

## Nuclear Medicine

<b>Degree</b>	Master of Science in Nuclear Physics and Technologies
<b>Specialization</b>	Nuclear medicine
<b>Mode of study</b>	Full-Time
<b>Language of instruction</b>	English
<b>Program duration</b>	2 years (120 ECTS) the program starts on August, 27
<b>Tuition fee per year</b>	302 220 Russian Rubles

According to the World Health Organization, cancer is one of the main causes of mortality and persistent disability in the world. Annually about 14 million sickness cases and more than 9 million deaths from this disease are registered. In accordance with experts, the modern method of nuclear medicine are able to increase share of early detection of malignant tumors from current 40% to 75% and decrease cancer mortality rate by 25-30%. Therefore, specialists in nuclear medicine, especially in radiation therapy, radiopharmaceuticals and imaging are in high demand all over the world.

### Program overview

Nuclear medicine is an excellent networked educational program, aimed at training competitive specialists for Russian and international research and medical centers. TPU has developed this program in cooperation with leading research centers, medical educational institutions, high-tech enterprises in the field of medicine and medical physics. TPU has solid experience in the development and production of medical radiopharmaceuticals using the basic facilities of the Tomsk Polytechnic University, such as the IRT-T research reactor and the R-7M cyclotron. The program is divided into three terms covers basic physics of nuclear medicine and medical sciences, radiation safety, radiation therapy and imaging, and producing and application of radiopharmaceuticals.

### Main modules:

- Anatomy and Physiology
- Fundamentals of Roentgenology
- Clinical Dosimetry
- Treatment Planning
- Modern Techniques of Radiation Therapy.
- Fundamentals of Radiation Therapy Planning
- Clinical Application of Modern Techniques of Radioisotopic and X-ray Diagnostics

- Radiochemistry
- Application of Radionuclides and Radiopharmaceuticals in Diagnostics and Therapy

### Academic Staff:

- **Irina Miloichikova**, lecturer, physicist of Tomsk Research Institute of Oncology, webpage at TPU: <http://portal.tpu.ru/SHARED/i/IRCHA1988/eng>, radiation therapy planning
- **Evgenia Sukhikh**, PhD, lecturer, head of Medical Physics Department of Tomsk Regional Oncology Center, webpage at TPU <http://portal.tpu.ru/SHARED/1/LILIA>, radiation therapy planning
- **Evgenii Nesterov**, PhD, lecturer, researcher of the Laboratory 31 IPT, webpage at TPU <http://portal.tpu.ru/SHARED/n/NEA/eng>, producing radiopharmaceuticals
- **Vladimir Ussov**, PhD, lecturer, head of X-ray and Tomographic Diagnostics Department of Tomsk Cardiology Research Institute, h-index Scopus 10, imaging

### Learning Outcomes

Professional skills	
LO1	Apply deep mathematical, scientific, social, economic and professional knowledge in theoretical and applied research in the field of medical physics and nuclear medicine
LO2	Assign and solve innovative engineering and physical tasks, implement projects in the field of medical physics and nuclear medicine
LO3	Create theoretical, physical and mathematical models, describing the distribution and interaction of ionizing radiation with matter and living tissue, as well as processes in accelerators, processes and mechanisms of radioactivity transfer in the environment and living tissue
LO4	Develop new algorithms and methods for design of modern physical medical equipment, conduct measurement of the characteristics of ionizing radiation fields, and carry out research in medical physics and nuclear medicine
LO5	Assess the prospects for the development of nuclear medicine, analyze radiation risks and scenarios of potential accidents, develop measures to reduce risks and ensure radiation safety, guided by laws and regulations, prepare an expert report
LO6	Design and organize innovative business, develop and implement new types of products and technologies, form an effective strategy and an active risk management policy at enterprise, apply methods for assessing quality and performance of staff, apply basic knowledge in the national patent law and copyright

<b>Soft skills</b>	
LO7	Demonstrate advanced knowledge in social, ethical and cultural aspects of innovative professional activity
LO8	Conduct independent research activities and independent continuing education for improving his/her qualification level throughout his/her professional activity
LO9	Sufficient language skills, allowing students to communicate about professional topics, prepare materials and present results of professional activities
LO10	Individual and team working skills, leadership skills, and responsible and professional performance of the duties

### **Career Opportunities:**

Positions and career fields:

- Researcher and medical physicist in the field of radiation therapy planning
- Researcher and medical physicist in the field of clinical dosimetry
- Radiological/Radiation safety officer
- Researcher and medical physicist in the field of imaging
- Academic staff member in the field of nuclear medicine

Types of organizations:

- Research institutes
- Medical centers and institutions
- Clinics
- Universities
- Medical laboratories

Internships:

- Tomsk Regional Oncology Center
- Tomsk Oncology Research Institute
- Tomsk Cardiology Research Institute
- Kemerovo Regional Oncology Center

### **Postgraduate Opportunities (Further Studies):**

Post-graduate and post-doc programs allow continuing research in the following areas: research and development of clinical dosimetry techniques, planning radiation therapy, new methods for radiation therapy, and production of new radiopharmaceuticals.

### **Laboratory Facilities**

1. Water phantom Blue Phantom (analyzer of dosing fields), Tomsk Polytechnic University, classroom 029/10 c
2. Program of PCLab, Tomsk Polytechnic University, classroom 12c/10 c
3. Theratron Equinox (Co<sup>60</sup> radionuclide), Tomsk Regional Oncology Center
4. Linear accelerator Elekta Synergy, Tomsk Regional Oncology Center
5. Multisource HDR (Co<sup>60</sup> radionuclide), Tomsk Regional Oncology Center
6. Xstrahl-300 (60-300 keV), Tomsk Regional Oncology Center
7. Treatment planning system XIO (conventional radiotherapy, conformal radiotherapy, IMRT radiotherapy) Tomsk Regional Oncology Center
8. Treatment planning system Monaco (IMRT\VMAT radiotherapy) Tomsk Regional Oncology Center
9. Treatment planning system HDRplus (brachytherapy) Tomsk Regional Oncology Center
10. Treatment planning system PLUNC (conventional radiotherapy, conformal radiotherapy, IMRT radiotherapy), Tomsk Polytechnic University
11. X-ray machines (Apollo DRF Villa Sistemi Medicali), Siberian Medical State University
12. Magnetic resonance tomography (TOSHIBA Excelart Vantage), Siberian Medical State University
13. Ultrasound machines (Toshiba Aplio 400, 500), Siberian Medical State University
14. Single photon emission computer tomography (Philips BrightView), Siberian Medical State University
15. Negatoscopes, Siberian Medical State University
16. Laboratories producing radioisotopes and radiopharmaceuticals at research nuclear reactor of TPU
17. Laboratories producing radioisotopes and radiopharmaceuticals at Cyclotron R7M of TPU
18. Laboratory of Spectroscopy of Applied physics department
19. Laboratory of Dosimetry of Applied physics department

**Modules:**

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<b>Semester 1</b>		
1	Foreign Language (Russian)	3
2	Ionizing Radiation Interaction with Biological Objects	3
3	Anatomy and Physiology. Bases of Roentgenology	6
4	Mathematical Methods for Radiological Sciences	3
5	Dosimetry Bases of Ionizing Radiation and Radiation Safety	3
6	Student Term Work	6
7	Teaching Practicum	3
<b>Semester 2</b>		
8	Professional ethics	3
9	Foreign Language (Russian)	3
10	Fundamentals of Pathology and Oncology	3
11	Mathematical Methods for Imaging in Medicine and Medical Statistics	3
12	Radiobiological Bases of Radiation Therapy	3
13	Clinical Dosimetry	3
14	Student Term Work	6
15	Teaching Practicum	
16	Research Practice	6
<b>Semester 3</b>		
17	Treatment Planning	3
18	Modern Techniques of Radiation Therapy. Fundamentals of Radiation Therapy Planning	6
19	Clinical Application of Modern Techniques of Radioisotopic and Roentgen Diagnostics	6
20	Radiochemistry. Application of Radionuclides and Radiopharmaceuticals in Diagnostics and Therapy	6
21	Student Term Work	6
<b>Semester 4</b>		
22	Research Practice	9
23	Pre-graduation Practical Training	18
24	Master Thesis	6