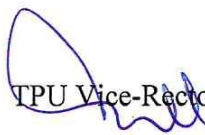


APPROVED BY


TPU Vice-Rector for Academic Affairs
/ Mikhail A. Solovyov
29.06.2020

Programme Name: Nuclear Science and Technology

Degree: Master of Science

Field of Study: Nuclear Physics and Technology

Specialization: Nuclear Safety, Security and Non-Proliferation of Nuclear Materials

Mode of Study: Full-time

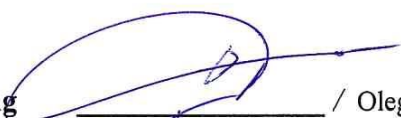


Language of Instruction: English

Director

of School of Nuclear Science & Engineering

Head of Nuclear Fuel Cycle Division

Program Director

 / Oleg Yu. Dolmatov
 / Alexey G. Goryunov
 / Vera V. Verkhoturova

Programme Name: Nuclear Science and Technology

Programme Description

Degree awarded	Master of Science in Nuclear Physics and Technology
Specialization	Nuclear Safety, Security and Non-Proliferation of Nuclear Materials
Mode of Study	Full-Time
Language of Instruction	English
Programme Duration	2 years (120 ECTS)
Entry Requirements	<p>Academic Entry Requirements: Bachelor Degree or equivalent degree and qualification.</p> <p>English Language Requirements: English as a native language / IELTS (5.5 or better) or Equivalent Certificate / TPU Entrance Test</p> <p>Selection process: All individuals are selected on their results of TPU Entrance Exams. Additional selection criteria: GPA in Bachelor Programme; relative merits and abilities of the applicant, approved by certificates.</p>
Fees and Funding	General TPU policies are applied. Please see regulations applied to this programme or make an enquiry to the department.
How to Apply	<p>Application via on-line application system is possible, please follow the link: https://abiturient.tpu.ru/interstudent/app-form.html or by email: omrs@tpu.ru.</p> <p>For more details, please go to: https://abiturient.tpu.ru/interstudent/contacts.html</p>

Programme webpage: <https://abiturient.tpu.ru/direction?type=magistracy>

Introducing Your Degree

National Research Tomsk Polytechnic University (hereinafter referred to as TPU) has been providing for training specialists in a range of nuclear fields, including nuclear power engineering, medical physics and nuclear medicine, and a lot others, for more than 65 years.

The international nuclear safety regime at nuclear facilities implies the development and implementation of educational programmes aimed at training personnel for enterprises and organizations that have radiation-hazardous industries or are associated with the control, accounting and physical protection of nuclear and radioactive materials and facilities.

One of the remarkable features of the program is TPU being one of the ROSATOM core universities, which provides its both Russian-speaking and international students with a unique opportunity to conduct research at the premises of its own only-in-Russia university research and training reactor.

Another important characteristic of the programme is that admitted students have an opportunity to complete industrial internship at the premises of State Atomic Energy Corporation Rosatom enterprises, which enables graduates to apply the obtained knowledge and skills in practice.

Therefore, graduates in the field of nuclear physics and technology are in high demand all over the world.

Programme Overview

Nuclear Safety, Security and Non-Proliferation of Nuclear Materials is an excellent academic programme, which offers candidates extensive and deep training in the key areas relating to nuclear security and physical protection of nuclear power and research facilities.

One of the distinctive features of the program is that it has been designed in compliance with the recommendations developed by the International Atomic Energy Agency (IAEA), which are applied to the training of specialists in the area of nuclear security, and includes such elements as accounting for and control of nuclear material, physical protection of nuclear material and facilities, security policy, legal and managerial aspects of nuclear non-proliferation, social and political factors of terrorism. In addition, the practical training organically integrated into the programme structure aims to familiarize students with the principles of development, implementation and maintenance of nuclear security at nuclear facilities, and hence provides trainees with specialized technological tools and technical devices to develop their professional competences in the target area.

Another outstanding characteristic of the programme is that students are offered a unique opportunity to conduct research at the premises of its own only-in-Russia university research and training reactor IRT-T TPU. By the end of the study, graduates are expected to:

- create mathematical models describing the processes in the spectrometers;
- develop methods for improving security of nuclear materials and technologies;
- develop generalized solutions to the problem, conduct analysis of these options, forecast possible consequences, find compromise solutions under conditions of multi-criteria, uncertainty, project planning;
- use information technology for the development of new installations, materials and products;
- develop technical assignments, standards and technical descriptions of new facilities;
- carry out analysis of technical and theoretical design, consider their compliance with the requirements of laws in the field of industry, ecology, radiation and nuclear safety and other regulatory acts;
- conduct objective assessment of the proposed solution or project in relation to the international standards, draw out an expert report.

Learning Outcomes

Universal competences

1. Ability to make critical analysis of problem-based situations based on the systems analysis approach, generate decisions and action plans.
2. Ability to run a project at all life-cycle stages.
3. Ability to organize and lead the teamwork and generate a team strategy to achieve the target goal.
4. Ability to use modern communication technologies to realize academic and professional interaction.
5. Ability to analyze and account for cultural diversity in the process of intercultural interaction.
6. Ability to set and pursue individual and professional activity priorities and ways to modify professional activity based on the self-esteem.

General professional competences

1. Ability to formulate goals and objectives of the research study, select assessment criteria, identify priorities for solving problems
2. Ability to apply modern research methods, evaluate and present the results of the performed research.

3. Ability to present research outcomes in the form of articles, reports, scientific reports and presentations using computer layout systems and office software packages.

Professional competences

1. Ability to organize and control the performance of personnel work related to accounting and control, physical protection of nuclear materials and radioactive substances in storage, use and transportation at nuclear facilities
2. Ability to develop measures to ensure the safe operation of technical means, equipment, devices and mechanisms, draw up and analyze scenarios of potential accidents, develop methods to eliminate the likelihood of failures and reduce the risk of accidents
3. Ability to apply research methods and calculations of modern systems, instruments and devices in the field of nuclear physics, physical measurements, control and physical protection of nuclear and radioactive materials technologies
4. Ability to create theoretical and mathematical models describing the propagation and interaction of radiation with matter, the effect of ionizing radiation on materials, humans and environmental objects, neutron multiplication in systems containing fissile materials
5. Ability to carry out independent experimental or theoretical research to solve scientific and industrial problems using modern equipment, calculation and research methods.
6. Ability to analyze technical and computational-theoretical developments, take into account their compliance with the requirements of laws in the field of industry, ecology and safety and other regulations
7. Ability to apply methods of optimization, analysis of options and accounting for uncertainties in the design of accounting, control and nuclear security systems for the nuclear fuel cycle.
8. Ability to draw up technical assignments, use information technology and application software packages in the design and calculation of facilities, equipment and systems used to monitor ionizing radiation levels in the management of radioactive materials and waste.
9. Ability to use information security technologies, to automate work processes associated with the use of nuclear technologies, to develop algorithms and software for security purposes.
10. Ability to develop technical requirements and assignments, to use information technology, legal and regulatory norms and standards for organizing and conducting safe operations related to internal and external movements of nuclear and radioactive materials, installations, export and import of equipment and materials
11. Ability to conduct training sessions and develop instructional materials for the training courses within the cycle of professional training programs (bachelor's degree).

Core training courses

1. Nuclear technologies and ecology of fuel cycle
2. Radiation safety and shielding
3. Methods and procedures for accounting and control of nuclear materials
4. Technologies and elements of security systems
5. Physical protection systems design and evaluation
6. Nuclear Cyber Security
7. Safety and reliability of technical systems
8. Development of basic solutions for nuclear facilities construction team project
9. Vulnerability assessment of physical protection systems for nuclear facilities
10. Methods and instruments for nuclear and other radioactive materials measurements

Degree Requirements

To be awarded the Master Degree, a student should successfully complete all programme courses and modules and defend his/her Master thesis.

Description of a course including assessment methods and tools is given in the training course program.

Facilities and Equipment

1. Research Nuclear reactor IRT-T.
2. Reactor analytical simulator complex of Russian Reactors:
 - NPP with VVER-1000 and BN-800 reactors.
 - Main coolant pump and its assisting systems.
 - Cooling circuit of control and protection system.
 - Feedwater heating system.
 - Main condensation system.
 - Protection and locking of NPP general systems equipment.
3. Modern spectroscopic complexes (Canberra Ind.).
4. Analytical complex for security systems, identification devices, means of detection and video recording.
5. Lab of radiation sources research.
6. Lab of nuclear power installations processes modelling.
7. Lab of nuclear and radioactive materials analysis.
8. Lab of NPP materials.
9. Lab of thermal hydraulic processes research in NPP equipment.
10. Lab of modelling the processes in NPP equipment.
11. Software and methodological resource base: MCU5TPU, WIMS, MCNP

Academic Exchanges

A part of the Program can be studied at TPU partner university. Please see all possibilities and regulations at www.ciap.tpu.ru

Career Opportunities:

Career fields and types of organizations:

- National nuclear power plants.
- National regulatory bodies.
- Nuclear educational and research institutions.

Positions:

- Engineer / operator at a nuclear power plant.
- Researcher in the field of nuclear physics and technologies.
- Teaching position in the field of nuclear physics and technologies.

Internships:

- Enterprises of State Atomic Energy Corporation Rosatom.
- TPU Research Nuclear Reactor IRT-T.
- TPU's laboratories.

Further Studies:

Graduates can apply to the TPU's PhD program in the field "Nuclear, Thermal and Renewable Energy and Associated Technologies", which is implemented in English.

Program Director:

Dr. Vera V. Verkhoturova

E-mail: verhoturova@tpu.ru

Tel. +7 (3822) 701-777 ext. 2337

Address: Russia, Tomsk, 2 Lenin Avenue, room 224.

Faculty and Research Staff:

1. Goryonov Alexey, professor, Head of Nuclear Fuel Cycle Division, Nuclear Science & Engineering School, TPU, +7 (3822) 701-777 ext. 2331, e-mail: alex1479@tpu.ru, personal site: <https://portal.tpu.ru/SHARED/a/ALEX1479>
2. Kuznetsov Mikhail, associate professor, Nuclear Fuel Cycle Division, School of Nuclear Science and Engineering, tel.: +7 (3822) 701-777 ext. 2330, e-mail: kms@tpu.ru, personal site: <https://portal.tpu.ru/SHARED/k/KMS/eng>
3. Naymushin Artyom, associate professor, Nuclear Fuel Cycle Division, School of Nuclear Science & Engineering, tel.: 701-777 ext. 2258, e-mail: agn@tpu.ru, personal site: <https://portal.tpu.ru/SHARED/a/AGN/eng>
4. Semenov Andrey, senior lecturer, Nuclear Fuel Cycle Division, Nuclear Science & Engineering School, TPU, +7 (3822) 701-778 ext. 2330, e-mail: semenov_ao@tpu.ru, personal page: https://portal.tpu.ru/SHARED/s/SEMENOV_AO/eng
5. Silaev Maxim, associate professor, Nuclear Fuel Cycle Division, School of Nuclear Science & Engineering, tel: +7 (3822) 701-777 ext. 5410, e-mail: silaev@tpu.ru
6. Stepanov Boris, assistant professor, Nuclear Fuel Cycle Division, School of Nuclear Science and Engineering, TPU, e-mail: sbp@tpu.ru, phone: +7 (3822) 701-777 ext. 2259, personal site: <https://portal.tpu.ru/SHARED/s/SBP/eng>
7. Yakovleva Valentina, Doctor of Technical Sciences, Professor of Nuclear Fuel Cycle Division, Nuclear Science & Engineering School, TPU, +7 (3822) 701-777 ext. 5209, e-mail: vsyakovleva@tpu.ru, personal site: <http://portal.tpu.ru/SHARED/v/VSYAKOVLEVA/eng>

Key Facts and Recognition

The master degree programme "Safety, Security and Non-Proliferation of Nuclear Materials" was developed in 2020. The target program is realized in English for both Russian-speaking and international students.