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METHODOLOGICAL GUIDELINES FOR PRE-DIPLOMA PRACTICE AND MASTER'S DIPLOMA DESIGN

for students specialty 274 'Automotive Transport'
of all forms of education

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Compilers: O. Yu. Rebrov
A. P. Kozhushko
Ye. S. Pelypenko
M. O. Mitzel

Reviewer: V. M. Shevtsov

Department of Automotive and Tractor Engineering

CONTENT

INTRODUCTION

The methodological guidelines are intended for students of the specialty 274 Automotive Transport of all forms of education, supervisors of master's pre-diploma practice, and supervisors of master's theses.

They contain the main requirements for conducting pre-diploma practice, organizing diploma design, and performing and defending master's level theses.

1 GENERAL DESCRIPTION OF PRACTICE

The pre-diploma practice, lasting 8 weeks, is conducted in the 11th semester. To familiarize students with the tasks for the diploma project (work) and the work plan during the practice, organizational meetings are held before its start, where a pre-diploma practice diary is issued.

The overall supervision of the students' pre-diploma practice is carried out by the practice supervisor from the university.

When issuing the topics for the diploma project, project supervisors must familiarize themselves with the production capabilities of the practice bases and take this information into account when developing the task for the diploma project. If it is not possible to ensure familiarization with the necessary equipment and work technology at one enterprise, the practice supervisor coordinates the possibility and conducts excursions to other enterprises where such familiarization can be carried out.

During the pre-diploma practice, the student attends lectures and seminars on the following topics:

- modern structures of STO and motor transport enterprises;
- advanced diagnostic methods and modern diagnostic equipment;
- marketing research of the car market (according to the assignment) and spare parts;
- structure, functions, main divisions of the auto service, and its management;
- new construction materials and advanced technologies in the field of car repair;
- Modern technologies for car maintenance and repair;
- organization and design of devices for car repair and maintenance;
- determination of changes in the technical and economic indicators of cars in operation;
- forecasting the vehicle's resource and the periodicity of maintenance;
- rules for the design of working, assembly drawings and specifications, the procedure for making changes, storing drawings and their accounting;
- use of CAD in design practice;

Students participate in excursions to the STO, the administration of the auto service enterprise, and production sites.

Duties of the university practice supervisor:

- before the start of practice, conclude an agreement with the enterprise regarding the students' practice;

- coordinate and approve the working program of the pre-diploma practice;

- together with the head of the enterprise's technical training department, compile a list of practice supervisors from the enterprise, familiarize them with the practice program and the content of individual tasks;

- agree on the students' work schedule;

- obtain information about the place of practice (types of work performed – their list, types of vehicles serviced, availability of equipment, apparatus, stands);

- select a group of students whose diploma project will be based on the equipment of the practice base and the technology of conducting work, which should be reflected in the individual assignment for practice signed by the diploma project supervisor from the university;

- issue an individual assignment;

- ensure control over the practice, timely conduct of safety instructions;

- conduct periodic monitoring of students' attendance in practice;

- if possible, ensure students' participation in the work used at the enterprise, familiarize them with the design of stands, the requirements for their operation, safety instructions when working on them, equipment and tools, the technology of performing work, and quality control of execution;

- if possible, organize employment at the enterprise as a manager, maintenance and repair engineer, or design engineer for the development of equipment for the repair and maintenance of vehicles.

Responsibilities of the practice supervisor from the enterprise:

- provide students with the opportunity to use technical documentation (test and diagnostics reports of vehicles, materials on claims and failures, occupational safety, technical and economic justification of 4 vehicle units), DSTU;

- conduct excursions according to the program;

- organize lectures with leading specialists from STO or transport enterprises;

- organize consultations with the supervisors of diploma projects (works);

- conduct consultations;

- monitor the students' fulfillment of the practice program.

Duties of student interns:

- diligently follow the practice program, the internal labor regulations of the enterprise, and safety techniques;

- systematically fill out the practice diary;

- keep records of the studied material necessary for the completion of the bachelor's diploma project and the preparation of the report;

- collect the necessary materials for the diploma project.

2 OBJECTIVE OF PRACTICE

Objective of practice:

- systematization, consolidation, and deepening of theoretical and practical knowledge in the specialty and their application in solving specific tasks related to the technical operation of vehicles during the preparation for the diploma project (work);

- development of independent work skills and mastery of methodologies for solving problems and issues to be addressed in the diploma project (work).

Practice tasks:

- study the structure of the working STO or automotive enterprise;

- study the organization of the enterprise's marketing department;

- study the technology of designing and implementing new technical solutions for product improvement into production;

- assist students in studying the organization of technological processes for diagnostics, repair, and maintenance of vehicles at the enterprise;

- to develop practical skills in working with modern diagnostic equipment and tools at specialized auto service stations;

- to familiarize with the organization of the production and economic activities of the enterprise, the order and regulations of work on the maintenance, diagnostics, and repair of vehicles;

- to acquaint students with car servicing and its preparation for sale;

- evaluate the possibility of predicting the resource and maintenance frequency of the company's vehicles;

- help students understand how typical malfunctions are eliminated at this company, especially those of the units considered in the diploma project;

- assist in collecting materials on the topic of the diploma project (work) and in consolidating and deepening knowledge of specialized disciplines

- collect the necessary data to complete the individual assignment for practice.

As a result of the practice, students should:

• ***Know:***

- methods for performing maintenance, diagnostics, and repair of vehicles, and the selection of modern equipment for these tasks;

- justification for the placement of STO in the city;

- planning of STO, placement of stations and equipment;

- the technology of repair and restoration of parts, the sequence of operations for assembly, disassembly, and assembly of units;

- evaluation of the technical and economic indicators of the vehicle during operation;

- methodology of marketing research in automotive transport.

• ***Be able to:***

- identify the main factors of economic categories, scientific foundations, and ways to increase production and save resources;

- evaluate the mechanical strength of developed structures;

- develop plans for STO and stations, designs of units, vehicles, and STO equipment;

- modernize vehicle design elements based on the analysis of current research and patent information;

- work with modern equipment, prepare requests for equipment and spare parts, and prepare technical documentation for repair;

- conduct marketing research;

- be able to design STO in accordance with current regulatory documents;

- develop and calculate schemes of electrical installations for various purposes, determine the composition of their equipment, and calculate their operating modes.

- compile and prepare operational documentation as provided by the rules of technical operation of vehicles, and perform vehicle maintenance at service stations.

• ***Acquire skills:***

- working as a manager at an auto service enterprise;

- working as a specialist in diagnostics or car repair;

- working in personnel training and management;

- working in the marketing field and in the field of material and technical support;

- working as a design engineer;

- working as a production site master.

3 CONTENT OF PRACTICE

During the practice, students must collect materials on the following issues:

1. Characteristics of the auto service enterprise as an object of diploma design. Organizational form of the auto service enterprise and its structural divisions, types of activities. Market research. Characteristics of products and their consumers.

2. Production program. Production base, technical and operational indicators. Annual performance indicators. Production organization. Structure of the technical service management.

3. Designs of vehicles serviced at the enterprise. Main units and systems of vehicles, their designs. Arrangement of systems in vehicles. Body structures, methods and technologies of disassembly and assembly of units and systems, their installation and dismantling.

4. Methods of diagnostics and repair of automobiles. Modern methods of diagnosing automobile systems. Modern methods of repair and restoration of vehicle units and assemblies. Working technologies and technological processes of technical maintenance and repair of automobiles.

5. Modern equipment and technical facilities of the STO. Analysis and study of equipment for diagnostics and repair, proposals for the use of other equipment and updating the material and technical base. Technical and operational indicators of the equipment.

6. Technological scheme of the STO, auto service, or auto enterprise. Technological layout scheme for the placement of posts and equipment at the STO with the selection of equipment and its technical characteristics.

7. Technical and economic justification of the adopted technical solutions.

8. Individual assignment for the completion of the diploma project.

According to the received individual assignments, students study the design of the base model, traction and certification tests, features and conditions of its operation, schemes of mechanisms and systems of the car, its diagnostics, maintenance and repair, and collect materials for the diploma project or work.

During the practice, students study:

- main equipment of the STO, workstations, and types of work;
- forms of labor organization for workers;
- quality management system for vehicle maintenance and repair;
- organization of vehicle storage;
- technology of all types of maintenance work;
- technology of control-diagnostic and adjustment work;
- technology of disassembly and assembly work during current and major repairs;
- technology of repair for units and assemblies;
- methods of restoring car parts and mechanisms;
- organization of production zones and departments of the STO;
- planning of maintenance and repair of cars;
- competitive environment of the STO and its competitiveness;
- specifics of marketing research;
- technological planning of production zones, sections, and workplaces;
- compliance with safety and fire safety regulations;
- organizational and technological principles of vehicle diagnostics;
- technological equipment used to perform the aforementioned tasks;
- technical and economic justification of the decisions made.

In addition, during the practice, students become acquainted with the enterprise, its history and development prospects, main departments, experimental base, and attend lectures on the development of automotive services, product improvement, and service provision technologies.

4 CONTROL MEASURES

During the practice, students use the enterprise's calculation and graphic materials, directories, DSTU and standards applied at the enterprise, literature, and other materials necessary for completing the practice report. Diaries, reports, graphic and calculation materials are submitted to the department three days before the practice credit submission.

The diary has a standard form approved by the order of the Rector of NTU 'KhPI', which reflects the following:

- type of student practice, educational unit, course, group, specialty;
- rules for maintaining and formatting the diary;
- assignment for practice;
- calendar plan for practice completion;
- report on the implementation of the practice program;
- feedback from the practice supervisor with an assessment of the student's work.

Diary forms are issued during the introductory practice conference at the graduating department under personal signature.

Upon completion of the pre-diploma practice, the student submits the following documentation to the supervisor for review:

1. *Practice diary.*
2. *Report on the implementation of the practice program.*

When preparing the report, the student must:

- analyze which auto service services are performed by the enterprise and what work is being done to improve the technological processes of diagnostics and repair;
- provide the organizational structure of the STO, the enterprise;
- list typical failures of vehicle components that are included in the topic of the diploma project (work);
- characterize the equipment and materials used for the repair of main vehicle components and systems;
- describe one stand for performing diagnostics or adjustment or repair work, according to the individual task, describe the technology of performing work on the specified stand and safety techniques;
- provide an approximate technological scheme of the STO or auto service;
- demonstrate quality control during repair work;
- show the operation of the enterprise using new equipment and technologies;
- include evidence of the application of modern CAD in the technological process (if available);
- demonstrate the enterprise's efforts to improve working conditions during repair and diagnostic work.

The practice report, consisting of 18-22 pages in A4 format, contains a detailed description of the work performed by the student, information on the completion of all sections of the practice program and individual assignment, conclusions and proposals, and a list of references used. The text of the report may include relevant calculations, explanations, tables, diagrams, charts, etc. The report compiled by the student must have continuous page numbering and be bound. The report is reviewed and approved by the practice supervisor, both from the base enterprise and the university.

When evaluating the pre-diploma practice, the student's attitude towards work, feedback, or characteristics from the institution where the student underwent practice are taken into account.

After the completion of the pre-diploma practice, the group supervisor (of the student) from the base institution prepares a report on the work. The report is accompanied by proposals and materials prepared by the student and accepted by the management for use in practical work.

The management of the base institution of practice organizes a discussion of the student's work results and evaluates it according to the national system and the ECTS system (Table 1).

The main documents of practice, including the diary with an individual plan, the practice report, proposals and materials prepared by the students and accepted for use in the practical work of the practice base, and the characterization of each student, must be signed by the supervisor of the practice base and certified with a seal upon arrival and departure from the practice base. Documents are submitted to the instructor who supervised the industrial practice.

Table 1 – Knowledge and Skills Assessment Scale: National and ECTS

Total points for all types of educational activities	ECTS Grade	Grade according to the national scale
90 ... 100	A	excellent
82 … 89	B	good
75 … 81	C	
64 … 74	D	satisfactory
60 … 63	E	
35 … 59	FX	unsatisfactory with the possibility of retaking
1 … 34	F	unsatisfactory with mandatory re-study of the discipline

The practice defense is conducted by a commission consisting of practice supervisors from the university. A student who has not completed the practice program for valid, documented reasons may be granted the right to retake it according to an individual schedule. A student who has not completed the practice program for invalid reasons or received an unsatisfactory grade upon retaking it will be expelled from the university.

5 GENERAL PROVISIONS FOR DIPLOMA DESIGN

The master's qualifying thesis is completed at the final stage of education and involves the systematization, consolidation, and expansion of theoretical and practical knowledge in the specialty and the application of this knowledge in solving specific scientific, technical, and other tasks; the development of independent work skills; mastering the methodologies of conducting theoretical and experimental research related to the completion of the thesis.

The thesis is an independent final project of the student. Higher education applicants have the right to choose the topic of their final qualification work from the list of topics available on the Department of Automotive and Tractor Engineering's website in the 'Educational Process' section. They can also propose their own topic with justification for its development and the availability of relevant materials.

When working on the thesis, the student must demonstrate the following skills:

– conduct a detailed analysis of the given problem;

– correctly select and justify appropriate technical solutions for its resolution;

– perform calculations of the chosen technical solutions using modern software tools;

– apply mathematical methods for research and processing of experimental data, elements of optimization;

– to fully and technically competently present their solutions in the explanatory note;

– to clearly and qualitatively display the results of their research in the graphic part or illustrative materials.

Supervisors of final qualification works are appointed from among the professors and associate professors of the University or highly qualified industry specialists. The defense of final qualification works for the awarding of the master's qualification level takes place in accordance with the Regulations on the Examination Commission at the National Technical University 'Kharkiv Polytechnic Institute' [9].

6 ORGANIZATION OF DIPLOMA DESIGN

The topic of the thesis (DR) is determined by the graduating department or proposed by employers with justification for its relevance. Students are given the right to propose their own topic. Topics should be relevant, reflecting the current state and development prospects of specific areas of science and technology. The titles of the topics should be concise and clear.

If necessary, the topics of the theses may be adjusted or changed. The title of such topics is re-approved by the rector's order based on the relevant justification from the department.

The thesis is carried out based on the assignment approved by the head of the department and is compiled in accordance with STZVO-KhPI-2.01-2021 [10].

The task takes into account:

– the availability of material based on the results of the pre-diploma practice;

– the topics of the department's and supervisor's scientific works;

– the availability of literature and patent research on the topic;

– a calendar plan for the implementation of the DR, developed jointly by the supervisor and the higher education applicant, indicating the sequence and deadlines for the completion of individual stages of the work.

During the execution of the DR, the supervisor recommends to the candidate a list of necessary information sources (regulatory documents, monographs, textbooks, articles, patents), conducts consultations, and checks the implementation of the work schedule by individual stages and as a whole. Based on the results of the checks, the supervisor determines the percentage of completion of the thesis in accordance with the approved plan.

The applicant reports to the supervisor and the head of the department within the established timeframe, who determine the degree of readiness of the thesis.

7 STAGES OF EXECUTION AND CONTENT OF THE THESIS

The first (preparatory) stage begins with determining the topic of the work, discussing the goals and objectives of the DR with the student, the conditions for collecting necessary information sources, and the possible implementation of the obtained results. The first stage ends with the defense of the pre-diploma practice report.

At this stage, the student must complete approximately 10–15% of the work: provide a description of the design object; analyze the technological processes of the service station; gather all necessary materials on service provision, energy consumption, characteristics of administrative or residential buildings, and production facilities for analyzing the efficiency of the service station's technological equipment; determine the parameters and operating mode of the equipment.

The second stage includes the processing of materials from the pre-diploma practice, taking into account the knowledge and skills acquired during its execution, as well as information obtained from printed and electronic sources. At this stage, 20–25% of the work is completed.

The third stage of diploma design is the main one, in which a list of issues outlined in the assignment is developed, and the results of the work are highlighted.

The fourth stage – the final one, involves the final review of the sections and their approval by the advisors, the formation of the note for the thesis, and the preparation of graphic and illustrative materials.

The fifth stage – the defense of the theses.

The thesis generally includes the following documents:

1) title page;

2) document list;

3) thesis assignment;

4) explanatory note;

5) design documents (if available);

6) technological documents (if available);

7) software documents (if available);

8) posters and illustrative materials (presentations).

The explanatory note is a textual document that provides a report on the execution of the DR. It sequentially contains the following structural elements:

1) title page;

2) abstract;

3) content;

4) list of symbols and abbreviations (if available);

5) introduction;

6) main part (sections of the explanatory note);

7) conclusions;

8) list of information sources;

9) appendices (if available).

The title page is the first page of the explanatory note of the thesis. The abstract provides a concise summary of the content of the explanatory note, including the object, purpose, methods, and obtained results of the work. The abstract is written in two languages: Ukrainian and one foreign language (English, German, French, etc.). The content of the work includes the structural elements of the explanatory note in the following sequence: list of symbols and abbreviations (if available); introduction; titles of sections and subsections of the main part; conclusions; list of information sources; appendices. The introduction provides a brief description of the current state of the scientific and technical problem being addressed in the work, highlights its relevance, and the expected results.

The essence of the main part of the explanatory note is the presentation of information about the subject and object of the research, namely theoretical information, research methods, characteristics and properties of the object, the principle of operation of the object, and the main solutions that provide an understanding of its structure, etc. All provided information should reveal the essence of the work and the obtained results.

The work also contains sections on economic assessment and justification of the DR, labor protection, and safety in emergency situations, which are carried out using methodological materials from the respective departments. The volume of the main part of the explanatory note should not exceed for a master's DR: by specialty - 150 pages; for economic justification - 15 pages; for labor protection and safety in emergency situations - 15 pages.

The conclusions of the DR should present concise results of the work performed, as well as an assessment of the technical and economic efficiency of the implementation of the work results. The number of sources in the list of information sources should not exceed 80. All information sources must be referenced in the main part of the explanatory note.

Appendices may contain:

– illustrations or tables;

– materials that, due to their large volume or form of presentation, cannot be included in the main part (for example, photographs, block diagrams, descriptions of computer programs, etc.).

All appendices of the thesis must be referenced in the relevant sections of the explanatory note, and the appendices with their designations and titles must be included in the content.

All requirements for the design of the thesis and its structural elements are set out in the standards of the higher education institution [6, 10], and during the execution of the work, the DSTU [3–5] should also be used.

In thesis projects, design documents (if available) should generally be executed at the level of a sketch or technical project in accordance with the state standards of the Unified System for Design Documentation (USDD), specifically DSTU GOST 2.001, DSTU 2.104 [9, 10]. The total volume of graphic design documents should not exceed 8 sheets of A1 format.

Illustrative materials (presentation) are to be prepared in electronic form. The presentation may include illustrations from the explanatory note, as well as the results of the design, technological, and software documents. The presentation must also be printed on A4 paper sheets and have a title page, created in any form, indicating the topic of the DR, the surname of the performer and the supervisor, and be attached at the end of the explanatory note.

8 PROCEDURE FOR PREPARING THE THESIS FOR DEFENSE

The supervisor evaluates the readiness of the thesis for defense based on the completion of the task and the schedule, signs the DR, and provides feedback characterizing the work done by the applicant. Based on this, the head of the department makes a decision on the admission of the work to the defense and signs the title page.

After this, the higher education applicant submits an electronic version of the thesis to the department for placement in the electronic Repository of qualification graduation works of higher education applicants at the National Technical University 'Kharkiv Polytechnic Institute' within the timeframe established by the department, but no later than 1 day before the deadline according to the University's academic schedule.

In case a higher education applicant is not allowed to defend the DR by the head of the department, this issue is considered at the department meeting with the mandatory participation of the supervisor. The protocol of the department meeting is submitted for approval to the director of the institute, and then for confirmation to the rector of the University.

Theses that are allowed by the graduating department for defense are submitted for review. The reviewer places their signature on the title page of the explanatory note. The diploma work, along with the feedback and review, is submitted to the State Examination Commission for defense.

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Compilers:
REBROV Oleksiy Yuriyovych
KOZHUSHKO Andriy Pavlovych
PYLYPENKO Yevhen Serhiiovych
MITSEL Mykola Oleksandrovych

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