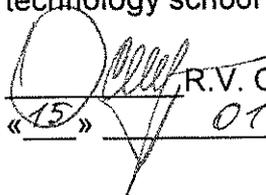
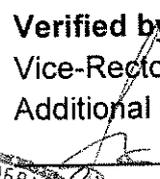


Federal State Autonomous Educational Institution of Higher Education
«National Research Tomsk Polytechnic University»

Approved by
Director of Advanced Manufacturing
technology school


R.V. Ostvald
«15» 01 2026 г.

Verified by
Vice-Rector for Development of
Additional Education


P.N. Rvalov
01 2026 г.



The seal is circular with a double border. The outer ring contains the text 'НАЦИОНАЛЬНО-РЕСПУБЛИКАНСКИЙ ТОМСКИЙ ПОЛИТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ' at the top and 'ФЕДЕРАЛЬНОЕ АГЕНСТВО ОБРАЗОВАНИЯ И НАУКИ' at the bottom. The inner ring contains 'ТОМСКИЙ ПОЛИТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ' at the top and 'РОССИЙСКАЯ ФЕДЕРАЦИЯ' at the bottom. In the center is the coat of arms of the Russian Federation.

Admission Examination Program for Master's Degree Applicants

Field of Study: 22.04.01 Materials Science

Main Educational Program: Materials Science and Design

Tomsk, 2026

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ANNOTATION

Field of Master's Degree Training:

22.04.01 Materials Science and Engineering

Main Educational Program:

Materials Science and Design

Responsible Academic Unit:

Materials Science Department, School of Advanced Manufacturing Technologies

Acting Head of the Department:

Alexandr Ya. Pak

Phone: +7 (3822) 701-777 ext. 1948

E-mail: ayapak@tpu.ru

The Admission Examination Program for the field of study 22.04.01 Materials Science has been developed in accordance with the Federal State Educational Standards of Higher Education (Bachelor's level) and is interdisciplinary in nature.

The purpose of the admission examination is to select applicants who are most capable and prepared to master the chosen educational program, as well as to ensure inter-university and inter-program academic mobility of bachelor's degree graduates applying for master's degree programs.

GENERAL REQUIREMENTS FOR THE EXAMINATION PROCEDURE EXAMINATION FORMAT

The admission examination (hereinafter referred to as the AE) is conducted in the form of an interview (oral discussion based on assigned questions, including presentation of answers, solutions, related formulas, construction of graphs, etc.) remotely via video conferencing systems.

The AE is conducted individually by the examination board with each applicant. Applicants are asked questions that allow assessment of their level of basic engineering (general professional) competencies, professional and personal potential, as well as their understanding of the conditions and specifics of study within the chosen field.

Language of the interview: English.

The admission examination for the educational program may be taken only once.

Duration of the interview: not more than 30 minutes, including:

- up to 10 minutes for identity verification, consent to personal data processing, discussion by the examination board of the final score and announcement of the result to the applicant;
- up to 20 minutes for the interview itself.

The procedure for conducting the AE remotely (hardware and software requirements, etc.) is regulated by the *Regulations on the Admission Examinations for Master's Degree Programs at TPU*.

The interview conducted via video conferencing is subject to mandatory audio and video recording. Conducting the interview without recording is not permitted.

Interview Procedure

General Participation Requirements

To participate in the AE, the applicant must submit an application to the TPU Admissions Committee indicating the chosen fields/programs of study. The application may be submitted in person, by mail, or via the Unified Public Services Portal.

The applicant must select examination dates in accordance with the approved AE schedule and register through the applicant's personal account (<https://apply.tpu.ru/>).

On the day of the AE, the applicant must connect to the specified platform (video conferencing/proctoring system) no later than 30 minutes before the start of the examination.

Applicants who registered but failed to attend the AE at the scheduled time may be admitted on another day, subject to availability and re-registration.

Conduct of the Interview

1. On the examination day, applicants are admitted to the virtual interview room according to the schedule. Admission is allowed only upon presentation of an identity document.
2. Identity verification is carried out by visual comparison of the applicant with the identity document (with photograph) via video communication. The applicant states their full name and demonstrates the identification document to the camera. This procedure is recorded.
3. The applicant provides consent to personal data processing via the dialogue window of the communication platform.
4. The interview is conducted by members of the examination board. The applicant is asked **three main questions**, one randomly selected from each section of the AE program. Topics are selected from the list provided in the section "*Content of Sections and Topics of the Admission Examination Program*". A sample interview ticket with possible scoring is provided in Appendix 1.
5. The examination board may ask additional questions to clarify or supplement the main answers. These questions are not scored separately but may affect the final score. All questions are recorded in the Examination Board Meeting Minutes (Appendix 2).
6. The final score is determined in accordance with the criteria specified in the *Assessment Criteria* section.
7. At the end of the interview, the Examination Board Meeting Minutes are completed and the result is communicated to the applicant. In the case of a remote examination, the Minutes are sent to the applicant by email.

Applicants who disagree with the result or believe that procedural violations occurred may submit an appeal. The appeal procedure is regulated by the relevant TPU regulations (Order of the Rector of TPU dated December 12, 2019 No. 94/od)

RECOGNITION OF RESULTS OF ENTRANCE EXAMINATIONS

An applicant who is a winner or prize-winner of student Olympiads, conferences, and other educational and scientific events within the last two academic years prior to admission may, at their own discretion, be equated with individuals who have received the maximum score (100 points) or an equivalent number of points based on test results in accordance

with the requirements established by the Admission Regulations of TPU for the current year of admission, unless otherwise provided by applicable regulatory and local acts.

ASSESSMENT CRITERIA

The maximum final score for the admission examination is **100 points**. The minimum passing score is **50 points**.

The final score is the sum of points awarded for answers to all questions.

Evaluation levels:

- **High (90–100%)** — comprehensive, well-reasoned answers with examples; strong analytical skills;
- **Intermediate (75–89%)** — correct answers with minor inaccuracies;
- **Satisfactory (50–74%)** — incomplete answers; reliance on prompting questions;
- **Insufficient (0–49%)** — poor understanding of the material.

Applicants scoring below 50 points are not admitted to the competition.

CONTENT OF SECTIONS AND TOPICS OF THE ADMISSION EXAMINATION

Section 1. Materials Science

1. Crystal Lattices. Anisotropy. Polymorphism.
2. Binary Alloy Phase Diagrams. Liquidus. Solidus. Phases: solid solution, mechanical mixture, chemical compound.
3. Solidification Process. Ingot structure. Dendritic segregation. Crystal lattice defects.
4. Failure Mechanisms. Fracture mechanisms and fracture surface structures.
5. Polymorphic, Eutectic, Peritectic, and Eutectoid Transformations in Iron-Carbon Alloys.
6. Carbon Steels. Classification according to purpose, deoxidation degree, quality level, carbon content, and position on the Fe-C diagram.
7. Cast Irons. Classification by graphite inclusion shape and metallic matrix phase composition. Graphitization process. Advantages and disadvantages of cast irons as structural materials.
8. Heat Treatment Specifics for Hypoeutectoid and Hypereutectoid Steels.
9. Alloyed Steels. Classification of alloy steels by composition, microstructure, and application.
10. Copper and Its Alloys.
11. Aluminum and Its Alloys. Castable and deformable aluminum alloys.
12. Titanium, Magnesium, Zirconium, and Their Alloys.
13. Polymer Materials. Thermoplastics. Thermosets.
14. Technical Ceramics. Structural features and properties.
15. Composite Materials. Formation principles.

Section 2. Manufacturing Processes for Nanostructured Materials and Additive Technologies

1. Types of Chemical Bonds in Solids.
2. Inorganic Glass. Glassy State.
3. Silicon Oxide: Properties and Products Based on It.
4. Aluminium Oxide: Properties and Products Based on It.
5. Nanomaterials. Basic Concepts.

Section 3. Material Properties

1. Stress. Deformation. Mechanisms of Plastic Deformation.

2. Dislocations. Burgers Vector. Interaction Between Dislocations.
3. Mechanical Tests: Tensile, Compression, Flexural Testing.
4. Mechanical Characteristics of Materials.
5. Dynamic Testing Methods.
6. Fatigue of Metals.
7. Creep Behavior.
8. Hardness Measurement Techniques: Brinell, Rockwell, Vickers, Microhardness. Similarities and Differences.
9. Methods for Enhancing Metal Strength.
10. Physical Properties of Materials.
11. Porosity Types. Permeable and Impermeable Porous Materials.
12. Surface Shape and Condition of Pores.
13. Properties of Porous Materials Based on Metallic Compounds.
14. Sorption Processes. Adsorption and Absorption.
15. Adhesion and Cohesion.

Section 4. Material Processing Technologies

1. Fundamentals of Cast Production Technology. High-Productivity Casting Methods. Single-use and Multi-use Molds.
 2. Principles of Pressure Working of Metals. Rolling Production.
 3. Bulk and Sheet Stamping.
 4. Machining Operations. Cutting Movements. Non-contact Machining Methods. Blade and Abrasive Machining.
 5. Fundamental Physics Behind Welding Joints.
 6. Welding Methods: Mechanical, Thermal, and Thermomechanical.
 7. Metal Brazing. Brazing Techniques.
 8. Powder Metallurgy: Material Production and Equipment.
 9. Fabrication Methods for Composite Materials.
 10. Additive Manufacturing Technologies for Producing Components from Polymers, Metals, and Alloys.
-

RECOMMENDATIONS FOR PREPARATION TO THE ENTRANCE EXAMINATION

Main Literature:

1. Guliaev, A.P. & Guliaev, A.A. (2012). *Metallurgy*. Moscow: Alliance. 7th ed., revised and supplemented. 644 p. Illustrations. Bibliography at end of chapters. Subject index: pp. 637-643. ISBN 978-5-903034-98-7. Access scheme: <http://catalog.lib.tpu.ru/catalogue/simple/document/RU%5CTPU%5Cbook%5C2372752>.
2. Lakhtin, Yu.M. (2015). *Metallography and Heat Treatment of Metals*. Moscow: Alliance. 5th ed., revised and supplemented. Stereotype edition. 447 p. Illustrations. Bibliography: pp. 443-444. Subject index: pp. 445-447. ISBN 978-5-91872-084-4. Access scheme: <http://catalog.lib.tpu.ru/catalogue/simple/document/RU%5CTPU%5Cbook%5C3409473>.
3. Zolotorovsky, V.S., Portnoy, V.K., Solonin, A.N., Prosviryakov, A.S. (2013). *Mechanical Properties of Metals. Static Testing. Laboratory Practice* [Electronic resource]. Moscow: MISIS. 116 p. Access scheme: http://e.lanbook.com/books/element.php?pl1_id=47422.
4. Vakalova, T.V., Khabas, T.A., Revva, I.B. (2013). *Practical Training on Basics of Technology of Refractory Non-metallic and Silicate Materials*. Tomsk: Publishing House of TPU. 2nd ed., revised and supplemented. 176 p. Illustrations. Bibliography: pp. 172-173. Access scheme: <http://catalog.lib.tpu.ru/catalogue/simple/document/RU/TPU/book/3272845>.
5. Ryzhonkov, D.I., Levina, V.V., Dzidziguri, E.L. (2021). *Nanomaterials*. Moscow: Knowledge Lab. 6th ed. 368 p. Electronic text. Access scheme: <https://e.lanbook.com/book/176410>

Supplementary Literature:

1. Adaskin, A.M. (2019). *Materials Science and Technology of Metallic, Nonmetallic, and Composite Materials*. Textbook: Bachelor's Degree Program. Moscow: Forum Publishers. 400 p. ISBN 978-5-00091-431-1. Access scheme: <http://new.znaniy.com/go.php?id=9821052>.
2. Zemskov, Y.P. (2019). *Material Science*. Saint Petersburg: Lan'. 188 p. ISBN 978-5-8114-3392-6. Electronic text. Access scheme: <https://e.lanbook.com/book/1139103>.
3. Dmitrenko, V.P. & Manuylova, N.B. (2019). *Materials Science in Machine Building*. Moscow: INFRA-M. 432 p. Electronic text. Access scheme: <https://new.znaniy.com/catalog/product/94972>.

Internet Resources: Professional databases and information-reference systems available via link: <https://www.lib.tpu.ru/html/irs-and-pdb>

Tomsk Polytechnic University

Field of Master's Degree Training: 22.04.01 Materials Science and Engineering

Main Educational Program: Materials Science and Design

Ticket for Entrance Examination (Interview)

№	Questions	Max score for AE
Main questions		100
1.	Binary Alloy Phase Diagrams. Liquidus. Solidus. Phases: solid solution, mechanical mixture, chemical compound	33
2.	Physical Properties of Materials	33
3.	Bulk and Sheet Stamping	34
Additional questions		-
1.	Formation Mechanisms of Covalent Bonds	-
2.	What are the basic components of composite materials? Provide examples.	-
Total		100

Appendix 1
 Template for Minutes of Meeting of
 Examination Board

APPROVED
 Chairman of the Examination Board
 _____ / _____ /
 (signature) name
 « ____ » _____ 20__ г.

MINUTES
 of the meeting of the Examination Board

Field of Master's Degree Training: 22.04.01 Materials Science and Engineering

Main Educational Program: Materials Science and Design

Date « ____ » _____ 20__ г.

Commission Members:

Name	Position

Applicant

Name

Questions asked

№	Questions	Score
Main questions		
1.		
2.		
3.		
Additional questions		
1.		-
2.		-
Total		

Document Approval Sheet

Admission Examination Program for Master's Degree Applicants, Field of Study: 22.04.01
Materials Science, Main Educational Program: Materials Science and Design

Head of program



M.S. Petyukevich

Head of the Department



A.Ya. Pak