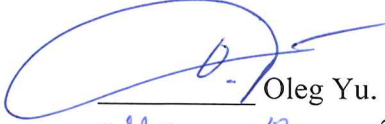


NATIONAL RESEARCH TOMSK POLYTECHNIC UNIVERSITY

APPROVED

Director of TPU School of Nuclear Science
and Engineering

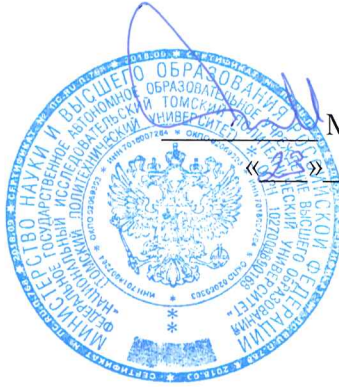


Oleg Yu. Dolmatov

«22» 10 2020

VALIDATED

TPU Vice-Rector for Academic Affairs



Mikhail A. Solovyev

«22» 10 2020

**Programme for the Entrance Exams for Master Degree Studies
in Specialisation 03.04.02 Physics
for Degree Programmes Delivered through the Medium of English**

Tomsk 2020



OUTLINE

Master degree specialization: 03.04.02 Physics

Teaching university structural unit:

TPU School of Nuclear Science and Engineering

Degree Programme: Condensed Matter Physics

Andrey M. Lider, PhD in Engineering, Professor, Head of Degree Programme Condensed Matter Physics, Head of the Division for Experimental Physics at TPU School of Nuclear Science and Engineering

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The programme for the entrance exams for specialization 03.04.02 Physics (degree programme Condensed Matter Physics) is developed in compliance with Federal State Standards for higher education (bachelor degree studies) and is of interdisciplinary nature.

The objective of the entrance exams is to select all the excellent candidates who apply to study on the chosen programme within the specialization; it also enables to facilitate mobility of bachelor graduates who apply to study on master degree programmes in the higher education institutions.

GENERAL REQUIREMENTS TO THE ENTRANCE EXAMS PROCEDURE

REGULATIONS AND PROCEDURES

The entrance exams for candidates to master degree programme Condensed Matter Physics within specialisation 03.04.02 Physics are held in the format of an oral interview conducted in English language.

An oral interview is conducted by the Examination Board with each of candidates individually. A candidate is interviewed with the questions which enable to evaluate the degree of the main engineering skills (general professional skills) development.

Not more than 30 minutes is allocated for each candidate's interview.

The entrance exams in the format of an oral interview conducted by the Examination Board can be organized in special designated sites (in university teaching rooms – examination halls) or via remote exam setting. Under certain conditions, the procedure of conducting the entrance exams via remote exam setting is monitored by an invigilator.

On the day of the entrance exams, the candidates are allowed into a university examination hall where the entrance exams will be held according to the list in which each candidate is assigned the time for an oral interview.

An oral interview with each candidate comprises 4 questions (one question of random choice from each of the topics and themes from the entrance exams programme). The Examination Board can question a candidate with 1-2 additional questions within the topics and themes of the entrance exams programme. The questions addressed to a candidate and the marks are drawn up in the entrance exams report (see Appendix 1). The entrance exams report is drawn up immediately after the entrance exams take place. The entrance exams results are communicated to a candidate by the Examination Board after the Examination Board meeting. A candidate is to put his/her signature in the report.

The procedure for conducting the entrance exams in remote exam setting is regulated by the active procedures and regulations validated by the rector's orders: The Procedures and Regulations of the Entrance Exams for TPU Master Degree Studies and the Procedures and Regulations for the Entrance Exams Conduct.

A candidate has a right of appeal the entrance exams results if a candidate, on stated grounds, considers that the mark assigned in the entrance exam is erroneous and (or) if there is evidence of substantive irregularity in the conduct of the entrance exam. Such appeals are dealt with in compliance with the Regulations for TPU Board of Appeal validated by the rector's order.

ASSESSMENT: MARKS AND DESCRIPTORS

Maximum mark for the entrance exam is 100.

Minimum mark*, sufficient for considering the entrance exam results as successfully passed is 56.

The total mark is determined as the sum of marks for answers provided by a candidate for each of the questions including candidate's answers to additional questions.

An answer provided by a candidate to each of the questions (4 main questions and 1-2 additional questions) is evaluated by the Examination Board separately according to the descriptors, below:

Mark Range	Descriptors
0-7	The answer has no valuable information, a candidate reveals absence of knowledge of the main concepts, is not able to relate theory to practice.
8-14	Partially relevant or not sufficiently comprehensive answer evidencing significant gaps in knowledge; formal answers by the book; evidence of not understanding the questions.
15-20	Sufficient knowledge revealed; sufficient comprehensive answer is provided. A candidate demonstrates ability to form his/her own judgement. There are insignificant gaps in knowledge presentation.
21-25	Comprehensive based on critical thinking answer generated by a candidate. The answer relates theory and practice and is supported by conclusions made by a candidate.

FOOTNOTE

** In case a candidate earns less than 56 marks for the entrance exams, a candidate is not allowed for enrollment competition as having not passed the entrance exams.*

THE ENTRANCE EXAMS PROGRAMME TOPICS AND THEMES

Theoretical Physics	<ul style="list-style-type: none">– The Basics of Crystallography;– Mechanical Properties of Solids;– Thermal Properties of Solids;– Thermodynamics in Materials Science;– Electrical Properties of Solids and Superconductivity;– Quantum Mechanics;– Electrodynamics;– Statistical Physics
Physical Principles of Mechanics. Molecular Physics. Thermodynamics	<ul style="list-style-type: none">– Kinematics;– Dynamics;– Conservation Laws;– Special Theory of Relativity;– The Fundamentals of Molecular-kinetic Theory;– The Fundamentals of Thermodynamics;– Distribution Functions
Electricity. Electromagnetism. Oscillations	<ul style="list-style-type: none">– Electrostatics;– Direct Current Flow;– Magnetic Field;– Magnetic Properties of Matter;– Maxwell Equations;– Mechanical and Electromagnetic Oscillations
Wave Optics. Quantum Mechanics. Atomic and Molecular Physics.	<ul style="list-style-type: none">– Interference;– Diffraction;– Polarization;– Quantum Theory of Radiation;– Bohr's Hydrogen Atom;– The Fundamentals of Quantum Mechanics;– The Fundamentals of Atomic and Molecular Physics

RECOMMENDATIONS ON HOW TO PREPARE FOR THE ENTRANCE EXAMS

General Physics

1. R. Shankar. Fundamentals of Physics: Mechanics, Relativity, and Thermodynamics. - Yale University Press. – 2014. – 464.
2. R. Shankar. Fundamentals of Physics II: Electromagnetism, Optics, and Quantum Mechanics. - Yale University Press. – 2016. – 608.
3. Richard P. Feynman, Robert B. Leighton, Matthew Sands. The Feynman Lectures on Physics: Mainly Mechanics, Radiation, and Heat. – vol.1. – 2013. – 968.
4. Richard P. Feynman, Robert B. Leighton, Matthew Sands. The Feynman Lectures on Physics: Quantum Mechanics. – vol.3. – 2013. – 688

Theoretical Physics

1. Courtney, T. H., Mechanical Behavior of Materials. - 2nd edition. - Waveland Press, Long Grove, IL. - 2005. – 752.
2. Hosford, W. F., Mechanical Behavior of Materials. – Cambridge, University Press, New York. - 2005. – 436.
3. Callister W.D., Rethwisch D.G. Materials Science and Engineering: An Introduction. – Wiley. – 2014. – 990.
4. Hull, D., and D. J. Bacon, Introduction to Dislocations, 5th edition, Butterworth-Heinemann, Oxford. - 2011. – 268.
5. B.D. Culity, C.D. Graham. Introduction to magnetic materials. – Wiley. – 2009. – 565.
6. N. Spaldin. Magnetic Materials: Fundamentals and Applications. – 290.
7. Hummel, R. E., Electronic Properties of Materials, 4th edition. – Springer, New York. - 2011.
8. D.J. Griffiths. Introduction to quantum mechanics. – Pearson. – 2005. – 468.
9. N. Zettili. Quantum Mechanics: concepts and applications. – Wiley. – 2009. – 690.

DEVELOPED BY:

1. Elena I. Kuprekova, PhD in Physics. Associate Professor at the Division for Experimental Physics, TPU School of Nuclear Science and Engineering.
2. Galina V. Erofeeva, PhD in Pedagogy, Professor at the Division for Experimental Physics, TPU School of Nuclear Science and Engineering.
3. Elena A. Sklyarova, PhD in Pedagogy, Associate Professor at the Division for Experimental Physics, TPU School of Nuclear Science and Engineering.

APPROVED
The Examination Board Chair

/ _____ /
« ____ » _____ 2020

THE REPORT
of the Examination Board meeting

the oral interview for _____

(code of specialisation, title of degree programme)

Date of the entrance exam _____ 2020

A candidate

Name, Patronymic (Second) Name, Family Name

The Examination Board members:

Name, Patronymic (Second) Name, Family Name	University Position
	the Examination Board Chair

The questions asked (entrance exam questions card number – _____):

#	Question	Marks
1.		
2.		
3.		
4.		
5.		
The Total Mark		

The Examination Board members' signatures:

Name, Patronymic (Second) Name, Family Name	Signature

With the oral interview results _____ (agree/ do not agree)

(signature) / _____ /
(Name, Patronymic (Second) Name, Family Name of a Candidate)