INTERNATIONAL HIGHER SCHOOL OF MEDICINE

Department of Cardiac Surgery and Radiology

SYLLABUS
Radiology Basics

2025-2026 academic year
for students of medical faculty
2nd course III semester, groups of Central Campus (according to the timetable)
1 credit (30 h, including auditorial 18 h, independent work – 12 h)

Practical classes:

№	Name of the teacher	Location of classes	WhatsApp number
1	Skorobogatova Oksana Vladimirovna	Vedanta on 34, Fuchik st.	+996 559 755 559
2	Maksutov Chyngyz Zhyrgalbekovich	Vedanta on 34, Fuchik st.	+996 556 090 090
3	Malaev Dastan Urmatovich	Vedanta on 34, Fuchik st.	+996 500 521 721
4	Turgunov Azatbek Kanatbekovich	Vedanta on 34, Fuchik st.	+996 556 050 088
5	Daniyarov Bektur Sanzharbekovich	Vedanta on 34, Fuchik st.	+996 554 091 767

The Syllabus is considered
at the meeting of the department of Cardiac Surgery and Radiology
Protocol № 2 dated 01.09.2025
Head of the department _____ I.H. Bebezov

Course Objective: consists of studying diagnostic imaging methods for their adequate use for the diagnosis and treatment of various pathological conditions.

Knowledge:

• Types and properties of radiation;
• biological effect of ionizing radiation;
• methods of protection against ionizing radiation;
• principles of image formation for different methods of radiation diagnostics;
• descriptive terminology used in the X-ray method, CT, MRI, ultrasound, radionuclide and interventional studies in the analysis of radiation images of organs;
• varieties of each method, their diagnostic capabilities and technique;
• diagnostic capabilities and limitations of radiation diagnostic methods;
• indications and contraindications for each diagnostic imaging method;
• design and principle of operation of diagnostic equipment: X-ray diagnostic devices, CT scanners, MRI scanners, ultrasound machines, devices for radionuclide diagnostics, angiographs;
• normal radiation anatomy of organs.

Skill:

• Determine the priority of using radiological methods for various diseases and injuries;
• submit a referral for radiation examination;
• prepare the patient for radiation examination;
• recognize the research method and methodology based on the materials of radiation studies;
• recognize projections of radiation images of organs;
• identify images of anatomical structures using different radiation methods.

Attitude: An algorithm for using medical devices in standard cases.

Pre-requisites. To study this academic discipline requires knowledge, skills and abilities, formed by previous disciplines: Macro- and microanatomy, Normal physiology, Medical physics and higher mathematics, Biochemistry, Latin language

Post-requisites. As a result of studying this section, the foundation is laid for further study by students of the following clinical disciplines: Radiation diagnostics, Radiation therapy, Internal diseases, Children's diseases, Surgical diseases, Cardiac surgery, Urology, Traumatology, orthopedics and extreme surgery, Otorhinolaryngology, Obstetrics and gynecology, Public health and health

THEMATIC PLAN OF PRACTICAL CLASSES

№	Theme of practical class	Hours	Date
1	Introduction to Radiology	2	01.09.2025 - 10.01.2026
2	X-ray method	2	01.09.2025 - 10.01.2026
3	Contrast X-ray research methods	2	01.09.2025 - 10.01.2026
4	Computed Tomography (CT)	2	01.09.2025 - 10.01.2026
5	Magnetic Resonance Imaging (MRI).	2	01.09.2025 - 10.01.2026
6	Ultrasound examinations (ultrasound)	2	01.09.2025 - 10.01.2026
7	Interventional radiology	2	01.09.2025 - 10.01.2026
8	Radionuclide diagnostics	2	01.09.2025 - 10.01.2026
9	Unit control	2	01.09.2025 - 10.01.2026
Total		**18 hours**	

THEMATIC PLAN OF INDEPENDENT WORK OF STUDENTS

№	Theme of independent work	Hours	Date
Unit I Radiology Basics	Studying the results of non-invasive research methods. Situational tasks. Abstracts and presentations on specific topics.	12	01.09.2025 - 10.01.2026

Recommended reading for the discipline:

1.Basic

№	Authors	Title	The year of publishing
1	Mayur Arun Kulkarni, Saurabh S Patil, Amit M Shetty	Conceptual Review of Radiology. Nothing beyond for PGMEE.	2018
2	E. Scott Pretorius, Jeffrey A. Solomon	Radiology Secrets Plus (3d edition)	2011

2.Additional

№	Authors	Title	The year of publishing
1	Satish K Bhargava	Textbook of Radiology for Residents and Technicians. 3d edition	2007
2	Jerry L. Prince, Jonathan M. Links.	Medical Imaging Signals and Systems. 2nd edition.	2015
3	David Sutton	Textbook of radiology and imaging. 7th edition	2003

Resources of the information and telecommunication network "Internet"

1. RadiologyEducation: https://www.radiologyeducation.com/
2. PubMed: https://www.ncbi.nlm.nih.gov/
3. MedLine: https://www.nlm.nih.gov/
4. Medscape: https://www.medscape.com/
5. Radiopaedia: https://radiopaedia.org/

Grading policy and procedures for all types of work

For the period of studying the discipline, the student gains points for the relevant parameters (per unit):
current score - 40 points
independent work - 20 points
control score (final assessment of knowledge per unit) - 40 points
Maximum score - 100 (40+20+40)

Grading system for student's achievements

Grading criteria per discipline				
Maximum score	Intervals			
	«unsatisfactory»	«satisfactory»	«good»	«excellent»
Current control- 40	0-23	24-30	31-35	36-40
Interval description	Not ready for class	Passive, does not participate in the discussion of the lesson topic	Actively participates in the discussion of the topic of the lesson, periodically gets confused in the details.	Actively participates in the discussion of the topic of the lesson, gives a complete and accurate answer to the question.
Independent work - 20	0-11	12-15	16-17	18-20
Interval description	Doesn't answer questions on the topic	Has difficulty answering, has poor knowledge of the topic	Answers well, but occasionally gets confused in some answers	Confident, complete answer. Shows good knowledge of the topic, does not get

				confused in answers
Control work (module) – 40	0-23	24-30	31-35	36-40
Interval description	Doesn't answer questions	Has difficulty answering, does not know the answer well	Answers well, occasionally gets confused in some answers	Answers all questions correctly, completely. Don't get confused with answers

Conduct Policy: (lateness, absence, behavior in the auditorium, late submission of work).
- Punctuality and completion of tasks.
- Mandatory attendance of classes.
- Attending class in a clean medical uniform.
- Eliminating conversations on a cell phone in the classroom.
- Active participation in the learning process.
- Doing homework on time.
- Academic detention at the time specified by the teacher.

For violations of the Conduct Policy, the total points for discipline might be reduced to 1-10 points.

Academic Ethics Policy.
- Be tolerant, respect the opinions of others.
- Formulate objections in the correct form.
- Constructively support feedback in all classes.
- Plagiarism and other forms of dishonest work are unacceptable. Plagiarism includes the following: the absence of references when using printed and electronic materials, quotes, thoughts and works of other authors or students.
- Prompting and cheating during tests, exams, classes is unacceptable as well as passing an exam for another student, unauthorized copying of materials.

For violations of the Academic Ethics Policy, the total points for the discipline may be reduced to 1-10 points.

Guidelines for the lessons of the discipline
Radiology basics
Key questions covered in lesson 1.
The history of discovering of the X-rays, their properties. Types of radiation used in diagnostic imaging. Ionizing and non-ionizing radiation. Basic methods of obtaining images in radiology: roentgenologic, ultrasonic, magnetic resonance, radionuclide, thermographic. Effective equivalent dose of ionizing emission. Medical personnel and patients' categories. Methods of protection from ionizing radiation.
Recommended reading for the lesson:
1)Michael Y. M. Chen, Thomas L. Pope, David J. Ott – Basic Radiology, 2nd ed., 2004.
Key questions covered in lesson 2. The acquaintance with radiographic and fluoroscopy rooms, hardware of radiology equipment and means for protection from ionizing radiation. Types of the X-ray apparatus. Principle of image acquisition by X-ray technique. Natural contrast of organs and tissues. The methods of X-ray study: general, particular and special. Differences between conventional and digital techniques. Terminology used for an X-ray description. Demonstration and analysis of X-rays, fluoroscopic images and liner tomograms of various normal organs
Recommended reading for the lesson:
1)E. Scott Pretorius, Jeffrey A. Solomon-Radiology Secrets Plus (Third Edition), 2011.
2)Michael Y. M. Chen, Thomas L. Pope, David J. Ott – Basic Radiology, 2nd ed., 2004.
Key questions covered in lesson 3. Artificial contrasting of the object of study. Classification of contrast agents. Radio-positive (radiopaque) and radio-negative (radiolucent) contrast media. Contrast material which is used in non-ionizing methods such as US and MRI. The techniques of contrast agent administration. The upper and the lower gastro-intestinal tract fluoroscopy. Demonstration and analysis of the normal bronchograms, intravenous pyelograms (IVP), angiograms and barium-enema images of the colon.

- Mayur Arun Kulkarni, Saurabh S Patil, Amit M Shetty - Conceptual Review of Radiology. Nothing beyond for PGMEE. 2018 CBS Publishers &Distributors
- E. Scott Pretorius, Jeffrey A. Solomon Radiology Secrets Plus (3d edition) 2011 Elsevier 978-0-323-06794-2
- Satish K Bhargava Textbook of Radiology for Residents and Technicians. 3d edition 2007 India Binding House, NOIDA, U.P. 81-239-1433-4
- Jerry L. Prince, Jonathan M. Links. Medical Imaging Signals and Systems. 2nd edition 2015 Elsevier saunders

Key questions covered in lesson 4.
The principle of acquiring CT-images. The visual and densitometry analysis of CT-images. Attenuation coefficient of X-ray emission. Hounsfield Scale. The diagnostic capacities of image data enhancement. Spiral and electron-emitting CT-

scanners, their diagnostic capacities: CT-angiography, three dimensional (3D) reconstruction of the image, virtual endoscopy. Electrocardiogram gate CT. Terminology used for CT-images description. The advantages and limitations of CT method. Contraindications. The demonstration and analysis of normal anatomical regions on CT-scan images (head, thoracic and abdominal cavities).

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Key questions covered in lesson 5. The principle of acquiring images in MRI. Nuclear magnetic resonance principle. The main parameters of MR-images: proton density, T1, and T2. The methods of analysis of MR-images: spin-lattice and spin-echo.Basic methods of MR studies: Magnetic Resonance Imaging (MRI), MR-Angiography, cholangiography, MR-spectroscopy, MR-perfusion, MR-diffusion, functional MRI. The peculiarities of MR-images data. The terminology used for MR-images description. The advantages and limitations of MRI method. Contraindications. The demonstration and analysis of normal anatomical regions on MRI-images (brain, kidneys, joints etc).

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Key questions covered in lesson 6. The principle of obtaining images of organs and tissues used ultrasound. The methods of US diagnostic: one-dimensional – echography (A and M-modes); two-dimensional – sonography (B-mode). Principle of the Doppler Ultrasound. Continuous wave Doppler, Duplex Doppler, Color Doppler, Power Doppler, and Tissue Doppler. The terminology used for US-images description. The advantages and limitations of US. The demonstration and analysis of different types of US-images of normal organs: echograms, sonograms, dopplerograms. The demonstration of ultrasonographic examinations.

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- Satish K Bhargava Textbook of Radiology for Residents and Technicians. 3d edition 2007 India Binding House, NOIDA, U.P. 81-239-1433-4
- Jerry L. Prince, Jonathan M. Links. Medical Imaging Signals and Systems. 2nd edition 2015 Elsevier saunders

Key questions covered in lesson 7. Introduction to interventional radiology. Types of guidance. Types of intervention. Extravascular interventions: endobronchial, endobiliary, percutaneous nephrotomy, endoeosophageal, percutaneous drainage of cysts and abscesses, fine needle aspiration cytology (FNAC). Percutaneous surgery on bones and joints. Special tools. The demonstration of the interventional techniques. Endovascular interventions. Types: endovascular dilatation of vessels (angioplasty), endovascular prosthetics (stenting), embolization, installation of inferior vena cava filters, laser tunneling. Advantages and disadvantages. Possible complications, adjustments and measures to prevent them. The demonstration of endoscopic procedures.

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- E. Scott Pretorius, Jeffrey A. Solomon Radiology Secrets Plus (3d edition) 2011 Elsevier 978-0-323-06794-2
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Key questions covered in lesson 8. Principle of obtaining radionuclide images. Requirements for radiopharmaceutical tracers. Types and applications of radiopharmaceutical tracers. Regulation of the radionuclide studies. Protection of personnel and patient from open source of radiation. Methods of radionuclide study/imaging: Scintigraphy, Single Photon Emission Computed Tomography (SPECT), Positron Emission Tomography (PET), Radiography, Radiometry (Clinical and Laboratorial). Radioimmunoassay (RIA). The terminology used for radionuclide images description. The advantages and limitations of nuclear medicine. Contraindications. The demonstration and analysis of scintigrams of normal anatomical organs (lungs, liver, thyroid, skeleton).

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Key questions covered in lesson 9. Testing, solving situational problems using the necessary details (X-rays, CT scans, MRI, etc.)

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Methodological instructions for the implementation of independent work on the discipline.
Radiology basics

Every student is given an individual learning project which must be completed. The results should be reported in the form of presentation.

Every group is given one common learning project which must be completed. The results should be reported in the form of presentation.

Questions for projects

- History of radiology. The discovery of X-rays, radioactivity, ultrasound.
- The history of the emergence of computer and magnetic resonance imaging.
- Device X-ray diagnostic devices, their types. Requirements for placement, features of operation.
- The device of computer tomographs, their types. Requirements for placement, features of operation.
- The device magnetic resonance imagers, their types. Requirements for placement, features of operation.
- Device ultrasound machines, their types. Requirements for placement, features of operation.
- Medical thermography. Principle, methods, practical application.
- Elastography. Methodology, scope.
- Echocardiography. Methodology.
- Cone-beam computed tomography.
- Coronary angiography.
- 3D tomosynthesis for the diagnosis of mammary glands.
- Interventional procedures in cardiac surgery.
- Interventional procedures in oncology.
- Interventional procedures in urology.
- Interventional procedures in neurosurgery.