

МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ  
ТЕРНОПІЛЬСЬКИЙ НАЦІОНАЛЬНИЙ ТЕХНІЧНИЙ УНІВЕРСИТЕТ  
ІМЕНІ ІВАНА ПУЛЮЯ

**Пилипець М. І., Радик Д. Л., Ткаченко І. Г.,  
Паньків В. Р., Паньків М. Р.**

**Методичні вказівки**  
**англійською мовою**  
**до екзамену з фаху студентів освітнього рівня бакалавр**  
**для здобувачів вищої освіти з числа іноземних громадян**  
**за спеціальністю 131 «Прикладна механіка»**

Тернопіль  
2019

Укладачі:

*Пилипець М. І.*, докт. техн. наук, професор;  
*Радик Д. Л.*, канд. тех. наук, доцент;  
*Ткаченко І. Г.*, канд. тех. наук, доцент;  
*Паньків В. Р.*, канд. тех. наук;  
*Паньків М. Р.*, канд. тех. наук, доцент.

Рецензенти:

*О. М. Лясота*, канд. техн. наук, доцент.

Схвалено та рекомендовано до друку на засіданні  
кафедри технології машинобудування  
Тернопільського національного технічного університету імені Івана Пулюя.  
Протокол № 4 від 21 травня 2019 р.

Схвалено та рекомендовано до друку на засіданні  
факультету інженерії машин, споруд та технологій  
Тернопільського національного технічного університету імені Івана Пулюя.  
Протокол № 8 від 30 травня 2019 р.

М 54      Методичні вказівки англійською мовою до екзамену з фаху студентів  
освітнього рівня бакалавр для здобувачів вищої освіти з числа іноземних  
громадян за спеціальністю 131 «Прикладна механіка» / Укладачі :  
Пилипець М.І., Радик Д.Л., Ткаченко І.Г., Паньків В.Р., Паньків М.Р. –  
Тернопіль : Тернопільський національний технічний університет імені  
Івана Пулюя, 2019. – 20 с.

УДК 621

© Пилипець М. І., Радик Д. Л., Ткаченко І. Г.,  
Паньків В. Р., Паньків М. Р., ..... 2019  
© Тернопільський національний технічний  
університет імені Івана Пулюя, ..... 2019

Ministry of Education and Science of Ukraine  
Ternopil National Technical University the named after Ivan Puluj

Mechanical Engineering  
department

## **METHODICAL INSTRUCTIONS**

to the examination on the student's specialty  
of a bachelor's educational level degree  
Direction of preparation 131 "Applied mechanics"

Ternopil  
2019

Compilers:

*Pylypets M. I.*, Doctor of Technical Sciences, Professor, Head of the Mechanical Engineering department;

*Radik D. L.*, Ph.D., Associate Professor of the Mechanical Engineering department;

*Tkachenko I. G.*, Ph.D., Associate Professor of the Mechanical Engineering department;

*Pankiv V. R.*, Ph.D.;

*Pankiv M. R.*, Ph.D., Associate Professor of the Mechanical Engineering department.

Reviewers:

*O. M. Lasota*, Ph.D., Associate Professor.

Considered and approved at the meeting of the Machine Building department of the TNTU named after Ivan Puluj.

Protocol № 4 dated May 21, 2019.

Approved and recommended for publication by the scientific and methodical council of the Mechanics and Technology Faculty of the TNTU named after Ivan Puluj.

Protocol № 8 dated May 30, 2019.

M 54      Methodical instructions to the examination on the student's specialty of a bachelor's educational level Direction of preparation 131 "Applied mechanics" / Compilers : Pylypets M.I., Radik D.L., Tkachenko I.G., Pankiv M.R., Pankiv V.R. – Ternopil : Ternopil National Technical University the named after Ivan Puluj, 2019. – 20 p.

UDC 621

Composed taking into account the curriculum for bachelor Direction of preparation 131 "Applied mechanics".

© Pylypets M. I., Radik D. L., Tkachenko I. G.,  
Pankiv V. R., Pankiv M. R., ..... 2019

© Ternopil National Technical University the  
named after Ivan Puluj, ..... 2019

## **1. General information**

Attestation of applicants for a bachelor's degree direction 6.050502 - "Mechanical Engineering" with professional orientation on specialty 7.05050201, 8.05050201 - "Technology of machine building" of correspondence form of study is conducted by the examination commission openly and publicly after the full implementation of the studying program due to curriculum (work curriculum) in the form of a specialty examination.

Attestation is carried out on the basis of assessment of the level of professional knowledge and skills of graduates provided for educational qualification characteristics of bachelor in the field of "Mechanical Engineering" and curricula of the Ternopil National Technical University named after Ivan Puluj, using national methods of complex diagnostics.

The information base on the basis of which the means of objective control of the degree of achievement of the ultimate goals of educational and professional training are formed, are the content modules, which consist of annotations of disciplines.

Preparation for a specialty exam is the final stage in the training of students in the relevant bachelor's program and aims to systematize, consolidate and expand the theoretical knowledge, skills and abilities, determination of the ability of their practical application in solving the professional tasks provided for primary positions in accordance with the requirements of educational qualification characteristics.

The examination on the specialty is conducted as a complex examination of the students' knowledge of the disciplines envisaged by the curriculum in the relevant field of training. It is conducted on the exams ticket drawn up according to the curriculum in accordance to the methodology determined by the department.

The examination on the specialty is conducted at an open meeting of the examination committee with at least half of the members of the commission with the mandatory presence of the chairman of the commission.

The work of the examination commission is carried out within the terms stipulated by the schedule of the educational process and according to the schedule

approved in accordance with the established procedure. The schedule of meetings of the examination commission is communicated to the general public not later than one month before the beginning of the specialty examination.

The decision of the examination commission on the assessment of the level of students' training is taken by a public majority vote of the members of the commission who participated in the meeting in form a closed meeting. With the same number of votes, the voice of the chair of the commission is decisive.

A student who has not passed a specialty examination or did not appear on him without valid reasons is deducted from the university as having completed the curriculum but has not passed the certification.

Students who did not take a specialty examination on a valid, documented reason may be extended by the rector to the next term of the examination committee, but not more than one year.

Re-examination of the specialty is allowed only during the next period of the respective examination commission, during the three years after graduation. The list of examinations in the specialty for persons who make them repeatedly is determined by the curriculum which acted in the year of graduation from the university.

According to the results of the examination commission meeting, draw up protocols.

In them are recorded asked questions make estimates obtained on the exam on specialty, special opinions and comments of the members of the commission.

The protocol signed by the chairman and members of the examination committee who participated in the meeting.

## **2. Stages and the general description of the examination on specialty**

The examination on specialty provides for the performance of certain attestation qualification tasks and is a form of qualification tests, which objectively and reliably determines the level of education and professional training of university graduates.

The examination on a specialty consists of two stages:

1st stage - test examination of competencies provided by the educational qualification characteristics of the bachelor and provided by a set of disciplines:

- Theory of machines and mechanisms;
- Technology of structural materials and materials science;
- Technological foundations of mechanical engineering;
- Basics of labor protection;
- Technological methods of machine parts workpieces production;
- Technology of typical parts processing and assembling of machines;
- Technological equipment.

stage 2 - a written solution to a practical problem that allows to check the formation of relevant competencies that are provided by a set of disciplines:

- Theory of machines and mechanisms;
- Technology of structural materials and materials science;
- Technological foundations of mechanical engineering;
- Technological methods of machine parts workpieces production;
- Technology of typical parts processing and assembling of machines;
- Technological equipment.

The examination on the specialty includes the following technological steps:

- creation of a system of test tasks and a set of complex practical tasks;
- examination (procedures for testing and solving tasks);
- verification of test forms;
- verification and evaluation of tasks;
- assessment of the degree of achievement of the ultimate goals.

The University ensures adherence to the following rules for carrying out the examination on specialty:

- unification of conditions for conducting measurements; methods of processing the results of testing and forms of their submission;
- informational and psychological preparation of students for exam;
- compliance with the requirements of secrecy during the copy of test tasks and their storage and use.

Student counseling during the examination on specialty is allowed only in matters that are not relevant to the content of the responses.

When preparing the exam on a specialty, students may use reference information in the form of guides, standards, both on paper and on electronic media, prepared in advance.

### **3. Requirements for test tasks**

The diagnostic tool is a closed-form test task with suggested answers, in which the correct ones are selected from the set of choices (four answers, only one of which is correct).

The system of basic test tasks is formed by expert evaluation of each task and their aggregate and covers all content modules from the complex of compulsory disciplines, which are defined in the educational-professional program of preparation of the bachelor's degree.

Test tasks of the closed form consist of two components:

- questioning (informative) part;
- four answers.

The questioned part of the test task is formulated in the affirmative or questionnaire form briefly, clearly, without double interpretation. The question part of the test task is highlighted in active color. Elements of response parts of test tasks have a separate indexation. Possible answers are not separated by any sign. Responses are placed symmetrically under the questionnaire.

If the answer involves a certain calculation procedure, then the latter is simple, without the need to use constituent hardware.

The test (selection of test tasks of each variant) includes 100 test tasks. This quantity is sufficient to ensure the correct accuracy of the measurement method.

Tests provide a proportional representation of all disciplines identified for attestation and various content modules from the structure of each of these disciplines.



#### **4. Requirements for a set of complex practical tasks**

The complex practical task from the content modules of several disciplines simulates the real task that a graduate can meet in practical activities in the initial positions, simulates the process of preparation, adoption and implementation of engineering solutions.

Duration of solving the problem - 4 hours.

Task structure:

- initial conditions (drawing details, type of production);
- regulatory support;
- task - select the workpiece; choose the optimal variant from the given processing method of the surface; to offer the routing technology of processing this part, to develop a calculation scheme of technological equipment, to propose measures for the protection of labor.

In a specialty exam using a set of 30 different tasks for one exam.

Each exam paper contains the name of the university, the department and specialty. It has a number, an informative part, information about the department, the protocol number and the date of the department meeting, on which has been approved. Each exam ticket is signed by the head of the department and the dean of the faculty, and approved by the rector.

All exam papers contain the same type of interrelated questions that cover theoretical, computational and practical aspects of the development of routing technology for mechanical processing of machine parts and labor protection, as well as an individual task application in the form of work drawing details.

#### **5. The procedure for carrying out the examination on specialty**

When passing the test, the student is given 60 minutes to answer 30 questions.

Student knowledge control is carried out using a computer. The Mechanical Engineering Department for the passage of testing on subjects passed on the state exam, a specially developed program-shell "TEST-EXAM" for PC.

The order of testing is as follows. After starting the program, the student is familiar with the general rules of using it, finds his group, and then the last name in the proposed (listed in advance) lists. The amount of time allowed for testing begins after the choice of the discipline (in an arbitrary order) and the command "Go to questions".

To answer a question, you need to identify one correct version from the four proposed and place an appropriate mark next to it. The answer is perceived by the PC after pressing the "Confirm" button. From the moment of the confirmation of the correct answer, it will not be possible to change the choice.

The "TEST-EXAM" program is designed in such a way that when passing the test student is given the opportunity to answer the questions in an arbitrary order using the commands "Subjects" and "Go to questions".

Completion of testing takes place in one of two ways:

- at the student's request (after answering all the questions asked, click on the "Complete Test" button and inform the teacher);
- automatically when the time it takes for testing end (the time tracking leads the PC).

After the test is completed, the test protocol is displayed on the PC monitor. It contains the student's personal details (the student's group, surname and initials), the date of the exam, information on the total number of test assignments the student answered, the number and percentage of correct answers, the grade for the test.

If a student voluntarily exits the program, closes the test results window or opens another program, he will automatically receive an "unsatisfactory" rating for the exam.

## **6. Evaluation criteria**

The examination committee records the result of computer testing and solving the task of each student in the examination information.

Assessment of theoretical knowledge level and practical skills obtained is based on the module-rating system of knowledge control. The final score for taking the exam in the specialty is based on the results of each of the stages:

- 60 points maximum - for performing test tasks (2 points per each correct answer);
- 40 points maximum - for solving the analytical and settlement task).

The evaluation of the problem solving results follows the following general criteria:

- 36-40 points - the task is completed in full, the answer is substantiated, conclusions and proposals are reasonably and properly documented;
- 30-35 points - the task was completed in full, but minor inconsistencies were made in the calculations or execution; or provided that the task is properly executed at least 75%;
- 24-29 points - the task is executed not less than on 60% under condition of proper execution; or at least 75%, provided that minor mistakes are made in the calculations or design.

Final grading scale for a comprehensive state examination.

Be the scale of a single system of state documentation	By the nominal scale	By the scale of an educational institution
<b>A</b>	Excellent ..... <b>5</b>	90...100
<b>B</b>	Very good ..... <b>4</b>	85...89
<b>C</b>	Good ..... <b>4</b>	75...84
<b>D</b>	Sufficient ..... <b>3</b>	65...74
<b>E</b>	Decent ..... <b>3</b>	60...64
<b>FX</b>	Not satisfactory with the possibility of re-assembly ..... <b>2+</b>	35...59
<b>F</b>	Not satisfactorily with compulsory repeat course ..... <b>2–</b>	1...34

## **7. Summarizing the results of the specialty examination**

The results of the specialty examination are announced to graduates after the registration of the protocols by the examination committee, but not later than one day after its completion. During this, a general assessment of the students' answers, the most striking of them is noted, the level of theoretical training of students is characterized.

Upon termination of the examination commission its chairman makes a report, which indicates the conclusions, comments and suggestions on improving the educational process, teaching the disciplines of professional direction and improving the quality of professional training of " Mechanical Engineering " specialists.

The results of the examination on the specialty are discussed at the meetings of the Machine Building department and at the meeting of the Academic Council of the Mechanics and Technology Faculty.

The Academic Council of the Mechanics and Technology Faculty and the Machine Building department on the basis of the examination on specialty develop and implement appropriate proposals, measures aimed at further improving the teaching of professional disciplines and improving the quality of specialists training.

## **8. Recommended literature for preparation for exam on specialty**

### **1. Technological foundations of mechanical engineering**

1. Боженко Л. І Технологія машинобудування. Проектування технологічного спорядження [Текст]: Навчальний посібник для студентів машинобудівних спеціальностей вищих закладів освіти / Л. І. Боженко. – Львів: Світ, 2001. – 296 с.
2. Боженко Л. І. Технологія виробництва заготовок у машинобудуванні [Текст] / Л. І. Боженко. – Київ: НМК ВО, 1990. – 264 с.
3. Виноградов В. В. Технология машиностроения: введение в специальность. Технология машиностроения. [Текст] / Виноградов В. М. – М.: Издательский центр «Академия», 2007. – 176 с.

### **2. Mechanical engineering technology**

1. Боженко Л. І Технологія машинобудування. Проектування технологічного спорядження [Текст]: Навчальний посібник для студентів машинобудівних спеціальностей вищих закладів освіти / Л. І. Боженко. – Львів: Світ, 2001. – 296 с.
2. Боженко Л. І. Технологія виробництва заготовок у машинобудуванні [Текст] / Л. І. Боженко. – Київ: НМК ВО, 1990. – 264 с.
3. Виноградов В. В. Технология машиностроения: введение в специальность. Технология машиностроения. [Текст] / Виноградов В. В. – М. : Издательский центр «Академия», 2007. – 176 с.
4. Кострицкий В. Г. и др. Контрольно-измерительные инструменты и приборы в машиностроении: Справочник. [Текст] / Кострицкий В. Г., Кузьмин А. И. – К.: Техника, 1986. – 135 с.
5. Локтев А. Д. Общемашиностроительные нормативы режимов резания [текст] / А. Д. Локтев, И. Ф. Гущин, Б. Н. Балашов.: Справочник в 2 Т. – М: Машиностроение, 1991.

6. Руденко П. О. Проектування технологічних процесів у машинобудуванні. Навчальний посібник [Текст] / П. О. Руденко. – К.: Вища школа, 1993. – 414 с.
7. Руденко П. О. Вибір, проектування і виробництво заготовок деталей машин [Текст] / П. О. Руденко, В. О. Харламов, О. Г. Шустик. – Київ: Вища школа, 1993. – 288 с.
8. Справочник технолога-машиностроителя. В 2-х т. [Текст] / Под ред. А. Г. Косиловой и Р. К. Мещерякова. – М.: Машиностроение, 1985.

### **3. Technological equipment**

1. Боженко Л. І Технологія машинобудування. Проектування технологічного спорядження [Текст]: Навчальний посібник для студентів машинобудівних спеціальностей вищих закладів освіти / Л. І. Боженко. – Львів: Світ, 2001. – 296 с.
2. Боженко Л. І. Технологія виробництва заготовок у машинобудуванні [Текст] / Л. І. Боженко. – Київ: НМК ВО, 1990. – 264 с.
3. Кострицкий В. Г. и др. Контрольно-измерительные инструменты и приборы в машиностроении: Справочник. [Текст] / Кострицкий В. Г., Кузьмин А. И. – К.: Техніка, 1986. – 135 с.
4. Руденко П. О. Проектування технологічних процесів у машинобудуванні. Навчальний посібник [Текст] / П. О. Руденко. – К.:Вища школа, 1993. – 414 с.
5. Справочник металлиста: В 5-ти томах. [Текст] / Под ред. М. П. Новикова и П. Н. Орлова – Изд. 3-е, перераб. – М.: Машиностроение, 1977. – 720 с
6. Справочник технолога-машиностроителя. В 2-х т. [Текст] / Под ред. А. Г. Косиловой и Р. К. Мещерякова. – М.: Машиностроение, 1985.

### **4. Metal working equipment**

1. Металлорежущие станки. Учебник для машиностроительных втузов. Под ред. В. Э. Пуша. М.: Машиностроение, 1985. – 256 с.

2. Металлорежущие станки и автоматы. Учебник для машиностроительных вузов. Под ред. А. С. Проникова. – М.: Машиностроение, 1981. – 479 с.
3. Кузнецов Ю. М. Верстати з ЧПК та верстатні комплекси. Навчальний посібник. К. – Тернопіль, 2001. – 349 с.
4. Кузнецов Ю. М. Цільові механізми верстатів-автоматів і верстатів з ЧПК. Навчальний посібник, К. – Тернопіль, 2001. – 349 с.

## **5. Cutting tool**

1. Семенченко И. И., Матюшин В. М., Сахаров Г. Н. Проектирование металлорежущих инструментов. – М.: Машгиз, 1963, – 952 с.
2. Четвериков С. С. Металлорежущие инструменты. – М.: Высшая школа. 1965. – 730 с.
3. Алексеев Г. А., Аршинов В. А., Кричевская Р. М. Конструирование инструмента. – М.: Машиностроение, 1979. – 383 с.
4. Родин П. Р. Металлорежущие инструменты. – К.: Вища школа, 1990. – 424 с.

## **6. Theory of cutting**

1. Бобров В. Ф. Основы резания металлов / В. Ф. Бобров. / М.: Машиностроение, 1975. – 244 с.
2. Мазур М. П. Основи теорії різання матеріалів: підручник / М. П. Мазур, Ю. М. Внуков, В. Л. Доброскок, В. О. Залога, Ю. К. Новосьолов, С. Я. Якубов. Під заг. ред. М. П. Мазура. – Львів: Новий світ, 2010. – 422 с.
3. Грановский Г. И. Резание металлов / Г. И. Грановский, В. Г. Грановский // – М.: Машиностроение, 1986. – 365 с.

## Content

1. General information .....	5
2. Stages and the general description of the examination on specialty .....	6
3. Requirements for test tasks .....	8
4. Requirements for a set of complex practical tasks .....	9
5. The procedure for carrying out the examination on specialty .....	9
6. Evaluation criteria .....	10
7. Summarizing the results of the specialty examination .....	12
8. Recommended literature for preparation for exam on specialty .....	13



ДЛЯ НОТАТОК

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

## This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

## This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Навчально-методична література

**Пилипець М. І., Радик Д. Л., Ткаченко І. Г.,  
Паньків В. Р., Паньків М. Р.**

**Методичні вказівки  
англійською мовою  
до екзамену з фаху студентів освітнього рівня  
бакалавр  
для здобувачів вищої освіти з числа іноземних  
громадян за спеціальністю  
131 «Прикладна механіка»**

Комп'ютерне макетування та верстка *А. П. Катрич*

Формат 60х90/16. Обл. вид. арк. 0,74. Тираж 10 прим. Зам. № 3240.

Тернопільський національний технічний університет імені Івана Пулюя.  
46001, м. Тернопіль, вул. Руська, 56.  
Свідоцтво суб'єкта видавничої справи ДК № 4226 від 08.12.11.