developments, they are included in the list sources information, if on them there are link in texts.

In the list of sources of information, the number of sources should not exceed: for a master's degree – 80. Minimal number sources information establishes chair.

All sources of information should be referenced in the main oneparts

explanatory notes

Appendices

Appendices they can contain:

– additional illustrations or tables;

– materials that, due to the large volume or form of presentation, cannot be included in the main part;

– an additional list of sources that were not referenced in the text, but which can arouse interest

All annexes should be referenced in the relevant sections of the explanatory note.

Appendices with their designation and by name must be entered to content

Annexes are drawn up in accordance with the requirements of STZVO-KhPI-3.01.

Requirements to design explanatory notes

Explanatory note must be decorated in accordance to the requirements of STZVO-KhPI-3.01.

Numbering pages explanatory notes begins with numbers 2 on a sheet "Content".

Construction documents

Design documents in diploma projects (KD) should be performed, as a rule, at the sketch or technical level project in accordance with state standards of the Unified Design System documentation (ESKD), in particular DSTU GOST 2.001, DSTU 2.104, DSTU ISO 2.702, DSTU ISO 2.703, DSTU ISO 2.704, DSTU ISO 5457 and others.

Draftsmen and schemes are related to graphic, specifications andlists elements – to text design documents

General amount graphic design documents not shouldexceed for Master's degree program - **8** sheets format A1.

Minimal number sheets establishes chair.

ADDITION A

Form titular sheet
diploma project

MINISTRY EDUCATION AND SCIENCES UKRAINE

NATIONAL TECHNICAL UNIVERSITY
"KHARKIV POLYTECHNIC INSTITUTE"

Institute _____

_____

Department of _____

Specialty _____

Educational program _____

Project is allowed to be
defended by the signature of the
Head department

_____
(initials and surname)

_____
(signature, date)

GRADUATE PROJECT

the Second (master's) equal higher education

Topic of the project _____

Code of the project _____
(group, number topics by order)

Executant _____
(Full name)

Tutor of project _____
(position, Full name)

Kharkiv 20__

ADDITION B

The form of information on graduate project documents

B.1 First sheet

product name, object or topics	Name document	For-mat e	How many sheet	At-mark

				(2)				
	Name	Sub	Date					
Develop ment				(1)	summe r		Sheet	Arkushov
Checked						(4)		
					NTU "Khpi" Department (3)			
N. cont.								
Approval								

B.2 The following sheets

product name, object or topics	Name document	For-mat e	How many sheet	At-mark

(2)	Sheet

ADDITION C

Example filling data documents

product name, object or topics	Name document	For-mat e	How many sheet	At-mark
	Documents general			
	Task on GP	A4	1	
	Explanatory note to GP	A4	62	
	Construction documents			
Color casting shop	Draftsman general species	*	3	A1; 2A2
Molding machine	Composite drawing	A1	1	
Molding machine	Specification	A4	2	
Detail	Draftsman details	A1	1	
	Posters			
Indicator chart	Graphs			
		A1	1	
Technical characteristics	Tables			
		A1	1	
	Illustrative materials			
Technological bases of production of castings	Presentation			
		A4	8	

				MIT- M223ин.е.44 VD			
	Name	Sugnature	Date				
Development	SNP			Color casting shop. branch of the Moldavian Lithuania	summer	Sheet	Arkushov
Checked	SNP				D P M		1
				Information documents	NTU "Khpi" Department of Foundry		
N. cont.							
Approval							

D. Form task on diploma project

MINISTRY EDUCATION I SCIENCES UKRAINES

NATIONAL TECHNICAL UNIVERSITY
"KHARKIV POLYTECHNIC INSTITUTE"

Institute _____
Department _____
Higher education _____
Specialty _____
Educational program _____

Project is allowed to be defended by the signature of the
Head department _____
(signature)
_____
(initials and surname)
" ___" of _____the 20th ___year

TASK
ON GRADUATE PROJECT (THESE)

_____
(initials and surname)

1 Project topic _____

_____

Tutor of project _____
(name, name, on father scientific degree, scientific rank)

approved by order institution higher education from " _" _____20 __years No_____
2. The deadline for the student to submit the project
3. Source data for the project ___
_____
_____
_____

4 List questions, which need to develop in explanatory notes

_____

_____

_____

_____

_____

_____

5 List graphic material (with accurate indication mandatory draftsmen)

_____

_____

_____

_____

6 Consultants sections of the project

Section	Name, initials and position consultant	Signature, date	
		task published	task accepted

7 Date issues task _____

CALENDAR PLAN

Number stage	Name stages graduate project	Execution period stages of the project	Notes

Executant_____ _____

(signature) (surname and initials)

Tutor of project

(signature) (surname and initials)

ADDITION I

I.2 Form titular sheet explanatory notes to the GP

MINISTRY EDUCATION I SCIENCES UKRAINE

NATIONAL TECHNICAL UNIVERSITY
"KHARKIV POLYTECHNIC INSTITUTE"

Institute_____

Department _____

Specialty_____

Educational program_____

EXPLANATORY NOTE
to diploma project

_____equal higher education

on topic _____

Executed student _____course, groups _____

(signature, name and initials)
Work manager _____
(signature, name and initials)
Reviewer _____
(signature, name and initials)

Standard control _____
(signature, name and initials)

Kharkiv 20____

5. COMPLETION OF WORK ON THE GRADUATE PROJECT AND ITS DEFENSE

The student submits the completed GP, signed by the consultants and the standards controller, to the DC. DC evaluates the GP readiness for defense based on the task performance and the calendar plan, signs the GP.

On the basis of DC's feedback and signatures, consultants and standards controller, the head of the department makes a decision on the admission of the applicant to the defense and puts his signature on the GP title page. After that, the student submits the full GP electronic version to the department by the deadline set by department decision, but not later than 1 day before the deadline, allocated according to the schedule of NTU "KhPI" educational process, for its subsequent placement in the Electronic "Repository qualifying graduation theses of higher education applicants at the National Technical University "Kharkiv Polytechnic Institute".

The file format and file names of documents are formed in accordance with the "Instructions on the archiving technology in the electronic repository of qualifying graduation theses of higher education applicants at the National Technical University "Kharkiv Polytechnic Institute".

GPs admitted to defense by the graduating department are submitted for review. The composition of reviewers from among production specialists and scientific organizations is approved by the vice-rector based on the submission of the relevant department. In their conclusions, the reviewers note the relevance of the development (research) topic, novelty, student's specific personal participation in obtaining the results presented in the project, the substantiation degree of scientific (practical, organizational) provisions. The reviewer puts his signature on the title page of the explanatory note.

The GP together with feedback and review is submitted to the examination committee for defense.

The GP public defense is held at the meeting of the examination commission, the date of which is set by rector's order. In the defense process, the examination commission examines the submitted materials: the explanatory note and the graphic part of the project (if this part is exist), as well as listens to the diploma student's report (up to 15 minutes) and his/her answers to questions on the topic.

When protecting a GP, it is allowed to submit illustrative material in electronic form (presentation). In this case, all examination commission members should be provided with handouts duplicating the slides.

The following issues are taken into consideration in the evaluation and grading

master’s theses:

- logic of the thesis structure, clarity and persuasiveness of argumentation (including proper citation and referencing);
- scope and depth of theoretical and methodological review;
- comprehensiveness and depth of the data analysis;
- quality of argumentation and comprehensiveness of the feasibilitystudy;
- quality of the appearance of the thesis (including graphic presentations and tables);
- quality of the oral presentation of the results during the defense procedure.

The results of thedefense of master's theses are evaluated using the European Credit Transfer System (ECTS) (on the scale "A", "B", "C", "D", "E", "FX", "F"); a 100-point scale; and the national system ("excellent", "good", "satisfactory", "unsatisfactory") and given in table 5.1.

Table 5.1

Scales for graduate paper evaluation and their meaning

National	ECTS	100-point	Explanation
5	A	90-100	Excellent
4	B	82-89	Very Good
	C	75-81	Good
3	D	64-74	Satisfactory
	E	60-63	Sufficient (Satisfactory)
2	FX, F	<60	Failed (Unsatisfactory)

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за спеціальністю 131 Прикладна механіка та 136 Металургія
(англійською мовою)

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