TOMSK POLYTECHNIC UNIVERSITY ТОМСКИЙ ПОЛИТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ

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 Power Engineering

Mode of Study: Full-time

Language of Instruction: English

Director
of School of Nuclear Science & Engineering _____ / Oleg Yu. Dolmatov

Head of Nuclear Fuel Cycle Division _____ / Alexey G. Goryunov

Program Director _____ / Vera V. Verkhoturova

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Programme Name: Nuclear Science and Technology

Programme Description

Degree awarded	Master of Science in Nuclear Physics and Technology
Specialization	Nuclear Power Engineering
Mode of Study	Full-Time
Language of Instruction	English
Programme Duration	2 years (120 ECTS)
Entry Requirements	**Academic Entry Requirements:** Bachelor Degree or equivalent degree and qualification. **English Language Requirements:** English as a native language / IELTS (5.5 or better) or Equivalent Certificate / TPU Entrance Test **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.
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	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. For more details, please go to: https://abiturient.tpu.ru/interstudent/contacts.html

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.

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 Power Engineering is an excellent academic programme, which offers candidates extensive and deep training in the key areas relating to nuclear power energy production.
The program aims to train prepare students to develop engineering careers in the atomic fields that require specialized knowledge and skills. In general, program graduates are expected to lead engineering careers in industry, education, government or go on to study for a PhD degree. The target program provides its graduates with the depth and breadth of knowledge and skills, which are required to perform successfully in an area related to nuclear power facilities operation.
Students enrolled on the programme are engaged in the study of particular research problems, such as development of perspective materials for nuclear fuel cycle, improving the operational characteristics of nuclear facilities that emphasize theory and/or experimentation. Both training and research are conducted under the guidance of research supervisors and a multi-disciplinary team of scientific and engineering faculty.
By the end of the study, graduates are expected to:

- apply deep, mathematical, scientific, socio-economic and professional knowledge for theoretical and experimental research in the field of nuclear energy, nuclear materials and nuclear power installations;
- develop new and original ideas and design methods for solving engineering problems in areas related to nuclear fuel cycle, modernization and improvement of its advanced technological chains;
- plan and carry out analytic, modeling and experimental research in the nuclear fields relying on the latest achievements of science and technology;
- assess the prospects of the development of nuclear industry, analyze radiation risks and scenarios of potential accidents, develop measures to reduce risks and ensure nuclear and radiation safety in compliance with international laws and regulations, as well as make expert decisions;
- acquire practical working experience at the nuclear research reactor.

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 manage personnel, taking into account the motives of behavior and ways of developing business behavior of personnel, apply methods for assessing the quality and performance of personnel, develop and implement measures aimed at preventing industrial injuries and environmental violations.
2. Ability to develop and ensure the implementation of measures aimed at improving, modernizing, unifying manufactured devices, facilities and their components, developing standards and certificates, improving reliability of equipment operation.
3. Ability to apply basic methods, techniques and means of obtaining, storing, processing information to plan and manage the life cycle of manufactured products and their quality.
4. Ability to create theoretical and mathematical models describing the condensed state of matter, the propagation and interaction of radiation with matter, the physics of kinetic phenomena, processes in reactors, accelerators, the effect of ionizing radiation on materials, humans and environmental objects.
5. Ability to use fundamental laws in the field of nuclear physics, nuclear reactors, condensed matter, ecology in a volume sufficient for independent combination and synthesis of real ideas, creative self-expression.
6. Ability to evaluate prospects for the development of the nuclear industry, use its modern achievements and advanced technologies in research activities related to the development of technologies for obtaining new types of fuel and materials, radioactive waste management methods and techniques.
7. Ability to assess risks and determine safety measures applied for new facilities and technologies, draw up and analyze scenarios of potential accidents, develop methods to reduce the risk of their occurrence
8. 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
9. Ability to carry out independent experimental or theoretical research to solve scientific and industrial problems using modern equipment, calculation and research methods.
10. Ability to draw up technical assignments, use information technology, standard design automation tools and application software packages in the design and calculation of physical installations, materials and devices, use knowledge of methods of ecological efficiency and economic-value analysis in the design and implementation of projects.
11. Ability to develop design process documentation, execute engineering design and production projects.
12. 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. Control and safety of nuclear reactor
2. Design, maintenance and engineering of nuclear power plants
3. Development of basic solutions for NPP construction team project
4. Nuclear Technologies and Ecology of Fuel Cycle
5. Lab practicum at the TPU nuclear research reactor
6. Special materials of nuclear power facilities
7. Nuclear reactor design project
8. Reactor kinetics and control
9. Reactor physics

10. Steam generators for nuclear power plants
11. Steam turbines design projects
12. Thermal Hydraulics in nuclear reactors
13. Thermodynamics
14. Turbine installations

Degree Requirements

To be awarded to 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:

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Key Facts and Recognition

The master degree programme “Nuclear Power Engineering” was launched in 2012 upon the conclusion of the Agreement between TPU and the State Atomic Energy Corporation Rosatom.
The English-medium programme “Nuclear Power Engineering” takes its origin as a reworked programme “Nuclear Power Installations Operation” developed in close cooperation with the State Atomic Energy Corporation Rosatom.
The first students admission was carried out in 2015 when seven students from countries such as Egypt, Ghana, Nigeria, and India were admitted to the program. In June 2017, the defense of the master theses was conducted resulting in five graduates receiving certificates with honors.
The second admission took place in 2016 when 17 students representing such countries as China, India, Ghana, Nigeria, and Tanzania were enrolled on the Master degree program. The third and fourth admissions were held in 2017 and 2018 correspondingly. The 2017 admission included four international students and 2018 admission involved seven international students.
The admission of 2019 involved 18 international students from such countries as Egypt, Tanzania, Ghana, Zambia, Sudan, Malaysia, South Africa and others. In 2020, nine students from Ghana, Egypt and Nigeria were enrolled on the target program.