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**Federal State Autonomous Educational Institution of Higher Education
PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA
NAMED AFTER PATRICE LUMUMBA
RUDN University
ACADEMY OF ENGINEERING**

(educational division (faculty/institute/academy) as programme developer)

Base department "Machine-building technologies"

(department realizing the PhD program)

COURSE SYLLABUS

Engineering technology

(course title)

Scientific specialty:

2.5.6. Mechanical Engineering Technology

(code and name of scientific specialty)

The course instruction is implemented within the PhD programmes:

Mechanical Engineering Technology

(PhD program title)

1. DISCIPLINE (MODULE) GOAL

The purpose of mastering the discipline "Technology of mechanical engineering" is the theoretical and scientific preparation of a graduate student for the systematization of theoretical knowledge and practical skills and the formation of the applicant's skills of independent research activities in the field of mechanical engineering technology.

The main **objectives** of the discipline are:

- the formation of fundamental knowledge in the field of sciences, which constitute the theoretical basis of the specialty, the ability to predict the development of scientific research, technologies and technological equipment that have novelty and practical value;
- teaching the methodology of theoretical and experimental research, diagnosing, modeling and optimizing technological processes, technological equipment, cutting tools, tool systems and tooling for machine-building industries;
- teaching the methodology of engineering and technical creativity, to form his skills in generating innovative ideas and creating new technologies and technological equipment;
- instilling the skill of designing, calculating and improving technological processes, cutting tools, tool systems and equipment for machine-building industries.

2. REQUIREMENTS TO PHD-STUDENTS ON FINISHING THE COURSE

As a result of mastering the postgraduate program in mechanical engineering technology, the student should:

know:

- the theory of technological support and improvement of the quality of engineering products;

be able to:

- to develop technological processes for manufacturing parts of a given quality with the lowest cost of their production;
- scientifically sound evaluation of new solutions in the field of construction and modeling of machines, drives, equipment, technological systems, and specialized machine-building equipment, and means of technological equipment for production;

own:

- skills to evaluate new solutions in the field of construction and modeling of technological processes for the manufacture of machines, drives, equipment, technological systems and specialized equipment.

3. WORKLOAD OF THE DISCIPLINE AND TYPES OF ACTIVITIES

The total labor intensity of the discipline " Technology of Mechanical Engineering" is 3 credit units.

Table 3.1. Types of educational work by periods of mastering the postgraduate program

Types of activities		Total ac. hrs.	semester 2
<i>Contact work, acc.</i>		18	18
including:			
Lectures (LK)		thirty	thirty
Practical/seminar sessions (SZ)		thirty	thirty
<i>Independent work of students, acc.</i>		48	48
<i>Control (test with assessment), acc.</i>			
The total complexity of the discipline	ac.h.	108	108
	credit	3	3

4. CONTENT OF THE DISCIPLINE

Table 4.1. The content of the discipline (module) by type of educational work

Name of the discipline section	Contents of the section (topic)	Type of study work
Section 1. General issues of modern engineering production	<p>Topic 1.1 Introduction. General provisions and approaches to the design of technological processes for the manufacture of engineering products.</p> <p>Topic 1.2 Principles of construction of the production process. Basing theory. Methodology for designing the technological process of assembling machines. General provisions and approaches to automating the assembly process of machines. Topic 1.3 General methodology for designing a technological process for manufacturing a part. The main stages of designing the technological process of manufacturing a part: collecting initial information, analyzing the design of the part, choosing and evaluating the method of manufacturing the original workpiece and its geometry, assigning final and preliminary processing methods to the surfaces of the part, choosing the structure of the process route, synthesizing the structure of operational dimensions and technical requirements relative position, identification and construction of technological dimensional chains, adjustment, design of technological operations.</p> <p>Topic 1.4 Design features of typical and group technological processes.</p> <p>Topic 1.5 General methodology for designing operations. Designing operations performed on machine tools with numerical control. Design of technological processes for flexible automated production.</p>	LK , SZ

Name of the discipline section	Contents of the section (topic)	Type of study work
Section 2. Technological support of accuracy, quality of the surface layer and operational properties of machine parts and their connections	<p>Topic 2.1 Quality Scorecard. General provisions. Quality control. Quality assurance. Quality improvement. Control.</p> <p>Topic 2.2 International standards ISO 9000, the concept of total quality management TQM. Standardization in quality assurance products. Certification of engineering products.</p> <p>Topic 2.3 Classification of properties of engineering products. Single and complex indicators. Quality indicators of machines and parts. Parameters of geometric accuracy of machine parts.</p> <p>Topic 2.4 Ensuring the specified properties of products at the stages of production of blanks, manufacturing of machine parts and assembly. Achieving the accuracy of machine parts in their manufacture and assembly.</p> <p>Topic 2.5 Factors affecting the accuracy of processing. The accuracy of machine tools, the accuracy of tools, the rigidity of the technological system. Temperature deformations.</p> <p>Topic 2.6 Determination of processing errors caused by elastic deformations of the technological system. The procedure for determining the total processing error.</p> <p>Topic 2.7 Formation of the properties of the surface layer of the part. The concept of surface quality. Formation of surface properties with various processing methods. Influence of surface quality on the operational properties of machine parts.</p> <p>Topic 2.8 Product quality control. Methods of product quality control and their classification. The main tasks of technical control. Organization of technical control. Destructive and non-destructive methods of quality control. Analysis of defects and their causes. Basic quality management tools.</p>	LK , SZ
Section 3. Scientific basis for improving and creating new technological methods, including precision, parallel and combined methods of processing, hardening and applying multifunctional coatings	<p>Topic 3.1 Formation of surface properties with various precision, parallel and combined processing methods.</p> <p>Topic 3.2 The influence of surface quality on the performance properties of machine parts.</p> <p>Topic 3.3 Beam and plasma processing methods. Additive technologies. Processing methods associated with the passage of</p>	LK, SZ

Name of the discipline section	Contents of the section (topic)	Type of study work
	electric current. Magnetic processing. ultrasonic processing. Hydroabrasive processing. Pressure treatment, hardening. Coatings: purpose, application methods.	
Section 4. Scientific foundations of technological heredity	<p>Topic 4.1 The influence of roughness on the quality of machine parts. Influence of hardening of the surface layer.</p> <p>Topic 4.2 Technological inheritance and heredity. Influence of manufacturing and assembly technology on the operational properties of products: wear resistance and fatigue strength.</p> <p>Topic 4.3 Scientific foundations of technological quality assurance of machines and problems of its provision. Characteristics of quality indicators. Technical (operational) quality indicators. Production and technological quality indicators - production cycle, constructive continuity of the product, technological continuity of the product, and ways to improve them.</p> <p>Topic 4.4 System (product) performance. Physics of failures and basic methods of its study.</p> <p>Topic 4.5 Reliability theory, features of reliability issues. Basic terms and definitions of reliability. Methods for assessing reliability indicators. Reliability assessment indicators. Classification of machines by reliability and causes of loss of machine performance. Types and nature of failures. Determination of parametric reliability of products (systems). Reliability classes.</p> <p>Topic 4.6 Assessment of failure consequences and hazard levels. Ensuring the reliability of products. Product structure: serial, parallel and mixed. Reservation of systems and its schemes. Technological support of reliability: methods and possibilities. Statistical quality control.</p>	
Section 5. Mathematical modeling of technological processes, methods for manufacturing parts and	Topic 5.1 Mathematical modeling of technological processes, methods for manufacturing parts and assembling engineering products. Automated systems of	

Name of the discipline section	Contents of the section (topic)	Type of study work
assembling engineering products. Automated research systems in engineering technology	scientific research in engineering technology. Topic 5.2 Mathematical modeling of technological processes, methods for manufacturing parts and assembling engineering products. Automated systems of scientific research in engineering technology. Topic 5.3 Mathematical modeling of technological processes, methods for manufacturing parts and assembling engineering products. Automated systems of scientific research in engineering technology.	
Section 6. Setting up CNC machines. The use of machining centers. Automation of assembly processes .	Topic 6.1 Characteristics and design features of numerical control devices for technological equipment. Topic 6.2 Devices for monitoring the state of the control object . Devices of control systems. Information processing devices and the formation of control commands. Definition and assignment of the CNC interpolator. Actuators of CNC machines. Topic 6.3 Software for CNC devices with technological equipment. ISO 7-bit code. Program structure and information coding. Programming rules. Checking control programs. Topic 6.4 Programming multi-axis processing on machining centers. ATP assembly.	

5. EQUIPMENT AND TECHNOLOGY SUPPORT REQUIREMENTS

Table 5.1. Logistics of discipline

Auditorium with logistic list	Location
Lecture room No. 109 Equipment and furniture: - portable multimedia projector; - Interactive whiteboard SmartBoard 660; - tables and benches, chairs.	Moscow, Podolskoe sh., 8/5
Training room for practical training, current control and intermediate certification No. 112 Equipment and furniture: - personal computers with access to the Internet; - work tables, benches, chairs.	Moscow, Podolskoe sh., 8/5
Educational and methodical office for independent, research work of students No. 112	Moscow, Podolskoe sh., 8/5

Equipment and furniture:	
- personal computers with access to the Internet;	
- work tables, benches, chairs.	

6. METHODOLOGICAL SUPPORT AND LEARNING MATERIALS

Main readings:

1. Rogov, V. A. Engineering technology. Stamping and foundry production: a textbook for secondary vocational education / V. A. Rogov, G. G. Poznyak. — 2nd ed., corrected. and additional - Moscow: Yurayt Publishing House, 2021. - 319 p. - (Professional education). - ISBN 978-5-534-12327-2. - Text: electronic // EBS Yurayt [website]. — URL: <https://urait.ru/bcode/475998>
2. Technological processes in mechanical engineering: a textbook for secondary vocational education / A. A. Cherepakhin, V. V. Klepikov, V. A. Kuznetsov, V. F. Soldatov. - Moscow: Yurayt Publishing House, 2021. - 218 p. - (Professional education). - ISBN 978-5-534-05994-6. - Text: electronic // EBS Yurayt [website]. — URL: <https://urait.ru/bcode/470948>
3. Cutting materials. Cutting tool at 2 hours. Part 1: a textbook for universities / S. N. Grigoriev [and others]; under the general editorship of N. A. Chemborisov. - Moscow: Yurayt Publishing House, 2021. - 263 p. - (Higher education). - ISBN 978-5-534-00115-0. - Text: electronic // EBS Yurayt [website]. — URL: <https://urait.ru/bcode/469163>
4. Cutting materials. Cutting tool in 2 hours. Part 2: textbook for universities / S. N. Grigoriev [and others]; under the general editorship of N. A. Chemborisov. - Moscow: Yurayt Publishing House, 2021. - 246 p. - (Higher education). - ISBN 978-5-534-00114-3. - Text: electronic // EBS Yurayt [website]. — URL: <https://urait.ru/bcode/472429>

Additional readings:

1. Dedyukh, R. I. Material science and technology of structural materials. Fusion welding technology: textbook for universities / R. I. Dedyukh. - Moscow: Yurayt Publishing House, 2020. - 169 p. - (Higher education). - ISBN 978-5-534-01539-3. - Text: electronic // EBS Yurayt [website]. - url: <https://urait.ru/bcode/451364>
2. Technological equipment: a textbook for universities / H. M. Rakhimyanov, B. A. Krasilnikov, E. Z. Martynov, V. V. Yanpolsky. - Moscow: Yurayt Publishing House, 2020. - 265 p. - (Higher education). - ISBN 978-5-534-04474-4. - Text: electronic // EBS Yurayt [website]. — URL: <https://urait.ru/bcode/453150>
3. Maltsev, M.V., Shapovalov, Yu.N., Brazhnikov, E.B., A textbook for secondary vocational education. - Moscow: Yurayt Publishing House, 2021. - 121 p. - (Professional education). — ISBN 978-5-534-13671-5. - Text: electronic // EBS Yurayt [website]. — URL: <https://urait.ru/bcode/476713>
4. Rachkov, M. Yu. Technical means of automation: a textbook for universities / M. Yu. Rachkov. — 2nd ed., corrected. and additional - Moscow: Yurayt Publishing House, 2021. - 182 p. - (Higher education). - ISBN 978-5-534-11644-1. - Text: electronic // EBS Yurayt [website]. — URL: <https://urait.ru/bcode/471587>

Resources of the information and telecommunications network "Internet":

1. RUDN ELS and third-party ELS, to which university students have access on the basis of concluded agreements:
 - RUDN Electronic Library System - RUDN EBS <http://lib.rudn.ru/MegaPro/Web>
 - ELS "University Library Online" <http://www.biblioclub.ru>
 - EBS Yurayt <http://www.biblio-online.ru>

- ELS "Student Consultant" www.studentlibrary.ru
- EBS "Lan" <http://e.lanbook.com/>
- EBS "Trinity Bridge"

2. Databases and search engines:

- electronic fund of legal and normative-technical documentation
<http://docs.cntd.ru/>
- Yandex search engine [https:// www .yandex.ru/](https://www.yandex.ru/)
- Google search engine <https://www.google.ru/>
- abstract database SCOPUS <http://www.elsevierscience.ru/products/scopus/>

Educational and methodological materials for independent work of students in the development of the discipline/module:*

1. A course of lectures on the discipline "Technology of mechanical engineering".
2. Guidelines for self-study

* - all educational and methodological materials for independent work of students are placed in accordance with the current procedure on the page of the discipline in TUIS!

7. ASSESSMENT TOOLKIT AND GRADING SYSTEM FOR MIDTERM ATTESTATION OF STUDENTS IN THE DISCIPLINE (MODULE)

Assessment toolkit and a grading system to evaluate the level of competences (competences in part) formation as the course results are specified on the TUIS platform.

DEVELOPERS:

**Associate Professor, Ph.D.,
Department of Mechanical
Engineering Technologies**

Allenov D.G.

Position, department

Signature

Surname I.O.

HEAD OF BUP:

**Department of Mechanical
Engineering Technologies**

Boronina L.V.

Name of the department

Signature

Surname I.O.

HEAD OF OP VO:

**professor, doctor of technical
sciences,
Department of Mechanical
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Malkova M.Yu.

Position, department

Signature

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