TOMSK POLYTECHNIC UNIVERSITY ТОМСКИЙ ПОЛИТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ

APPROVED BY

Director of Nuclear Science & Engineering School
_____ / Oleg Yu. Dolmatov
"25" 06 2020

Course Name: Methods and techniques for radioisotopic diagnostics

Field of study: Nuclear Science and Technology

Programme name: Nuclear Science and Technology

Specialization: Nuclear medicine

Level of Study: Master Degree Programme

Year of admission: 2019

Semester, year: semester 3, year 2

ECTS: 6

Total Hours: 216

Contact Hours: 64

- **Lectures:** 16
- **Labs:** 32
- **Practical experience: 16**

Assessment: Exam

Division: Nuclear Fuel Cycle

Director of Programme _____ / Vera V. Verkhoturova

Instructor _____ / Vera D. Zavadovskaya

Course Name: Methods and techniques for radioisotopic diagnostics

Course Overview

Course Objectives	The aim of the training course «Methods and techniques for radioisotopic diagnostics» is the mastering of theoretical basis of modern nuclear medicine and practical skills in radiochemistry by using the latest advances in modern radiology technologies for implementation in practical and scientific activities.
Learning Outcomes	**Upon completion of the course, a graduate will obtain the knowledge of:** - physical basis of high-tech diagnostic modalities in modern nuclear medicine; - the main methodological approaches to the analysis of the results of scintigraphic studies using modern high-tech equipment in nuclear medicine. **Upon completion of the course, a graduate will be able to:** – apply the main diagnostic algorithms in the diagnostic study of human organs and systems. – choose and use the main pathological syndromes in analysis of radiology imaging; – perform digital processing of different images obtained by modern radiological modalities. **Upon completion of the course, a graduate will have experience in:** -scientific research using modern high-tech radiological diagnostic equipment; -creation and implementation of medical and engineering problems in modern nuclear medicine for solving innovative scientific and industrial problems.
Course Outline	The course consists of 8 sections which include: – 8 lectures (16 class hours); – 7 practical experiences (16 class hours); – 6 laboratory works (32 class hours).
Prerequisites (if available)	1. Anatomy and Physiology. Basics of Roentgenology 2. Fundamentals of Imaging in Medicine 3. Basics of Pathology and Oncology 4. Treatment Planning
Course Structure	The course material is divided into 8 parts. Each part consists of lectures and practical experiences. **Section 1. The modern cardiological radiology.** Methodology of modern radiological diagnostics in cardiology. Radiological diagnostic algorithm for ischemic heart disease, myocardial infarction. Interventional radiology in ischemic heart disease, acute myocardial infarction, congenital heart disease. The comparison of radiological imaging in the study of coronary vessel, in the diagnosis of myocardial ischemia / infarction. Radiological pattern of "soft", calcified and combined plaque. Assessment of the degree of stenosis of the coronary arteries. Radiological diagnostics of pulmonary embolism. **Section 2. Nuclear medicine in cardiology.** Nuclear medicine in the study of cardiovascular system. Nuclear medicine in

	the diagnosis of coronary heart disease. Radionuclide equilibrium ventriculography. Myocardial perfusion scintigraphy, indications, technique, RF. Myocardial scintigraphy with fatty acids to detect ischemia without stress tests. PET / CT and SPECT / CT as hybrid techniques that increase the diagnostic efficiency of each modality in the diagnosis of coronary heart disease. **Section 3. Nuclear medicine in diagnosis of disease of respiratory system and mediastinum** . Methodology of modern radiological diagnosis of lung cancer. Radiological diagnostic algorithms by central and peripheral lung cancer. Hybrid technologies - SPECT / CT and PET / CT in detection of determination of stage and operability of lung cancer. Multiple nodules in the lungs. Radiological diagnostic algorithms for detection of the causes of multiple nodules. Radiological monitoring monitoring of foci and nodules in the lungs. Perfusion lung scintigraphy. Ventilation scintigraphy of the lungs. Hybrid technologies - SPECT / CT and PET / CT in the diagnosis of tumor masses of the mediastinum. **Section 4. Modern nuclear medicine in diseases of the gastrointestinal tract and hepatoduodenal region.** Methodology of modern radiological examination of the gastrointestinal tract. Radiological diagnostic algorithm for acute pathology of the abdomen. Nuclear medicine in assessment of the evacuation function of the gastrointestinal tract. Nuclear medicine in detection of the source of gastrointestinal bleeding. Nuclear medicine in the diagnosis of neuroendocrine tumors of the gastrointestinal tract, metastatic carcinoid tumors. Hybrid technologies - PET / CT in the diagnosis of primary tumors of the gastrointestinal tract (esophagus, intestines) and secondary tumors (metastases). PET in the diagnosis of gastrointestinal stromal tumors. Methodology of modern radiological examination of the hepatopancreatoduodenal zone. Radiological diagnostic algorithm for obstructive jaundice. Nuclear medicine in the assessment of bile-excretory function (for example, biliary atresia). Radiological diagnostic algorithm (including nuclear medicine methods) in the assessment of postoperative conditions and traumatic changes in the liver and spleen. Radiological diagnostic algorithm for neoplastic processes of the liver, pancreas, spleen. Hybrid technologies (PET / CT, SPECT / CT) in the diagnosis of liver tumors (hepatocellular cancer, cholangiocarcinoma, pancreas, spleen). Labeled antibodies in the diagnosis of tumors of the digestive tract and gastrointestinal tract. Nuclear medicine study of the reticuloendothelial system in diffuse and focal liver diseases. **Section 5. Radiology diagnostics of the disease of urinary system and male and female pelvic organs.** Methodology of modern radiological examination of the urinary system. Radiological diagnostic algorithm for diseases of the urinary organs. The role of dynamic nephroscintigraphy in the assessment of renal function in diseases and abnormalities of the kidney. Radiological diagnosis of vesicoureteral reflux. The role of PET in renal imaging. Hybrid technologies (PET / CT, SPECT / CT) in the diagnosis of kidney tumors. Methodology of modern radiological examination of the male and female pelvis. Radiological diagnostic algorithm for prostate diseases. PI-RADS system in the diagnosis of prostate cancer.

	Radiological diagnostic algorithm for malignant neoplastic diseases of the pelvic organs in women. Hybrid technologies (SPECT / CT and PET / CT) in the diagnosis of cancer of uteri, cervix, and in the diagnosis of ovarian cancer. PET in the diagnosis of secondary tumors in primary cancer of the reproductive organs **Section 6. Neuroimaging. CT and MRI in the neuroimaging. Nuclear medicine in neuroimaging.** Methodology of modern radiological diagnosis of neurological diseases. SPECT and PET of the brain in cerebrovascular and degenerative diseases. Radiology study of cerebral perfusion. Neuroimaging. Radiological diagnostic algorithm for brain tumors. Hybrid technologies (PET / CT, SPECT / CT) for brain tumors. Structural and functional diagnostic methods in neuroimaging. Neuroimaging for traumatic brain injury. Radiological study of the spine, spinal canal, spinal cord. The role of nuclear medicine in the assessment of CSF dynamics. **Section 7. Nuclear medicine of musculoskeletal disease** Methodology of modern radiological study of the musculoskeletal system. Radiological diagnostic algorithm for primary and secondary bone tumors. Bone scintigraphy for metabolic diseases. Bone scintigraphy for traumatic injuries, in sports medicine. PET, PET / CT, SPECT / CT in the diagnosis of bone diseases. Nuclear medicine in the diagnosis of inflammatory diseases of bone and joints. Specific and non-specific indication of foci inflammation. Nuclear medicine in the differential diagnosis of oncological and inflammatory diseases of the bone. **Section 8. Radionuclide diagnostics in oncology. Radiology imaging in mammology.** Nuclear medicine in excluding/detection of metastatic bone lesions. PET / CT in the diagnosis and detection of stage of malignant tumors. Scintigraphic indication of "sentinel nodes" in breast cancer, melanoma, larynx, pelvic organs. Tumor-specific radiopharmaceuticals in oncology. Radiological study of the breast. Radiological diagnostic algorithm in the diagnosis of breast cancer. Breast cancer staging.
Facilities and Equipment	Classroom for lectures and practical experiences: 634050, Tomsk, Lenina Ave., 2, building 10, room 125A.
Grading Policy	In accordance with TPU assessment system we use: – Current assessment which is performed on a regular basis during the semester by scoring the quality of mastering the theoretical material and the results of practical activities (tests, tasks, problem solving). Max score for current assessment is 80 points. – Course final assessment (exam) is performed at the end of the semester. Max score for course final assessment is 20 points. In the process of mastering the course “Radiochemistry. Clinical Application of Radioisotopic and Roentgen Diagnostics”, students perform 7 laboratory works, which are organized on the basis of the Department of Radiation Diagnostics and Radiation Therapy and the Department of X-ray Diagnostics, the Department of Tomographic Research Methods and the Laboratory of Radionuclide Research Methods of the Siberian State Medical University under the guidance of specialists. The purpose of the laboratory work is to master the

	skills of conducting diagnostic studies and the analysis of diagnostic information. The results of laboratory work are issued in the form of reports with answers to test questions, submitted in writing to the teacher for verification of the discipline. Laboratory reports are defended orally. Reports on laboratory works are executed in accordance with the TPU standard. The number of pages in the report (with the exception of the title page and list of references) should be at least 15 and not more than 30. The maximum score for successful laboratory work is 4 points, depending on the topic and the amount of work performed. The number of points a student receives for each laboratory work is determined according to the knowledge assessment system. To perform current assessment of the quality of theoretical and practical material mastering during a practical lesson, a survey is conducted. Questions on the topic of the practical lesson are given to students in advance to prepare for the lesson. The survey is carried out orally. The total number of points for the survey is 3 points. Testing is carried out at the end of each lesson to assess the quality of theoretical and practical material mastering on the topic of the lesson. The test includes from 12 to 15 questions with one correct answer. The maximum score for each test 3 points. Students are admitted to the exam, provided that he successfully completed all semester surveys, tests, defended all laboratory works. The examination is performed orally in the form of answering theoretical questions. The examination paper includes 2 questions. Each question is supported with illustrative material in analog or digital format. The instructor during the oral examination has the right to ask additional questions about the exam program. The answer to each question is rated at 10 points. The maximum number of points that a student can obtain for the exam is 20 points.
Course Policy	Class attendance will be taken into consideration when evaluating students' participation in the course. Students are expected to be actively engaged in class discussions on the assigned reading materials. All classes are obligatory to visit. Attendance is strictly controlled. All classes are obligatory to presence. Students are required to wear a lab coat and indoor shoes.
Teaching Aids and Resources	**Compulsory reading:** 1. Radiation diagnostics: teaching aid for students of medical universities. Part 1: Methods of radiation diagnostics. Radiation anatomy of organs and systems. The main pathological syndromes / editor V. D. Zavadovskaya. - Moscow: Vidar, 2009. - 374 p. – Текст : непосредственный. 2. Ternovoy S. K. Radiology diagnosis and therapy. General radiology diagnostics: textbook: in 2 volumes. Vol. 1 / S. K. Ternovoy, V. E. Sinitsyn, A. I. Shekhter. - Moscow: GEOTAR-Media, 2014. - 232 p. - Текст : электронный // ЭБС "Консультант студента" : [сайт]. - URL : https://www.studentlibrary.ru/ru/book/ISBN9785970429891.html (дата обращения: 20.09.2020). - Режим доступа : по подписке. 3. Atlas of human ray anatomy / V. I. Filimonov, V. V. Shilkin, A. A. Stepankov, O. Yu. Churakov. - Moscow: GEOTAR-Media, 2010. - 452 p. - Текст: электронный // Консультант врача : электронная-медицинская библиотека. - URL: https://www.rosmedlib.ru/book/ISBN9785970413616.html (дата

	обращения: 20.09.2020). – Режим доступа: по подписке. 4. Radiology diagnosis of heart and vascular diseases: national guide / chap. ed. volume L.S. Kokov, ed. series of S.K. Ternovoy. - Moscow: GEOTAR-Media, 2011. - 688 p. - Текст: электронный // Консультант врача : электронная-медицинская библиотека. - URL: https://www.rosmedlib.ru/book/ISBN9785970419878.html (дата обращения: 20.09.2020). – Режим доступа: по подписке. 5. Radiology diagnosis of diseases of bones and joints: national guide / chap. ed. volume A.K. Morozov. - Moscow: GEOTAR-Media, 2016. - 832 p. - Текст: электронный // Консультант врача : электронная-медицинская библиотека. - URL: https://www.rosmedlib.ru/book/ISBN9785970435595.html (дата обращения: 20.09.2020). – Режим доступа: по подписке. 6. Radiology diagnosis and therapy of diseases of the head and neck: national guide / chap. ed. volume T.N. Trofimova. - Moscow: GEOTAR-Media, 2013 . - 888 p. - Текст: электронный // Консультант врача : электронная-медицинская библиотека. - URL: https://www.rosmedlib.ru/book/ISBN9785970425695.html (дата обращения: 20.09.2020). – Режим доступа: по подписке. **Additional reading:** 1. Atlas of X-ray anatomy and styling : a guide for doctors / ed. M.V. Rostovtsev. - 2nd ed. - Moscow: GEOTAR-Media, 2017. - 320 p. - Текст: электронный // Консультант врача : электронная-медицинская библиотека. - URL: https://www.rosmedlib.ru/book/ISBN9785970443668.html (дата обращения: 20.09.2020). – Режим доступа: по подписке. 2. Radiology diagnosis of the chest organs: national guide / chap. ed. volume V. N. Troyan, A. I. Shekhter. - Moscow: GEOTAR-Media, 2014. - 584 p. - Текст: электронный // Консультант врача : электронная-медицинская библиотека. - URL: https://www.rosmedlib.ru/book/ISBN9785970428702.html (дата обращения: 20.09.2020). – Режим доступа: по подписке. 3. Radiology diagnosis and therapy in gastroenterology: national guide / chap. ed. volume G. G. Karmazanovsky. - Moscow: GEOTAR-Media, 2014. - 920 p. - Текст: электронный // Консультант врача : электронная-медицинская библиотека. - URL: https://www.rosmedlib.ru/book/ISBN9785970430538.html (дата обращения: 20.09.2020). – Режим доступа: по подписке. 4. Radiology diagnosis and therapy in urology: national guide / chap. editors volume A. I. Gromov, V. M.Builov. - Moscow: GEOTAR-Media, 2011. - 544 p. - Текст: электронный // Консультант врача : электронная-медицинская библиотека. - URL: https://www.rosmedlib.ru/book/ISBN9785970420188.html (дата обращения: 20.09.2020). – Режим доступа: по подписке. 5. Radiology diagnosis and therapy in obstetrics and gynecology: national guide / chap. editors volume L. V. Adamyan, V. N. Demidova, A. I. Gus, I. S. Obelchaka. - Moscow: GEOTAR-Media, 2012. - 656 p. - Текст: электронный // Консультант врача : электронная-медицинская библиотека. - URL: https://www.rosmedlib.ru/book/ISBN9785970421178.html (дата обращения: 20.09.2020). – Режим доступа: по подписке.

	6. Radiology diagnosis of liver diseases (MRI, CT, ultrasound, SPECT, and PET): manual / chap. editor volume G. E. Trufanov. - Moscow: GEOTAR-Media, 2008. - 264 p. - Текст: электронный // Консультант врача : электронная-медицинская библиотека. - URL: https://www.rosmedlib.ru/book/ISBN9785970407424.html (дата обращения: 20.09.2020). – Режим доступа: по подписке. 7. Zavadovskaya, V. D. Fundamentals of radiation diagnosis of diseases of the musculoskeletal system: a textbook for students studying in the specialties "General Medicine", "Pediatrics", "Medical Biophysics", "Medical Cybernetics", "Dentistry" / V. D. Zavadovskaya. - Tomsk: Publishing House of the Siberian State Medical University, 2016. - 94 p — URL: http://irbis64.medlib.tomsk.ru/cgi-bin/irbis64r_14/cgiirbis_64.exe?Z21ID=&P21DBN=ELS&I21DBN=ELS&S21FMT=fullwebr&C21COM=S&2_S21P02=0&2_S21P03=I=&2_S21STR=-343668354 (дата обращения 20.09.2020). — Режим доступа: из корпоративной сети СибГМУ. — Текст: электронный.
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