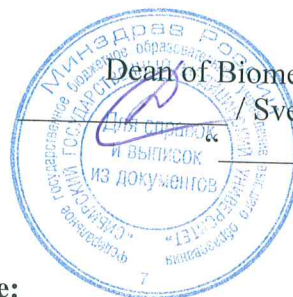


APPROVED BY



Dean of Biomedicine Department
/ Svetlana V. Gusakova
_____ 2020

Course Name:

ANATOMY AND PHYSIOLOGY. BASICS OF ROENTGENOLOGY

Field of study: Nuclear Science and Technology

Programme name: Nuclear Science and Technology

Specialization: Nuclear medicine

Level of study: Master Degree Programme

Semester, year: semester 1, year 1

Tomsk 2020

APPROVED BY

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

“25” 06 2020

Course Name: Anatomy and Physiology. Basics of Roentgenology

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: 2020

Semester, year: semester 1, year 1

ECTS: 5

Total Hours: 180

Contact Hours: 48

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

Self-study: 132

Assessment: Exam, graded credit-test

Division: Department of Biomedicine, Siberian State Medical University

Director of Programme

_____/ Vera V. Verkhoturova

Instructor

_____/ Liudmila V. Smagliy

_____/ Vera D. Zavodovskaya

Course name: Anatomy and Physiology. Basics of Roentgenology

Course Overview

Course Objectives	<p>The objective of the course is to study structural levels of organization of the human body, structural and functional organization of organs and systems of the body, its basic physiological functions and mechanisms of their regulation; physical foundations of high-tech diagnostic modalities; the principle of obtaining images using ionizing and non-ionizing radiation; fundamentals of the methodology of the diagnostic process in modern radiation diagnostics.</p>
Learning Outcomes	<p>Upon completion of the course, a graduate will obtain the knowledge of:</p> <ul style="list-style-type: none"> – modern methods of research, evaluation and presentation of the results of work performed – basics of the formulation of the results of research activities in the form of articles, reports, scientific reports and presentations using computer typesetting systems and office software packages – physical and technical fundamentals and principles of operation units of x-ray machines, computer tomographs, MR tomographs and devices for radionuclide diagnostics of radiation therapy apparatus and complexes, interventional radiology, radionuclide diagnostics – anatomy and patterns of functioning of organs and systems of the human body – theoretical foundations of diagnostic radiology – radiation anatomy of organs and systems – main characteristics of radiation therapy devices, their components, characteristics of the generated fields of ionizing radiation – approaches to the implementation of projects in medical physics and nuclear medicine, radiation therapy and dose planning <p>Upon completion of the course, graduates are expected to develop the following skills:</p> <ul style="list-style-type: none"> – to draw up the results of research activities in the form of articles, reports, scientific reports and presentations using computer typesetting systems and office software packages – compare and analyze operating principles, advantages and disadvantages, determine the main components and units of X-ray machines, computer tomographs, MR tomographs and devices for radionuclide diagnostics – apply knowledge about the structure and patterns of functioning of the body in professional activities – apply knowledge about the physical characteristics and capabilities of radiation research methods to determine various anatomical structures – implement projects in the field of medical physics and nuclear medicine, radiation therapy and dose planning <p>Upon completion of the course, graduates should acquire the practical experience in:</p> <ul style="list-style-type: none"> – experience of comparing and analyzing the principles of work, advantages and disadvantages, determining the main components and components of X-ray machines, computer tomographs, MR tomographs and devices for radionuclide diagnostics

	<ul style="list-style-type: none"> – methods for assessing the functional activity of organs and systems of the human body – experience using software to visually represent various anatomical structures – work skills to work with equipment for electrical, magnetic, optical and spectroscopic measurements
Course Outline	<p>The training course is delivered through the following teaching modes:</p> <ul style="list-style-type: none"> – 16 lectures; – 16 practical experiences; – 16 laboratory works; – term project. <p>The course consists of 6 sections, which are given below.</p> <p>Module “Anatomy, physiology”</p> <p>Section 1. The subject and tasks of the discipline "Anatomy and Physiology". The doctrine of the cell and tissues</p> <p>Section 2. Bones and their joints. Muscular system</p> <p>Section 3. Digestive system and digestion</p> <p>Section 4. Respiratory system. Breath</p> <p>Section 5. Excretory system. Endocrine system. Blood (blood system).</p> <p>Section 6. The structure and functions of the cardiovascular system</p> <p>Section 7. Nervous system</p> <p>Section 8. Sensory organs</p> <p>Module “Radiology Basics”</p> <p>Section 1. Introduction to the basics of radiation diagnostics</p> <p>Section 2. Features of imaging in radionuclide diagnostics</p> <p>Section 3. Central Nervous System</p> <p>Section 4. Respiratory system and mediastinum</p> <p>Section 5. Osteoarticular system</p> <p>Section 6. Urinary system. Male and female pelvis</p> <p>Section 7. Digestive system and gastrointestinal tract</p> <p>Section 8. Cardiovascular System</p> <p>Each section includes several lectures and practical experiences.</p> <p>The training course finishes with a credit test and requires obligatory completion and defense of a term project.</p> <p>Individual home assignment is a set of tasks with unique individual parameters for each student. Execution of all tasks is performed in the form of an explanatory note to the term project. Performance of individual home assignments is evaluated with maximum of 80 points.</p>
Course Structure	<p>The content of the course covers 6 topics. Each topic is studied through lectures and practical experiences.</p> <p>Module “Anatomy, physiology”</p> <p>Section 1. The subject and tasks of the discipline "Anatomy and Physiology". The doctrine of the cell and tissues</p> <p>As a result of mastering the section, the student will know the subject and tasks of the discipline "Anatomy and Physiology". The concept of the mechanisms of regulation of functions. The structure and properties of the cell. Electrophysiological processes in the cell. Types of tissue. Epithelial tissue. Connective tissue, its types. Muscle and nerve tissue. The concept of an organ and organ system. Body parts.</p>

Section 2. Bones and their joints. Muscular system

As a result of mastering the section, the student will know: the structure and connection of bones; structure of joints, their classification; types of movement in the joints. The skeleton of the body. The structure of the spinal column, sternum, ribs, joints. The skeleton of the upper limb. The skeleton of the lower limb. Large and small pelvis, sexual differences of the pelvis. Skull, departments, bones and their joints. Muscles, muscle fiber, types of muscles, ancillary apparatus. Skeletal muscle, meaning. Muscles of the head: chewing, facial. Muscles of the neck, groups, functions. Torso muscles: back, chest, abdomen. The areas of the back, chest, abdomen, white line of the abdomen. The muscles of the upper and lower extremities. Reduction mechanisms.

Section 3. Digestive system and digestion.

As a result of mastering the section, the student will know: departments, structural features, functions of the digestive tract: oral cavity, pharynx, esophagus, stomach, small and large intestine. Digestive tube sphincters. Peritoneum, structure, folds, location relative to abdominal organs. Large salivary glands: parotid, submandibular, sublingual. Saliva, composition, properties. Pancreas - structure and location. Composition and properties of pancreatic juice. Liver - location, macro and microscopic structure. Liver function. Gall bladder - location, structure. Bile, composition, properties, mechanism of formation and separation of bile.

Section 4. Respiratory system. Breath.

As a result of mastering the section, the student will know the structure of the airways: the nasal cavity, larynx, trachea, bronchi. Lungs, pleura. Respiratory cycle, pulmonary volumes. Physiology of respiration.

Section 5. Excretory system. Endocrine system. Blood (blood system).

As a result of mastering the section, the student will know the anatomy of the organs of the urinary system. Physiology of excretion. General characteristics of the endocrine glands. Pituitary gland, thyroid gland. Hormones of the pancreas, adrenal glands and gonads. Blood, its composition and functions. Plasma and shaped elements. Hemostasis and blood types.

Section 6. The structure and functions of the cardiovascular system

As a result of mastering the section, the student will know the general characteristics of the cardiovascular system. The structure of the heart. Physiology of the heart. Anatomy and physiology of blood vessels. Blood pressure. Regulation of blood circulation. Arterial system. Venous system. Physiology of microcirculation. Lymphatic system.

Section 7. Nervous system

As a result of mastering the section, the student will know the general principles of the structure of the nervous system. Classification of the nervous system. Types of neurons. Reflexes - a concept, types. Reflex arc. The structure, location and function of the spinal cord. The structure, location and functions of the brain: medulla oblongata, hindbrain, midbrain, diencephalon, and limb. Shells and cavities of the brain. Projection zones of the cortex. Cranial nerves, their characteristic. Classification of the autonomic nervous system. Central and peripheral parts of the autonomic nervous system.

Section 8. Sensory organs

As a result of mastering the section, the student will know the structure and functions of the olfactory sensory system, the taste sensory system, the visual sensory system, the auditory sensory system, and the vestibular sensory system.

Departments and structure of the proprioceptive sensory system. Cortical departments of analyzers.

Module “Radiology Basics”

Section 1. The subject and objectives of the discipline "Fundamentals of Radiology". Introduction to the basics of radiation diagnostics.

As a result of mastering the section, the undergraduate will know the Main imaging methods used in medical diagnostics - radiological (traditional radiography, computed tomography), scintigraphic, ultrasound, magnetic resonance. Physical foundations, visualization features, terminology. Artificial and natural contrasting of the object of study.

Section 2. Features of imaging in radionuclide diagnostics.

As a result of mastering the section, the student will know: General principles of radionuclide diagnostics. The principles of obtaining functional images of various organs and systems. Visualization of pathological processes. Difficulties in anatomical imaging, characteristic of radionuclide diagnostic methods. Hybrid diagnostic images as a way to increase the anatomical resolution in nuclear medicine.

Section 3. Central Nervous System

Radiation methods of the central nervous system (radiography, computed tomography, magnetic resonance imaging, scintigraphy). Radiation anatomy of the brain and spinal canal. White and gray matter of the brain, cerebrospinal fluid spaces (subarachnoid spaces, ventricles of the brain, tanks of the brain). Examination of the spine, spinal canal, spinal cord

Section 4. Respiratory system and mediastinum

As a result of mastering the section, the student will know: Methods of radiation research of the respiratory organs (radiography, computed tomography, magnetic resonance imaging, scintigraphy). Radiation anatomy of the respiratory system. Possibilities of high-resolution computed tomography in imaging of lung morphology (secondary pulmonary lobule. Comparative capabilities of radiography and computed tomography in visualization of lung structure. Mediastinum in X-ray, CT and MRI images. Mediastinum division into anterior, middle and posterior.

Section 5. Osteoarticular system

As a result of mastering the section, the student will know: Methods of radiation research of the osteoarticular system (radiography, computed tomography, magnetic resonance imaging, scintigraphy, ultrasound). Radiation anatomy of the osteoarticular system. X-ray, as a standardized method for the study of the musculoskeletal system. Possibilities of scintigraphy as an indicator of pathological processes of the osteoarticular system.

Section 6. Urinary system. Male and female small pelvis.

As a result of mastering the section, the student will know: Methods of radiation examination of the urinary system, male and female pelvis (radiography, computed tomography, magnetic resonance imaging, scintigraphy, ultrasound). Visualization of the adrenal glands. Features of the methodology for the study of the bladder. Radiation anatomy of the female and male pelvis.

Section 7. Digestive system and gastrointestinal tract

As a result of mastering the section, the student will know: Methods of radiation research of the digestive system and the gastrointestinal tract (radiography, computed tomography, magnetic resonance imaging, scintigraphy, ultrasound).

	<p>Methods of contrast x-ray examination of the biliary system and non-contrast MR cholangiography. Phase contrast study using radiopaque substances, paramagnets, echo contrasts. Radiation anatomy of the gastrointestinal tract and abdominal organs.</p> <p>Section 8. Cardiovascular System</p> <p>As a result of mastering the section, the student will know: Invasive and non-invasive methods of radiation research of the cardiovascular system - radiography, X-ray angiography, CT angiography, MRI angiography. scintigraphy. The concept of endovascular surgery. X-ray anatomy of the pulmonary circulation and heart chambers. Visualization of myocardial perfusion. Methods for indicating damaged myocardium.</p>
Facilities and Equipment	<ol style="list-style-type: none"> 1. Diagnostic complex of clinics of the Siberian State Medical University, Ministry of Health of Russia, includes X-ray machine Apollo DRF Villa Sistemi Medicali, □ CT General Electric Optima CT660, MRI General Electric Signa Creator 1.5T; □ SPECT Philips BrightView, ultrasonic devices Toshiba Aplio 400, 500, □ negatoscopes. 2. Classroom 213 Tomsk, Moskovsky tr., d. 2 p. 7 Block B, building SSMU includes □ 3 work table (3 pcs), □ 5 chairs, 1 □ medical examination couch, screen with 3 canvases, medical instrument rack, 2 personal computer with a monitor, automated audiometer AA-02, complex computer multifunctional for the study of EEG and EMG, reographic complex for assessing regional blood flow REO spectrum, pressotachospirograph PTS-14P, portable spirograph SMP-21/01, electrocardiograph EKTTS-3 / 6-04 Axion, computer electrocardiograph Polyspectrum 8, portable electrocardiograph Heart Mirror 3IKO, electrocardiograph EK12T-01-R-D, ЭК electrocardiograph EK ZT-01-“3-D”, dummy for an ECG (specialized simulator). 3. Classroom 214 Tomsk, Moskovsky tr., d. 2 p. 7 Block B includes 6 desks, desk for the teacher, 20 chairs, classroom board, 8 laboratory tables, 3 torsion scales, MBS microscope, spectrophotometer KFK 3 KM, 2 laboratory centrifuge, PH meter HI 2215, magnetic stirrer 190M. 4. Classroom 209 Tomsk, Moskovsky tr., d. 2 p. 7 Block B includes 8 desks, desk for the teacher, 24 chairs, classroom board, 6 laboratory tables, 4 torsion scales, MBS microscope, 2,2 computer 2.2GHZ Celeron 128k, computer 2000GHZ Celeron 128k, signal generator SFG-2010, source TEC-42,3 oscilloscope, spectrophotometer PE 5400UF, KFK 3-01 photometer, AKT-5 audiometer, PH meter with magnetic stirrer, electromyostimulator, Chemiluminometer Lum-1200.
Grading Policy	<p>In accordance with the rating system we use:</p> <ul style="list-style-type: none"> – Current assessment which is performed on a regular basis during the semester by scoring the quality of mastering of theoretical material and the results of practical activities (performance tests, perform tasks, problem solving). Max score for current assessment is 40 points, min – 22 points. – Course final assessment (exam) is performed at the end of the semester. Max score for course final assessment is 60 points, min – 33 points. <p>The final rating is determined by summing the points of the current assessment during the semester and protection of the course project at the end of the semester. Maximum overall rating corresponds to 100 points, min pass score is 55.</p>
Course Policy	Attendance is strictly controlled. All classes are obligatory for attendance.
Teaching Aids and	<p>Compulsory reading:</p> <ol style="list-style-type: none"> 1. Atlas of human ray anatomy / V. I. Filimonov, V. V. Shilkin, A. A. Stepankov,

Resources	<p>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.</p> <p>2. Ternovoy S. K. Radiology diagnosis and therapy. General radiology diagnostics: textbook: in 2 volumes. V. 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.</p> <p>Additional reading:</p> <p>1. Pasha, S. P. Radionuclide diagnostics / S. P. Pasha, S. K. Ternova; ed. S.K. Ternova. - M.: GEOTAR-Media, 2008. - 208 p. - Текст : электронный // ЭБС "Консультант студента" : [сайт]. - URL : https://www.studentlibrary.ru/book/ISBN9785970408827.html (дата обращения: 20.09.2020). - Режим доступа : по подписке.</p> <p>2. Sinitsyn, V. E. Magnetic resonance imaging / V. E. Sinitsyn, D. V. Ustyuzhanin; editor S.K. Ternovoy. - Moscow: GEOTAR-Media, 2008. - 208 p. - Текст: электронный // Консультант врача : электронная-медицинская библиотека. - URL: https://www.rosmedlib.ru/book/ISBN9785970408353.html (дата обращения: 20.09.2020). – Режим доступа: по подписке.</p> <p>3. Ternovoy, S. K. Computed tomography / S. K. Ternova, A. B. Abduraimov, I. S. Fedotenkov. - Moscow: GEOTAR-Media, 2008. - 176 p. - Текст: электронный // Консультант врача : электронная-медицинская библиотека. - URL: https://www.rosmedlib.ru/book/ISBN9785970408902.html (дата обращения: 20.09.2020). – Режим доступа: по подписке.</p> <p>4. 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.</p>
Instructors	<p>Vera D. Zavadovskaya, Professor, head of Department of Radiology and Radiotherapy, Siberian State Medical University, e-mail: wdzav@mail.ru, phone: +7 (3822) 901-101(ext. 1738).</p> <p>Liudmila V. Smaglyi, Associate professor, Department of Biophysics and functional diagnostics, Siberian State Medical University, e-mail: lud.smagly@yandex.ru, phone: +7 (3822) 901-101 ext. 1912.</p>