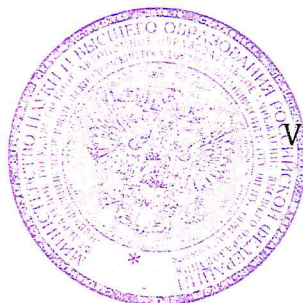


Federal state autonomous educational institution of higher education
National Research Tomsk State University



APPROVED BY:
Vice-rector for Academic Affairs of TSU
V.V. Dyomin

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28.05

2019

Entrance examination programme

Physics 03.04.02

Physics Methods and Information Technologies in Biomedicine

Master's Degree

AGREED WITH:
Dean of the Faculty of Physics

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S.N. Filimonov

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Tomsk
2019

According to the entrance examination of the programme, an applicant has to have an interview on the profile of the study programme and submit their portfolio.

An applicant for the double degree programme Physics Methods and Information Technologies in Biomedicine carried out jointly by Tomsk State University, University of Maastricht (the Netherlands), and Siberian State Medical University has to have a Bachelor's or Specialist's degree.

The Faculty of Physics of TSU has worked out the examination programme to reveal the following competencies and qualities of an applicant:

- knowledge of the main physics phenomena, their mechanisms, laws and practical application to biology and medicine;
- knowledge of the main molecular-kinetic theory, thermodynamics, structure and properties of liquid and solid bodies, nature of electromagnetic interaction, basics of the quantum nature of microcosm;
- ability to interpret materials in a comprehensible way using general physics terms and notions;
- ability to apply basic physical principles and laws to study and practice;
- ability to operate basic technical means: computer, computer network, software packages, including those of experimental data processing;
- knowledge of the principles of structural and functional organization of biological objects and mechanisms of homeostatic regulation;
- knowledge of the principles of cellular organization of biological objects, biophysics and biochemistry basis, membrane processes, and molecular mechanisms of life;
- up-to-date understanding of the fundamentals of biotechnology and genetic engineering, nanobiotechnology, and molecular modeling;
- general understanding of ecology.

The interview is held in Russian for Russian citizens and in English for foreign citizens. Video conferencing system is available.

To arrange and hold the entrance exams the following bodies are formed:

- Admission committee;
- Examination commission;
- Appeals commission.

Admission committee recruits candidates and accept documents.

Examination commission compiles exam papers and holds exams and interviews.

Appeals commission considers applicants' appeals.

The results of the entrance examination are presented in a minute. According to the minute, applicants are included into a ranking list. The ranking list provides information on each applicant with the points given for each exam.

The ranking list is arranged in the following way:

- scores are ranked in descending order;
- if scores are equal, scores are ranked in descending order by the results of an exam established as a priority by the University.

Applicants are enrolled from top to bottom until all places are available.

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Interview

Interview is aimed at evaluating an applicant's understanding of specific features and interrelations of areas underlying the content of the study programme (physics, biology, medicine, and computer science), their ability to apply physics research methods to biomedicine.

Applicants have to submit supplementary documents – Motivation Letter and Curriculum Vitae – in English before the entrance examination starts.

Motivation Letter unveils the applicant's motivation, reasons for choosing the study programme, and their expectations.

The form of Curriculum Vitae provided here (<http://biomed.tsu.ru/en/wp-content/uploads/sites/2/2017/01/CurriculumVitae.pdf>).

Interview is divided into 2 parts. Applicants talk to the members of Examination Commission. The first part focuses on physics-related questions. The second part concerns issues in biology, medicine, and biotechnology.

Sample interview questions

Part 1

1. What does physics study? The history of space-time physics, from Newton to Einstein.
2. Conserved physics quantities. Necessary and sufficient conditions for the conservation of physical quantities. Conservation laws in physics.
3. Newton's law of universal gravitation. Gravitational field.
4. Thermodynamic and statistical approaches to the study of many-particle systems.
5. First, second, and third laws of thermodynamics.
6. Electric charge and its properties. Coulomb's law.
7. Basic laws of electromagnetism.
8. Electromagnetic waves. Properties of electromagnetic waves.
9. Evolution of ideas about light.
10. Geometric optics. Laws of geometric optics.
11. Wave properties of light, interference and diffraction of waves.
12. Corpuscular properties of light. The concept of photon. Photo effect.
13. Basics of Quantum and Classical Physics.
14. Fundamental interactions in nature.

Part 2

1. Differences between living and non-living systems. Definition biological object. Characteristics of living systems.
2. Differences between living and non-living systems. Definition "biological object". Characteristics of living systems.
3. Interdisciplinary studies and their role in the development of science.
4. Biological, physical and mathematical models of biological systems.
5. Mathematical modeling of biological systems.
6. Physical characteristics of biological systems and their measurement.
7. Physical principles of diagnostic medical equipment.
8. Systems Biology and Bioinformatics.
9. Application of mathematical modeling to numerical experiments in biomedicine.
10. Bioengineering technologies in medicine.
11. Major achievements of the XXI century in biophysics and biomedicine.

12. Household appliances for medical purposes and their significance to humans.
13. Management of biological systems by means of external factors.
14. World from physics perspective and scientific revolution.
15. Role of science in the modern world.

Interview is aimed at revealing applicant's erudition and their interests in interdisciplinary studies in the subject area of the Master's programme. It also helps to see the motivation to persevere in future profession and identify practical skills and knowledge.

During the interview applicants shall demonstrate their speaking skills (monologue and dialogue). Evaluation criteria include fluency of speech, content, and reasoning of statements.

Applicants answer 2 questions.

Maximum score: **100 points**.

Minimum score: **60 points**.

An applicant not meeting the minimum passing mark cannot be submitted for admission.

Evaluation criteria:

- 40-60 points – the answer is complete, there are no incorrect statements or facts.
- 30-40 points – the answer is complete, though somewhat short or there are some minor mistakes and inaccuracies.
- 20-30 points – the answer contains some significant mistakes.
- 10-20 points – the answer does not correspond to the question or is not given at all.

Список литературы

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8. Kontseptsii sovremennogo estestvoznaniya [Concepts of modern natural science]. V.P. Romanov. Moscow, NIC INFRA-M. 2015. 128 p.

Verification procedure

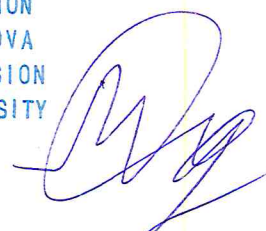
Examination commission listens to the applicant and writes down the answer to the interview answer sheet. Examination commission keeps records of the applicant's answer and follow-up questions in the minute of the meeting of Examination commission. Decision of the assessment is made openly.

Appeals procedure

If an applicant does not agree with the decision. they can make an appeal.

The applicant is not given another examination paper. Appeals committee thoroughly studies the answer sheet and records in the minute and gives a reasoned opinion on the validity of the assessment. In case of reasonable disagreement of Appeals committee members, the appeal can result in the mark being upgraded by majority vote.

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Portfolio

Each applicant has to submit their portfolio comprising their main achievements. Maximum score is **30 points**.

The list of individual achievements correspond to the Annex to the Admission Rules in 2019 *Procedure for Accounting Individual Achievements (Master's Degree)* and includes:

1. Sport achievements.
2. Diploma with honors.
3. Participation and (or) awards in competitions, conferences, and other intellectual and (or) creative contests.
4. Publications, taking into account the category of a journal/magazine.
5. Voluntarism.

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